DATE: January 31, 2020
TO: Independence City Planning Commission/Board of Zoning Appeals
FROM: Kelly Passauer, Zoning Administrator
SUBJECT: February 4, 2020 Planning Commission/Board of Zoning Appeals meeting

a. Consider approving minutes of the January 7, 2020 meeting.

MINUTES
Independence Planning Commission
Independence Board of Zoning Appeals
Tuesday, January 7, 2020
Veterans Room Memorial Hall 5:30 p.m.

Call to Order

The Planning Commission meeting was called to order by Chair Mary Jo Meier.

Planning Commissioners Present

Mary Jo Meier (1-0), Steve McBride (1-0), Barb Emert (1-0), Michelle Anderson (1-0), Tony Royse (1-0), Brent Littleton (outside) (1-0), Andy McLenon (outside) (1-0), and Lisa Richard (1-0).

Planning Commissioners Absent

Philipp Umlauf (Resigned)

Staff Present

Kelly Passauer, Assistant City Manager/Zoning Administrator, and Jeff Chubb, City Attorney

Visitors

Gary Hogsett, Tabatha Snodgrass, Mark Leaman (representing the Independence Gun Club and applicant) and Deana Combs

Minutes

a. Consider approving minutes of the December 3, 2019 meeting.

   Tony Royse made a motion to approve the minutes of the December 3, 2019 meeting after adding Jeff Chubb as present, Steve McBride seconded the motion. The motion carried 8-0.

b. Reorganization

   1. Election of Chair
   2. Election of Vice Chair
   3. Election of Secretary

   Mary Jo Meier made a motion that Andy McLenon serve as Chair, Barb Emert as Vice Chair and Michelle Anderson as Secretary. Tony Royse seconded the motion. The motion carried 8-0.

Planning Commission

c. Consider a request for a conditional use permit for an Indoor firing range in the C-3, Central Business District at 212 North Pennsylvania Avenue.

The following staff report was reviewed:

Background

On August 22, 2019 the City Commission initiated a public hearing before the Planning Commission to consider a text amendment to the Conditional Use Table to allow indoor firing ranges as a conditional use in the C-3 Central Business District. The request to the Commission was submitted by the Independence Gun Club who was represented by Police Chief Harrison.

On October 1, 2019 the Planning Commission conducted a public hearing amending Appendix B-Zoning of the City Code relating to "Indoor firing ranges." On a 6-1 vote the following was motion was approved:

> To recommend that the City Commission approve adding "Indoor firing ranges" to the permitted and conditional use table and allowing such use as a conditional use in the C-3 Central Business District with the following determinations:
>
> a. That such change is consistent with the intent and purpose of these regulations because it contains a retail element, and will attract people to the downtown;
>
> b. That the areas which are most likely to be directly affected by such change will include the C-3 Central Business district, which generally consists of the core downtown. The amendment will only allow indoor firing ranges with a conditional use permit which does provide an opportunity for property owners within the notification area to voice any concerns to both the Planning Commission and City Commission prior to approval and allows the City to impose conditions to address those concerns;
>
> c. The proposed amendment is made necessary because of new planning concepts in the C-3 Central Business District by adding a new use to the table of uses for indoor firing ranges, addresses higher downtown vacancy rates than existed when the Comprehensive Plan was adopted, by recognizing changes in Kansas legislation which now authorizes concealed carry without a permit, and providing for firearm training for public safety.
>
> To recommend that the City Commission add the following definition to Article IV. Rules and Definitions:
>
> > Indoor Firing Range: means an indoor area or facility designated or operated primarily for the use of firearms.

On October 23, 2019 the City Commission accepted the recommendation of the Planning Commission and adopted Ordinance 4315.

Overview of the Request

On November 20, 2019 the Zoning Administrator received a request from Mark Leaman representing the Independence Gun Club to issue a conditional use permit for the following described property which is currently zoned C-3, central business district:

Lots 12 and 13, Block 30, Original Plat to the City of Independence, Montgomery County, Kansas.

The applicant intends to operate an indoor firing range and retail store in a downtown commercial building at 212 N. Penn Avenue.

Conditional Use Permit

Article IX of the Zoning Ordinance addresses purpose and authority for granting conditionals uses.

901.0. Purpose and authority.
901.1. Purpose: Conditional uses are those types of uses which are considered by the city to be essentially desirable, necessary, or convenient to the community but which by their nature or operation have (1) a tendency to generate excessive traffic, (2) a potential for attracting a large number of persons to the area of the use, thus creating noise or other pollutants, (3) a detrimental effect upon the value of or potential development of other properties in the neighborhood, or (4) an extraordinary potential for accidents or danger to the public health or safety.

Such conditional uses cannot be allowed to locate as a "right" on any parcel of land within certain districts without consideration of existing conditions at the proposed location and of properties neighboring upon the specific site considered, nor without adequate and sufficient safeguards, when necessary, to lessen the impact of adverse factors.

901.2. Authority to grant permits: The governing body shall have the authority to grant conditional use permits, subject to such conditions of design and operation safeguards and time limitations as it may determine for all conditional uses specified in appendix "A" of this ordinance and for all permitted uses for which the planning and zoning commission has found that by their nature or in their operation have characteristics listed in clauses (1), (2), (3) and (4) of section 901.1 of this article, provided, however, that said conditional use permits for permitted uses shall not establish standards or conditions that are less restrictive than those set out in the district regulations for the district in which said use is located.
(Ord. No. 3863, § 1, 12-20-01)

In considering those types of uses which may be desirable, necessary or convenient to the community, the Commission should review and make recommendations based in part on 901.1.

Additionally, the decision of the Planning Commission to recommend approval or denial of the proposed conditional use shall be based on the following criteria (902.2):

a. *The proposed conditional use complies with all applicable provisions of these regulations, including intensity of use regulations, yard regulations and use limitation.*
   The requested location is in an existing building in the C-3 zone which has zero lot lines.

b. *The proposed conditional use at the specified location will contribute to and promote the welfare or convenience of the public.*
   The requested location will provide additional activity to the downtown and provide an opportunity for gun safety and training opportunities in a controlled environment. However, the Planning Commission could include additional conditions to further protect the welfare of the public.

c. *The proposed conditional use will not cause substantial injury to the value of other property in the neighborhood in which it is to be located.*
   It is unknown if this type of use will create substantial injury to the value of other downtown properties.

d. *The location and size of the conditional use, the nature and intensity of the operation involved in or conducted in connection with it, and the location of the site with respect to streets giving access to it are such that the conditional use will not dominate the immediate use of the neighboring property in accordance with the applicable zoning district regulations. In determining whether the conditional use will so dominate the immediate neighborhood, consideration shall be given to:*
   1. *The location, nature and height of buildings, structures, walls and fences on the site, and*
   2. *The nature and extent of landscaping and screening on the site.*

The requested location is in an existing building in the C-3 zone which has zero lot lines.

e. *Off-street parking and loading areas will be provided in accordance with the standards set forth in these regulations (article VII).*
The requested location is in an existing building in the C-3 zone which is exempt from the Off-street parking and loading regulations.

f. *Adequate utility, drainage, and other such necessary facilities have been or will be provided.*
The requested location is in an existing building in the C-3 zone which is already constructed with existing utilities and drainage systems. Additional necessary facilities may include those that deal with safety, noise, air and other environmental concerns.

g. *Adequate access roads or entrance and exit drives will be provided and shall be so designed to prevent traffic hazards and to minimize traffic congestion in public streets and alleys.*
The requested location is in an existing building in the C-3 zone which is exempt from the Off-street parking and loading regulations, therefore no entrance or exit drives will be required.

Action by the Planning Commission

Any recommendations regarding a conditional use permit for the subject property shall be based on Section 902.2 previously outlined in this report. Following your action, the application and your recommendation will be forwarded to the City Commission at which time they will have 30 days to adopt, modify or deny the Planning Commission's recommendation.

Staff Recommendation

If the Planning Commission determines to approve the request for a conditional use permit for an indoor firing range at 212 N. Penn Avenue the following conditions are recommended for consideration:

1. Applicant shall comply with all applicable Federal, State and local statutes, laws, ordinances or codes, including but limited to:
    a. Building codes,
    b. Fire codes,
    c. Zoning codes,
    d. U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations,
    e. U.S. Environmental Protection Agency (EPA) regulations,

f. Kansas Department of Health and Environment (KDHE) regulations.
g. Kansas Department of Agriculture regulations, division of Conservation (DOC) regulations, and
h. Bureau of Alcohol, Tobacco, Firearm and Explosives (ATF) registration requirements.

2. The facility shall comply with established guidelines, such as but not limited to the National Rifle Association (NRA) Range Source Book (current edition).
3. Indoor ranges must be designed so projectiles cannot penetrate the walls, floor or ceiling, and ricochets or back splatter cannot harm range users. Walls and partitions shall be designed to stop all projectiles fired on the range by containing or redirecting bullets to the backstop.
    a. Exterior walls from 24 inches behind the firing line, downrange to 12 inches past the bullet trap system, shall be of a design that is impenetrable to the ammunition fired in the facility. 8 inch fully grouted concrete masonry units or 6 inch concrete are acceptable for this bullet resistance.
    b. Floor system throughout the firing range enclosure shall be of a design that is impenetrable to the ammunition fired in the facility.
    c. Ceiling system shall be of a design that is impenetrable to the ammunition fired in the facility between any point vertically above the firing line, from 12 inches above the firing line to the underside of the safety ceiling system, and downrange. Safety ceiling system shall also extend a minimum of 24 inches behind a line extended vertically above the firing line. Safety/baffle ceiling system shall be manufactured and certified to stop all ammunition fired in the facility.
    d. Bullet trap system shall be manufactured and certified to stop and contain all ammunition fired in the facility.
    e. Shooting stalls, if present, shall be of a design that is impenetrable to the ammunition fired in the facility.
4. Floors, walls, backstops, and ceilings must be able to contain the sound in addition to the bullet fired and be made of an acceptable engineering standard compliant with standards applicable under conditions 1 and 2.
5. Lead exposure shall follow EPA and OSHA guidelines to make sure that the facility is properly ventilated.
    a. Shooting range enclosure ventilation system shall be a separate system from the remaining building. This system shall meet the requirements of the International Mechanical Code and NIOSH recommendations.
    b. Maintenance of this ventilation system shall be in accordance with manufacturer's guidance, OSHA regulations and EPA regulations.

6. Uncovered containers of spent bullets, bullet fragments, cartridge cases or debris from shooting range maintenance shall be properly disposed of and not be stored outdoors.
7. Eye and hearing protection shall be required within the shooting range enclosure whenever firing is conducted. OSHA compliant signs shall be posted requiring eye protection and hearing protection.
8. No outdoor shooting of any kind, regardless of whether said shooting is connected to the commercial use of the property, shall be allowed, permitted, or conducted on the property at any time under any conditions.
9. Fully automatic firearms are prohibited. Firearm use shall be limited to .45 caliber or less, provided that the facility is designed to meet all conditions listed.
10. The facility must be under its ownership's supervision and control while open and in use.
11. The indoor firing range shall not create a nuisance that interferes with others' rights to safety and enjoyment of their own property.
12. The business is to maintain at least a $2,000,000 commercial liability policy.
13. The applicant shall submit to the City for approval prior to operation, and maintain as a condition for operation, a Range Safety Plan that establishes rules and regulations which must be complied with. Such rules and regulations shall be prominently posted at the facility and shall addresses the following at a minimum:
    a. Firearm Handling Rules
        i. Address how firearms will be handled on site in a safe manner.
        ii. Guns shall be stored where they are not accessible to unauthorized persons.
    b. General Range Rules
        i. Range commands.
        ii. Designated range officer.
        iii. Downrange safety measures.
    c. Specific Range Rules based on type of facility
        i. Types of firearms permitted on site.
        ii. Types of activities permitted on site.
        iii. Caliber restrictions.
    d. Administrative Rules and Regulations
        i. Who is authorized to use the facilities? (members, public, law enforcement, etc.)
        ii. How are authorized personnel identified?
        iii. Who will enforce rules and penalties?

iv. What type of targets will be used?
v. Hours of operation?
vi. Barrier free accessibility shall be provided for use of the facility.
vii. What shooting activities are allowed and not allowed?
viii. Alcohol and controlled substances shall not be permitted at the facility.
ix. What age restrictions will be utilized for the facility or what safety procedures will be in place for minors?
x. How will firearms be transported into the facility?
xi. What procedures will be utilized to protect patrons and employees from health hazards such as lead contamination that includes but is not limited to, lead contamination monitoring, disposal methods, etc. to ensure a safe environment?
xii. Will food be served on site?

14. The Independence Chief of Police or his or her designee shall be made available a minimum of two times a year at a time of their choosing to perform an inspection of the facility to make sure the firearm range safety plan is being followed and that the facility is safe for use.
15. The above-listed conditions of approval shall be tied to the current applicant and not transferrable to any future property owners.

Staff's recommendation is based on the criteria set forth in 902.2, "a through g" of the zoning code.

Lisa Richard reviewed four articles on the danger of lead poisoning at gun ranges which are attached to these minutes.

Mary Jo Meier opened the public hearing and inquired if there any conflicts of interests.

No one indicated that they did.

Mary Jo Meier asked if anyone in the audience wished to make a comment.

Mark Leaman stated that if his group could not conform to the proper regulations, they would not open the range. He also noted that they will hire a professional service that deals with these issues but, not until they get the go ahead from the City.

Tony Royse asked if he had read all of the conditions associated with this permit and Mark Leaman replied that he had.

Steve McBride asked if they would follow the NRA's guidelines as well.

Mark Leaman replied that they would.

Mark Jo Meier asked if there were any other comments.

Gary Hogsett asked the Commissioners to keep an open mind for uses of downtown buildings and noted that the worst thing that could be done would be to have a building sitting empty.

Steve McBride asked if there will be a retail shop as well in the building.

Mark Leaman replied that there would.

Lisa Richard asked about the disposal process.

Mark Leaman explained that the brass and lead would be taken to Commercial Metals and disposed of properly.

Deana Combs asked if shooting would occur in the basement and would the glass be bullet proof.

Mark Leaman replied that shooting would not occur in the basement and the proper containment would be enforced.

Tabatha Snodgrass gave her support to Mark Leaman and his group.

Mary Jo Meier read through the conditions.

Lisa Richard asked for more discussion on the topic before they vote and voiced her concerns for the health of the people who would use or work at the facility.

Andy McLenon noted that Mr. Leaman is willing to spend the money for professionals and he would like to enable him to get to the next point of spending money so he could attack these issues.

Lisa Richard believes that what goes on in the building and the protection of those in the building are valid concerns for the Planning Commission and City Commission.

Steve McBride noted that this Commission is not here to determine what type of operations this business can have.

Lisa Richard stated that to avoid contamination issues in the future it needs to be a lead-free gun range and there needs to be language added for noise levels outside the building.

Andy McLenon stated that he did not want to tell someone how to run their business.

Lisa Richard moved to amend Condition #4 to add; *"There shall be no increase in the number of decibels outside the building as compared to a measurement prior to*

operation attributable to the indoor firing range." The motion was seconded by Michelle Anderson. The motion carried 5-3 with Lisa Richard, Andy McLenon, Michelle Anderson, Barb Emert and Mary Jo Meier voting aye; and Steve McBride, Tony Royse and Brent Littleton voting nay.

Lisa Richard recommended that the gun range be lead-free.

Mary Jo Meier asked Mark Leaman his opinion on making the proposed site a lead-free gun range.

Mark Leaman stated he would have to look into it but he thought that 99% of the handguns could not shoot that type of ammunition and he would have to talk with Chief Harrison since his officers would be training in there.

A motion was made by Andy McLenon to recommend approving a conditional use permit for an Indoor firing range in the C-3, Central Business District at 212 North Pennsylvania Avenue with the conditions recommended by City staff with the additional language added to condition #4 stating; *"There shall be no increase in the number of decibels outside the building as compared to a measurement prior to operation attributable to the indoor firing range."* The motion was seconded by Steve McBride. Lisa Richard requested that the motion be amended to include additional conditions. Andy McLenon declined to amend his motion. The motion passed 5-3 with Andy McLenon, Steve McBride, Brent Littleton, Barb Emert and Mary Jo Meier voting Aye; and Tony Royse, Michelle Anderson and Lisa Richard voting Nay. Motion carried.

d. Consider initiating a public hearing to consider a text amendment to Appendix B-Zoning of the City Code including, but not limited to:

   1. Article IV. Rules and Definitions.
   2. Appendix A. "Listing of Permitted and Conditional Uses" including, but not limited to "Orphanages" and other new additional use(s).

The following staff report was reviewed:

> The City Commission or Planning Commission may initiate text amendments to the zoning code. Recently staff was contacted by someone wishing to open a "Group Boarding Home" as defined by DCF which means "*Twenty-four hour nonsecure care for five to ten children between the ages of infancy to 16 years of age.*" The individual that contacted staff indicated that they would have five to eight children in foster care ranging in ages from 8 to 18 years of age. Staff found on another DCF document that "*Facilities providing services to children age 16 and older only do not require a license*" so I anticipate that is why the previous DCF definition only addresses children 16 and younger. The individual stated they will have an in-house manager and that the requestor will not live in the house.

According to the City Attorney, this request does not meet the statutory definition of a "Group Home" which has additional requirements as it pertains to municipalities, since the requestor does not plan to house disabled children.

The only other previous zoning case I could find that compares to this request was in 2013 when a company came in and wanted to buy a nursing home at 715 S. 2nd and turn it into a Boys' Home in which they requested the property be rezoned from R-2 to R-4. Action by the Planning Commission was initially tabled at their September 10, 2013 hearing pending more information and the requirement of a conditional use permit. On October 1, 2013 the Planning Commission approved a conditional use permit with several conditions but failed to address the rezoning. A valid petition was filed by the property owners within 200'. On October 23, 2013 the City Commission denied the rezoning on a unanimous vote stating that "*this use did not fit the character of the neighborhood*."

In reviewing the current conditional and permitted table of uses, the closest uses staff was able to locate include "*Day care centers – more than four children*" and "*Orphanages*".

Staff recommends that a public hearing be initiated to consider a text amendment that would add "*Children's Home*" into the permitted and conditional use table which would be a permitted use in an R-5 zone, and a conditional use in the R-3 and R-4 Zones. It is suggested to either modify "*Orphanage*" to match the suggested permitted uses of a "*Children's Home*" or combining it "*Children's Home/Orphanage*" or deleting "*Orphanage*" as a use since the "Children's Home" definition should cover both.

The following definitions are also proposed:

> *Children's Home: Any place, home or institution providing twenty-four hour nonsecure care to five or more children under the age of 18 years for compensation in which such children are under the custody of a state agency; provided, however, this definition shall not include children placed in family care in a family foster home, public and private schools organized, operated or approved under the laws of the state, children related by blood or marriage to the provider, caring for children within an institutional building while their parents or legal guardians are attending services, meetings or classes or engaged in church activities.*
>
> *Family Foster Home: A child care facility that is a private residence, including any adjacent grounds, in which the resident(s) provide family care for 24 hours a day for one or more children in foster care and for which a license is required by the State of Kansas.*

The above definitions were written to ensure that rezoning or conditional use permits would not apply to a family that serves as foster parent(s) in the home the foster parent(s) reside in.

In speaking with the City Attorney, if the applicant wishes to proceed with their request at the same meeting as the text amendment that can be permissible as long as the text amendment is heard before the request for rezoning or a conditional use permit. Since currently the closest use to the applicant's request is an "*Orphanage*", it has been suggested to the applicant to apply for rezoning to R-5 for an "*Orphanage*". The Planning Commission can recommend a lesser zoning classification with a conditional use permit after they have held the public hearing for the text amendment.

It should be noted that staff is cognizant of the need for foster care and is also supportive of local business opportunities that will bring additional jobs to the community. The City currently requires conditional use permits for daycares, so requiring a conditional use permit and/or rezoning for the requested use would not be out of line with the current code and would ensure that our zoning codes are consistent and fair to all.

Suggested Motion:

I move to initiate a public hearing to consider a text amendment to Appendix B-Zoning of the City Code including, but not limited to:

1. *Article IV. Rules and Definitions.*
2. *Appendix A. "Listing of Permitted and Conditional Uses" including, but not limited to "Orphanages" and other new additional use(s).*

Kelly Passauer explained the background on initiating the hearing.

Mary Jo Meier moved to initiate a public hearing to consider a text amendment to Appendix B-Zoning of the City Code including, but not limited to:

1. Article IV. Rules and Definitions.
2. Appendix A. "Listing of Permitted and Conditional Uses" including, but not limited to "Orphanages" and other new additional use(s).

The motion was seconded by Brent Littleton and passed 8-0.

e. Review vacancies and expired terms.

Staff provided the following information regarding two vacancies due to a resignation and an expired term:

PLANNING & ZONING COMMISSION (3 year terms -- 9 members)			
Members	**Term**	**Expires**	**Appointed/ Eligible to be Reappointed**
Mary Jo (Dancer) Meier Chair	1st term*	January 1, 2022	
Philip Umlauf	1st term*	January 1, 2020	August 20, 2015 Resigned December 2, 2019
Brent Littleton**	1st term	January 1, 2022	January 25, 2019
Tony Royse	1st term	January 1, 2022	March 28, 2019
Andy McLenon** Secretary	1st term*	January 1, 2021	October 26, 2016 January 8, 2018
Michelle Anderson	Unexpired	January 1, 2021	June 28, 2018
Barbara Emert	1st term*	January 1, 2021	March 7, 2017 January 8, 2018
Lisa Richard	1st term*	January 1, 2023	August 8, 2019 December 19, 2019
Steve McBride Vice Chair	2nd term	January 1, 2020	Nov 20, 2013 Effective 1/1/2014
*Served an unexpired term. **Outside City Appointment. Not on Board of Zoning Appeals.			
Meeting Place: Veterans Room, Memorial Hall Meeting Date: First Tuesday of each month Meeting Time: 5:30 p.m.			

Applications are being received until January 17, 2020. The application may be found at this link: https://www.independenceks.gov/DocumentCenter/View/1814/PZApplication-Due01172020

Mary Jo Meier thanked everyone for serving as it is not an easy job. She also thanked those that performed additional research and input.

Lisa Richard stated that the recommendation to the Commission should include the opposition's concerns.

Brent Littleton noted that conditions five and six cover that area and the building owner doesn't need to be cited to death.

Lisa Richard asked that the articles be provided to the Commission.

Board of Zoning Appeals (Does not include outside City appointments)

f. None.

Adjournment

A motion was made by Andy McLenon, seconded by Lisa Richard to adjourn.
Motion carried 8-0.

_____	_____
Andy McLenon, Chair	Michelle Anderson, Secretary

STAR RATING SYSTEM

Indoor Range & Retail Businesses

5 STAR RANGE

RATED BY National SHOOTING SPORTS Foundation PROMOTE • PROTECT • PRESERVE

4 STAR RANGE

RATED BY National SHOOTING SPORTS Foundation PROMOTE • PROTECT • PRESERVE

3 STAR RANGE

RATED BY National SHOOTING SPORTS Foundation PROMOTE • PROTECT • PRESERVE

DOES YOUR INDOOR RANGE AND RETAIL STORE HAVE WHAT IT TAKES TO BE AN NSSF STAR-RATED BUSINESS?

The National Shooting Sports Foundation® (NSSF®) is happy to introduce the new Star Rating System for indoor range and retail businesses. The rating system is based on our vision of a safe, well-managed, customer-oriented facility that is a strong promoter in the recreational shooting sports market. NSSF's new Star Rating Range Program will hold 5 Star facilities to a higher standard. These 5 Star-rated ranges will be the gold standard for our industry, those ranges having earned that rating through their focus on advancing best business practices.

Some ranges may not be able to immediately meet the requirements needed to achieve the full 5 Star rating—and that's okay! The important thing is that your range and retail business is meeting the needs of your customers regardless of where you rank, and from there you can use the 5 Star rating requirements as a guide to make additional improvements. Indeed, this rating system is intended to provide our member ranges an opportunity to identify areas within their businesses that can be refined to attract new customers and provide them a higher level of service.

Do you think you have what it takes to be an NSSF Star Rated facility? Let's get started and find out!

HOW TO USE THIS RATING FORM

There are four categories in the NSSF Star Rating System for indoor range and retail businesses: Appearance, Management, Shooting Sports Development and Amenities. Each category is divided into several sections that group related scoring criteria.
The first thing you should do when working with each section is to read the scoring criteria. Scoring is based on a 5, 3 or 0 rating. A 5 will mean your current facility meets the highest requirements for that particular item within that section. A 3 means you fall short of 5 Star standards but you do meet part of the criteria. If your business does not meet the criteria at all, give yourself a 0.

In order to validate your scores, you must supply us with additional support information. The additional information required is listed next to the items within each section. There is also a Supporting Documentation Checklist in the back of rating form. Make sure to use this as a reference so that you supply all supporting information on the flash drive that's provided to you within your application package.

In determining your facility rating, add up the earned points in each section and write the sum in the shaded box at the bottom of each respective section. The section scores will then be added up to determine your score for the category, then all category scores will be tabulated into a final total. From there you'll compare your scores with the star rating score requirements on the last page of the evaluation and determine where your facility stands.

NSSF STAR RATING RANGE ASSESSMENT

Complete the following sections using 5, 3, or 0 for your response. At the end of each section, tally your responses and calculate your points. At the end of the application, tally your subtotals for a total score.

5 = Demonstrates exceeding the criteria (requires proof and/or verification)
3 = Demonstrates meeting the criteria
0 = Does not meet criteria

1. APPEARANCE		Response Required	
SIGNAGE	You have a store sign that can be easily read from the road far enough in advance to make a safe turn from a vehicle. That sign is maintained to provide a professional image.	Picture attached	
	Your telephone number, web address and social media channels are clearly and professionally posted near the entrance so potential new customers/members can contact you during off hours.	Picture attached	
	You have signage that clearly states basic range and firearm safety rules posted where everyone will see them either before they enter your range or facility or while they're on the range. That signage is readable and maintained.	Picture attached with written explanation if more than one	
	You have a professional "Welcome" sign created by qualified personnel with a marketing background or an experienced marketing or advertising firm. That sign is consistent with your company's other branding and was produced by a reputable printing house. If you meet this criteria, give yourself 5 points. If you have a ready-made store-bought sign or something similar, give yourself 3 points. No "Welcome" sign rates 0 points.	Picture attached	
	You have a professional "Open" sign created by qualified personnel with a marketing background or an experienced marketing or advertising firm. That sign is consistent with your company's other branding and was produced by a reputable printing house. If you meet this criteria, give yourself 5 points. If you have a ready-made store-bought sign or something similar, give yourself 3 points. No "Open" sign rates 0 points.	Picture attached	
	You have your regular hours of operation clearly and prominently displayed on the outside of your facility.	Picture attached	
	You have a professional "Thank You for Coming" sign that was created by qualified personnel with a marketing background or an experienced marketing or advertising firm. That sign is consistent with your company's other branding and was produced by a reputable printing house. If you meet this criteria, give yourself 5 points. If you have a ready-made store-bought sign or something similar, give yourself 3 points. No "Thank You for Coming" sign rates 0 points.	Picture attached	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
FACILITY EXTERIOR & INTERIOR	All building exteriors look like they're professionally maintained.		
	Your windows are clean and uncluttered.	Picture attached	
	Grounds cleanup is part of your daily operating procedures and performed on a continual basis.	Written Explanation of Policy	
	Are walkways, curbs and firing lines made of concrete, asphalt or another material appropriate for the specific purpose? And are they regularly maintained for both safety and appearance reasons?	Picture and Policy	
	Your facility is landscaped and the landscaping is well maintained.		
	Your parking lot is well-lit at all times while the store is open for business.	Picture attached	
	The interiors of your public-access buildings are impeccably maintained…	Picture attached	
	Your clubhouse or lounge furniture is the kind of relaxing style you'd expect in a doctor's office or in other similar professional businesses or sports clubs.	Picture attached	
	The interior gets a thorough cleaning (vacuuming, dusting, etc.) on a regularly scheduled weekly basis at a minimum	Policy described	
	If you have posters and/or other artwork on the walls, they are all framed, neatly mounted or otherwise produced for a professional display appearance.	Picture attached	
	Give yourself 5 points if your facility's driveway, parking lot, roads and paths are paved or freshly graveled. Give yourself a 3 if these items are unpaved, but are smooth and regularly maintained (no ruts, washboards or potholes) AND where inclement weather does not significantly impact appearance or function. Any other description merits a 0.	Picture attached	
	Your building interior is brightly illuminated during hours of operation (and keeping in mind that sunlight counts).	Picture attached	
	Your firing line and target areas are brightly illuminated during hours of operation.	Picture attached	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		

Total Points Section 1: Points: _____ / 100

SAMPLE

2. MANAGEMENT		Response Required	
CORPORATE TECHNOLOGY	If your organization has a point-of-sale (POS) system, give yourself 5 points. No POS system merits a 0.	Description	
	If your organization uses an electronic bound book, give yourself 5 points. No electronic bound book merits a 0.	Description	
	If your organization has a corporate email (an email account with a domain name that ties directly to your organization; ex. gunsforsale@joesgunshop.com) that receives information requests and is monitored throughout each business day, give yourself 5 points, otherwise 0.	Description	
	If you provide a corporate email account for all full time employees give yourself 5 points. If you provide email addresses for the majority of employees, give yourself 3 points, or, if you do not typically provide emails for employees, give yourself 0 points.	Description	
	Award your facility 5 points if you have a fax machine, scanner or fax-to-email system that serves to send and receive documents electronically. If no such technology exists, then 0.		
	You have a phone system that provides a personal greeting and voicemail and can be regularly updated with messages.		
	Your phone system includes an auto-attendant service that provides your hours of operation and other useful information.		
	Your organization has a professional website.	URL attached	
	If your website has an integrated electronic hold-harmless/liability waiver, give yourself 5 points. If your waiver is posted to your website and viewers can print and complete the waiver prior to their arrival, give yourself 3 points.	URL	
	Your website is updated at least quarterly...	Describe	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
FINANCIALAWARENESS & COMPLIANCE	You have a formal accounting software package or utilize a professional accounting agency to help manage your business.	Description	
	You use customer conversion data to improve periodic sales performance.	Description/ example of analysis	
	You conduct surveys of your customer base at least once a year in order to measure and/or improve performance.	Description/ example of analysis	
	Your organization has had a mock ATF (or other firearms regulatory or consulting entity) audit at least once every three years (unless you have had an actual audit by the ATF during that same time period).	Description	
	Your organization has had a mock OSHA audit by an outside entity within the last three years (unless you have had an actual audit by a pertinent regulatory body during that period). If you perform your own audit, provide an outline of what that audit consists of.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
MARKETING & ADVERTISING	If you retain professional marketing personnel or utilize an outside agency at least three out of four quarters each year, give yourself 5 points	Description	
	If you have a written marketing plan that has been updated in the last 12 months, give yourself another 5 points.	Description	
	You have a comprehensive and professionally designed website that fully describes your facility and services.	URL	
	You have a comprehensive printed brochure that fully describes your facility and what's available on-site.	PDF or picture	
	If your website has all range rules and fees listed, you get 5 points.	URL	
	If the regular hours of operation, facility address and directions, along with specific business offerings, are clearly and prominently posted on your company's website and on your social media platforms, give yourself 5 points.	URL	
	Your range is listed in annual directory such as NSSF's Where to Shoot website or NRA's National Registry of Places to Shoot.		
	Your organization has had at least one major sales campaign within the last year that was advertised outside of your facility.	Describe	
	Give yourself 1 point (up to 5 points) for every local business (chamber, visitors' bureau, hotels, restaurants, etc.), where you promote your business by displaying brochures or flyers in their ad racks or boards..	Describe	
	If you engage your customer base through e-blast communication on a weekly or monthly basis and or have a newsletter that is sent out at least quarterly, give yourself another 5 points…	Describe and provide link to latest e-blast or newsletter	

SAMPLE

	Give yourself 5 points if you maintain at least a 4 star or greater average with online review sites such as Google, Yelp, Trip Advisor, etc., and you can prove you address customer complaints on those sites. Give yourself a 3 if you maintain a 4 star average but do not respond to complaints.	URL and describe process for bad experience follow up	
	If you utilize, on a weekly basis, social media channels such as Facebook, Twitter and Instagram with which to engage your customer base while promoting your business to prospective customers, give yourself 5 points.	URL	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
STAFF TRAINING	You require senior staff to attend at least one formal skills-development training seminar every year (such as those offered by the local college).	Description: examples of training	
	If your staff (including you) have attended industry training sessions such as SHOT Show University, Retailer Seminars, webinars, training programs offered through 3point5.com or other non-industry specific training classes to improve your business practices overall, give yourself 5 points.	Description	
	If you use outside business consultants for advice, policy development, professional management and/or staff training, give yourself 5 points	Description	
	You have a formal training procedure for on-boarding all new employees, to include orientation and classroom training.	Description	
	There are monthly mandatory staff meetings that always include a discussion of customer/member service.	Description	
	The staff is provided with a written procedures manual that is always immediately available and has been updated within the last 12 months.	Description	
	If your staff is trained on drug awareness and related policies, such as those provided by local law enforcement agencies, you get 5 point.s	Description	
	The entire staff is trained to and are evaluated on promptly greeting and welcoming visitors.	Description	
	Your staff is trained to be professional on the telephone and always answer by the third ring.	Description/tested by the committee randomly	
	If you allow employees to carry exposed or concealed firearms while performing their job duties, you require regular training and qualifications.	Description	
	if you allow employees to carry exposed or concealed firearms as part of their job duties, you have annual decision making and scenario training as a requirement to carry while on the job.	Description	
	You monitor all your employees for firearms retention practices and awareness.	Description	
	Your organization has a written firearms handling and carrying policy manual that specifically addresses what the employees are allowed to do with their firearms while working.	Description	
	You have instructors, and the majority (more than half) of them have formal training certified by the NRA or a governmental agency.	Description	
	Instructors without formal training have worked through a comprehensive "On the Job" training program supervised by certified (formally trained as listed above) instructors.	Description	
	If your facility has a full-time range master or chief range safety officers certified by the NRA or governmental agency, give yourself 5 points.	Description	
	Your facility has a written safety plan in place and your staff is trained and prepared to use it.	Describe	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
UNIFORMS	Your staff is required to be in a uniform that you provide.	Picture	
	You provide cleaning services (or pay for the service) for employee uniforms.	Describe	
	All employees have names embroidered on their uniforms or wear nametags.	Picture	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
SECURITY & SAFETY	You conduct background checks on all new hires.	Description	
	Your organization has a written emergency action plan for common emergencies.	Description	
	Your range has range safety officers on the ranges or patrolling the range at all times the ranges are active (hot).	Description	
	You have a CCTV camera system that covers more than 90 percent of your facility (inside and outside).	Description	
	Your CCTV security system allows remote viewing and playback.	Description	
	You maintain at least three months of CCTV backup video for all your cameras.	Description	
	If as a matter of policy you mainta in having a CPR-certified employee onsite during hours of operations, give yourself 5 points.	Description	

SAMPLE

SECURITY & SAFETY CONTINUED ····▶

	If you have a automated external defibrillator (AED) in your facility and maintain necessary required certifications, give yourself 5 points.	Picture	
	You maintain a fully equipped, readily available trauma kit and your staff is trained to use it.	Describe	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
LEADERSHIP	You stay on top of things by reviewing and updating all of your plans on an annual basis.	Description	
	Give yourself 5 points if you have a full-time manager (at least 32 hours/week), 3 points if you have a part-time manager or 0 points if you have not hired a manager for your business.	Description	
	Give yourself 5 points if your manager has a college degree or professional certification in a range or business discipline, 3 points if your manager has at least two years in range, retail or other related management. If none of these, 0 points.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
Total Points Section 2: Points: _____ / 295			

3. SHOOTING SPORTS DEVELOPMENT		**Response Required**	
SHOOTING SPORTS DEVELOPMENT	You provide scheduled and supervised public range time at least five days a week.	Description	
	If you rent a wide range of guns for on-range use, give yourself 5 points.	Picture attached	
	If you provide free or low-cost, quality eye and ear protection, give yourself 5 points.		
	If you offer free or low-cost introductory shooting programs throughout the year (i.e. First Shots), give yourself 5 points.	Description	
	Give yourself 5 points if you have trained, personable instructors available most business hours, 3 points if you have instructors available, but only by appointment. No instructors available merits a 0.	Description	
	Give yourself 5 points if you offer classroom or private instruction beyond carry license classes, 3 points if you contract or work with another agency or business to provide similar classes. No training other than carry licensing merits a 0. (Note: Hunter education classes intended to satisfy hunting license requirements count towards "other" training.)	Description	
	You have a fully functional classroom with professional, good quality audio and visual aids.	Picture attached	
	If you provide a new shooter/safety orientation presentation for all shooters, give yourself 5 points.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
COMMUNITY ENGAGEMENT	Community engagement efforts can earn you up to 55 points in the following section. Assess your earned points using the last 12-month period.		
	Give yourself 2 points for each special event over the last 12 months where the public was invited to the range (via personal invitation or advertisement on social media, website, online advertising, in the community's primary newspaper, on radio or on TV). 10 points maximum.	Description	
	Give yourself 2 points for each league program scheduled at your range each year. 10 points maximum.	Description	
	Give yourself 1 point for each non-profit group or any first-responder groups you allowed to use the facility at a discounted rate or for free over the last 12 months. 5 points maximum.	Description	
	Give yourself 1 point for every $1,000 your business activities have raised for charitable organizations. 10 points maximum.	Description	
	If you or your manager(s) are an active member of a local civic group, chamber of commerce, veterans support group or law enforcement charity or volunteer program, where the purpose of the membership is to foster the growth of your business and the shooting sports, give yourself 1 point per group. 3 points maximum.	Description	
	For each youth event (Boy Scouts, 4H, etc.) held at your range, add on an additional 5 points. 15 points maximum.	Description	
	Give yourself 1 point for each speech or presentation you delivered to a local or national group/organization and contributed to the development of the shooting sports. 3 points maximum.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		

SAMPLE

RANGE EQUIPMENT & PRACTICES	You utilize a modern electronic target-retriever system in all lanes and the equipment is well maintained.	Picture	
	If you have separate ventilation systems for each range bay and each system has HEPA filters for the return or exhaust air, give yourself 5 points. If your standalone range ventilation system uses HEPA filters for the return or exhaust air, give yourself 3 points.	Pictures	
	You have magnehelic pressure gauges or other electronic monitoring of air flow on all of your exhaust systems to ensure timely filter changes.	Picture attached	
	Your gauges are continually monitored.	Description & Picture	
	If your range/s floors are cleaned daily (including mopping or HEPA vacuuming) or during the day when necessary, give yourself 5 points. If you clean the floors only a few times a week, give yourself 3 points.	Description	
	If you provide Dlead soap or a similar personal cleaning product in the restrooms or at a wash station by your range for customers to use after shooting, give yourself 5 points.	Picture	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
ENVIRONMENTAL	You have written lead management health and safety plans set up to ensure your compliance with Federal and State Laws	Scored Below	
	This plan must contain the following 7 plan items–answer 5 if your plan includes the item or 0 if it does not:		
	Surface Lead testing procedures.	Description	
	Employee blood lead-level testing procedure.	Description	
	Lead mitigation procedures for staff and public.	Description	
	Trap maintenance and mining procedures.	Description	
	An injury prevention and wellness plan related to ranges, facilities and lead safety.	Description	
	Hazardous material handling and storage plan.	Description	
	Hazardous material disposal plan.	Description	
	You conduct surface lead checks regularly (at least once per quarter) in all employee and public spaces.	Description	
	You or your current manager(s) have participated in an NSSF Lead Management & OSHA Compliance Workshop or training webinars on these topics.	Description	
	Give yourself 5 points if you maintain a laminar air flow across the firing line of between 50 and 75 feet per minute. If not, the score merits a 0.	Description	
	If you have anything on your ranges (behind the shooting stalls by the back wall) that potentially disrupts the air flow, give yourself a 0, otherwise a 5.	Description	
	If you have hired or utilized any consultants to help develop, review or test your systems/procedures to ensure both OSHA and EPA compliance, give yourself 5 points.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		

Total Points Section 3: Points: _____ / 185

SAMPLE

4. AMENITIES		Response Required	
RETAIL STORE / PRO SHOP	(The following refers only to stock inventory and not to special-order items.)		
	Give yourself 5 points if your inventory includes everything a target shooter could want, including firearms, ammunition, targets, optics, accessories, cleaning and reloading supplies, clothing, books/ magazines/videos, etc. Give yourself 3 points if your inventory product mix is good, but not quite all-inclusive. Award yourself 0 points if you carry only some ammo and targets.	Describe	
	Your retail store area / pro shop is merchandised in a professional manner and all products are clearly displayed and labeled.	Pictures of Pro Shop	
	Display cabinets are well organized, shelf space is filled, and empty spaces are back filled for an orderly appearance.	Pictures of Pro Shop	
	Give yourself 5 points if your interior retail area is well lit at levels equal to retail industry lighting standards.	Pictures of Pro Shop	
	Give yourself 5 points if your retail cabinets are separately lighted (not just by ambient room lights).	Pictures of Pro Shop	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
RESTROOMS	Give yourself a 5 points if your range has modern indoor restroom facilities. Award yourself 3 points if your facility has restrooms that need improvement (the fixtures are old, wallpaper or paint is cracked and peeling, sinks have water stains, etc.). If you do not have restrooms, award 0 points.	Picture attached	
	Give yourself 5 points if you have separate men's and women's restrooms or multiple uni-sex restrooms. If you do not, 0 points.		
	Your restrooms are cleaned and restocked with the necessities at least twice a week, as otherwise needed and immediately before and after any special event.	Description	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
OTHER AMMENITIES	If you have a beverage vending machine or services that are well stocked, give yourself 5 points, otherwise 0.	Picture attached	
	If you have a snack vending machine or other food services, give yourself 5 points, otherwise 0.	Picture attached	
	If your range and buildings are handicap accessible, give yourself 5 points, otherwise 0.	Description	
	If you have an on-the-spot gun cleaning service, give yourself 5 points, otherwise 0.	Describe	
	If you have a certified graduate of a recognized gunsmithing school, give yourself 5 points, otherwise 0.	Describe	
	If your range has an indoor lounge where customers/members can relax and/or escape the weather, give yourself 5 points, otherwise 0.	Picture attached	
	If your indoor range (the actual ranges, not retail or office areas) are fully climate controlled, give yourself 5 points. If your range is partially climate controlled and/or your general weather conditions do not necessitate a need for such a system give yourself 3 points. If you do not have any climate control and your facilities are affected by weather and seasonal changes, award 0 points.	Describe	
	If you have meeting rooms or classrooms available for rent or use by other interested parties, give yourself 5 points, otherwise 0.	Describe	
	Total Points This Sub-section: 5 = _____ 3 = _____ Total = _____		
Total Points Section 4: Points: _____ / 80			

Total Points All Sections:
Section 1:_____ Section 2: _____ Section 3: _____ Section 4: _____
Points: _____ / 660

SAMPLE

HOW YOUR FACILITY RATES:

THE AVERAGE SCORES WERE AS FOLLOWS:

Appearance _____ points

Shooting Sports Development _____ points

Management _____ points

Amenities _____ points

TOTAL SCORE _____ points

Rating - Minimum Points Needed	✓		✓
1 STAR RATING - Register with NSSF		2 STAR RATING - Register and Membership with NSSF	
3 STAR RATING - 70% - 462 Pts		4 STAR RATING - 80% - 528 Pts	
5 STAR RATING- 90% - 594 Pts			

RATING REVIEW PROCESS

The review process will be spearheaded by NSSF's Manager of Shooting Promotions, Zach Snow, who will work with a review panel comprised of members of the NSSF Range Advisory Council (additional NSSF staff may also be asked to participate in a facility review as warranted). You will want to compile your evaluation responses into a formal submission packet so that NSSF's assessment can be completed in a way that leaves as few questions as possible from the review panel. This is one case where more information is better than less, for a detailed submission package can go a long way toward demonstrating your commitment to a higher star rating.

Once your self-evaluation and supporting documentation are complete, please contact Zach Snow at zsnow@nssf.org, telephone 203-426-1320 ext. 224, or mail your submission package to his attention at NSSF, 11 Mile Hill Rd, Newtown, CT 06470-2359. Please give the review panel at least 30 days to evaluate your application and its supporting documentation provided.

Name: (as you want it to appear on the certificate): _____

Contact Person: _____ Title: _____

Mailing Address: _____

City, State, Zip: _____

Telephone number: _____

E-mail: _____

SAMPLE

RANGE PROGRAM STAR RATING ASSESSMENT FOR INDOOR RANGE AND RETAIL BUSINESSES

Listed below are the items you must provide along with your completed application so that we may validate your given scores. Failure to supply this supporting information will prevent your range from becoming an NSSF 3-5 star-rated business.

Supporting Documentation Checklist:

APPEARANCE

Signage Pictures

- Exterior sign clearly visible from the road
- Storefront business information picture
- Range rules sign/s (include all and describe locations)
- Welcome sign
- Open sign
- Store hours of operation sign
- Thanks for Coming sign

Facility Exterior and Interior Pictures and Policies

- Building Exterior (at least four pictures)
- Windows (all)
- Grounds clean up policy
- Pictures of the walkways, curbs and firing line, plus your regular maintenance policy
- Landscaping pictures
- Parking lot lighting pictures (day and nighttime photos can both be provided)
- Building interior (at least four pictures)
- Lounge furniture
- Interior cleaning policy
- Wall artwork
- Driveway and parking lot
- Interior lighting
- Firing line and target area lighting

MANAGEMENT

Corporate Technology Descriptions & URLs

- Point-of-sale (POS) system description
- Electronic bound book description
- Corporate email account for information description (provide email address)
- Corporate email addresses for all full-time employees
- Description of method used for sending and receiving documents electronically
- Phone number for personal greeting/voicemail and auto attendant service
- Website URL
- Electronic hold-harmless/liability waiver URL
- Description of business practices related to updating business website

Financial Awareness & Compliance Descriptions

- Description of formal accounting software or the professional accounting agency used to manage your business
- Description of how you use customer conversion data to improve periodic performance
- Description of how surveys were conducted, an example of the most recent survey and its analysis report
- Description of your ATF mock audit practices used in the last three years or, if you've been audited by the ATF in the last three years, tell us about the outcome
- Description of your OSHA mock audit practices in the last three years

Marketing & Advertising Descriptions, Examples and URLs

- Description of marketing personnel on staff or the agency you use and the services they provided for at least three-quarters of the year
- Outline of your marketing plan or the actual marketing plan for the current year
- Website URL routing us to the page that best describes your business
- PDF or picture of your comprehensive printed brochure
- Website URL(s) to the page(s) that include all range rules and fees
- Website and social media URLs to the pages that show hours of operation, property address and directions and any pages that present current special offers
- Description of one of the major sales campaigns occurring within the last year and the outside advertising channels used to promote the event
- List the local businesses where you have displayed brochures or other promotional materials over the last 12 months (no more than five)
- Description of e-blast campaign or newsletter communication efforts and a URL or PDF of the most recent e-blast or newsletter
- URLs reflecting you're maintaining online review site reviews of four stars or better and examples of how you address customer complaints on those sites
- Social media profiles showing your level of activity working to engage established customers and attract prospective ones

Staff Training Descriptions and Examples of Policies

- Description of the formal skills-development training seminar/s you require your senior staff to attend and an example of the most recent training seminar they've participated in
- Description and examples of industry-specific training seminars or non-industry training programs you and your staff have attended over the last three years (i.e. SHOT Show University, NSSF Retailer Seminars, 3point5 training, etc.)
- Description of outside business consultants used
- Description of formal training procedures for on-boarding all new employees, including orientation and classroom training
- Description of monthly mandatory staff meetings
- Description or the actual copy of your written procedures manual that's readily available to all employees and is updated every year
- Description of drug-awareness employee training
- Description of policy related to greeting and welcoming customers upon arrival and departure
- Description of staff training policy related to answering the phone
- Description of regular staff training and qualifications required in order for employees to carry exposed or concealed firearms while working
- Description of the required annual decision making and scenario training employees must go through in order to carry while working
- Description of how you monitor employees related to firearms retention practices and awareness
- Description or actual copy of your written firearms handling and carrying policy that explains what employees are allowed to do with their firearms while working
- Description of the staff training credentials your instructors have
- Description of your comprehensive on-the-job training program provided to employees/instructors who lack any formal training and that is provided by a formally trained instructor
- Description of the range safety officer component of your business and their credentials (i.e. full-time range master, chief range safety officer, range safety officers, etc.)
- Description or an actual copy of your written safety plan to include the regular staff training practice sessions

Uniform Pictures and Description

- Picture of staff uniforms you provide
- Description of the cleaning services used for employee uniforms
- Picture of employee name tags or names embroidered on staff shirts

Security & Safety Descriptions and Picture

- Description of background check practices for new hires
- Description or actual copy of your written emergency action plan for common emergencies
- Description of your range safety officer patrolling practices
- Description of your CCTV camera system that covers 90 percent of the facility (inside and outside)
- Description of your CCTV camera systems remote viewing and playback options
- Description of your backup video storage practices
- Description of your business practices related to having a CPR-certified employee onsite during hours of operation
- Picture of your automated external defibrillator (AED) and a copy of any document verifying that your business is maintaining the necessary certifications for this device
- Describe what your trauma kit includes and provide a picture of it

Leadership Descriptions

- Describe how you review and update all your plans on an annual basis
- Description of your management staff team
- Description of your managers' educational backgrounds (whether college degree, professional certification or overall tenure in the range-retail or similar business management experience)

SHOOTING SPORTS DEVELOPMENT

Shooting Sports Development Descriptions and Pictures

- Pictures showcasing your inventory of rental guns
- Describe your business practices related to providing eye and ear protection to customers
- Describe the introductory programs you offer throughout the year
- Describe your instructors' credentials and the business practices related to this area
- Describe how your business approaches the training/instructor segment. If your business provides training/instructional classes, please list all the courses currently offered
- Pictures of the classroom and the audio and visual aids used
- Describe the new shooter/safety orientation procedure you provide for all new shooters and first-time customers

Community Engagement Descriptions

- List the special events (no more than five) you hosted over the last 12 months that were open to the public, and provide examples of invitations or advertisements developed to promote these events
- List the league programs you held over the last 12 months (no more than five)
- List the non-profit groups or other entities you've allowed to use your range at a discounted rate or for free over the last 12 months (no more than five)
- List the charitable organizations your business has supported and the amount of money that has been donated to them over the last 12 months
- List the local civic groups that you (the owner) or your managers belong to and regularly participate in (no more than three groups)
- List the youth events held at your range over the last 12 months (no more than three)
- List the presentations that you or your staff have delivered to a local or national group or organization that contributed to shooting sports development (no more than three)

Range Equipment & Practices Pictures and Descriptions

- Picture of your well-maintained, modern target retrieval systems
- Pictures of your range ventilation system and the HEPA filtration banks
- Picture of your HVAC's magnehelic pressure gauges or electronic air monitoring system used to ensure timely filter changes
- Description and a picture of monitoring practices related to your pressure gauges
- Description of your cleaning practices related to the floors of your ranges
- Picture of bathroom sinks or wash stations where you provide a cleaning product (such as Dlead soap) that rinses any lead off of your customers hands after shooting on the range

Environmental Plans, Descriptions and Pictures

- Surface lead testing procedures plan
- Employee blood lead level testing procedures plan
- Lead mitigation procedures for staff and public
- Trap maintenance and mining procedures plan
- Injury prevention and wellness plan related to ranges, facilities and lead safety
- Hazardous material handling and storage plan
- Hazardous material disposal plan
- Description of your procedures related to regularly conducting lead surface tests in all employee and public spaces
- Specify which NSSF Lead Management & OSHA Compliance workshop you or another staff member participated in (specific location, or note participation in a webinar series)
- Description of how you maintain a laminar air flow of 50-75 feet per minute across the firing line and pictures showcasing the testing procedure (i.e. conducting smoke tests and measuring air velocity)
- Picture demonstrating that you have nothing behind the shooting stalls that would potentially disrupt the laminar airflow on your ranges.
- Describe the consultation services you've utilized to develop, review and test your systems and procedures to ensure compliance with EPA and OSHA

AMENETIES

Retail Store/Pro Shop Description and Pictures

- Describe what your store's inventory includes
- Pictures of your store highlighting how it's merchandised in a professional manner and how all products are clearly displayed and labeled
- Pictures of your store demonstrating that display cabinets/cases are well organized, shelf space is filled and empty spaces are back filled to present an orderly appearance
- Pictures of retail areas demonstrating the quality lighting used to ensure a warm and bright environment for customers
- Pictures of your separately lighted display cabinets/cases

Restroom Pictures & Description

- Pictures showcasing your modernized restrooms (male and female and/or unisex restrooms)
- Describe your weekly procedures related to general bathroom facility upkeep and maintenance

Other Amenities Pictures and Descriptions

- Picture of your beverage vending machine or similar offerings
- Picture of your snack vending machine or similar offerings
- Describe your businesses handicap accessibility amenities and include any pictures that demonstrate what you've done to accommodate those who are physically challenged
- Describe your on-the-spot cleaning services
- Describe your gunsmithing services and provide background on your gunsmith's schooling credentials
- Picture of the lounge area
- Describe your shooting range climate control system
- Describe the availability of classroom or meeting room use by outside parties and provide a couple examples of how other parties have used it

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Decontamination of Community Building gun range to cost city thousands

Don Cole, left, watches his son, Dean Cole, both of Lawrence, take target practice Wednesday, Jan. 9, 2008 at the Douglas County Rifle/Pistol Club Range at the Community Building, 115 W. 11th St.

There is a room in the Lawrence Community Building that is closed off to the public — not even a ventilation system runs between it and the rest of the structure. Before the door is ever opened, a level of cleanup akin to that for asbestos and methamphetamine labs is needed.

“The door is locked and nobody’s going in until we get it cleaned, so I think we’re safe and should be doing what we’re supposed to be doing,” said Ernie Shaw, interim director of the Lawrence Parks and Recreation Department.

For decades, the approximately 1,400 square-foot space housed a gun range that has left behind high levels of lead contamination. As patrons fired their weapons over the years, bits of lead from those bullets built up. A test found the presence of lead in some areas that was 17,000 times greater than what is considered safe by the U.S. Department of Housing and Urban Development, according to a report provided to the Journal-World by the Parks and Recreation Department.

The Community Building was constructed in 1940, and was originally designed to be an armory. Shaw said that, as far as he knew, the space in the basement had always been a shooting range.

The Douglas County Rifle & Pistol Club leased the space from the city and operated the gun range. In February, the *club was ordered to cease operations* after city leaders realized its location violated the federal Gun Free School Zones Act, enacted in 1990. Since then, the primarily concrete room in the basement of the Community Building, 115 W. 11th St., has been locked up.

Testing for lead contamination

As the owner of the building, the city subsequently tested the area for lead contamination. The results of those tests showed that each of the four samples taken from the room — and one from the public stairway leading down to it — had excessive levels of lead contamination.

HUD guidelines state that lead levels above 40 micrograms per square foot are hazardous, and the five wipe samples taken from the floor within and right outside the room ranged from about 400 to 681,000 micrograms per square foot.

One of the reasons units for lead test are so small is because even low levels of lead are toxic if ingested. Lead is especially harmful for infants and children, and even low levels of lead in blood have been shown to affect IQ, ability to pay attention and academic achievement, according to the Centers for Disease Control. The effects of lead exposure cannot be corrected.

However, when the building was renovated — updates that included the

installation of a central heating and cooling system — the shooting range was not included. For that reason, Shaw said it kept the contamination mostly localized.

“It’s not connected to any ventilation systems or heating systems or anything like that — it just stands alone,” Shaw said. “So the recommendation was to shut it off, and before you start using it again it basically needs to be cleaned, probably professionally, since it has fairly high lead levels in it.”

Lead hazard in public areas

The lowest result — which was still 10 times the limit — came from the one public area in the building that tested above the hazard level. The stairway to the basement where the gun range was located was found to have about 400 micrograms of lead per square foot, which is about 10 times the limit of 40 micrograms of lead per square foot.

Shaw hypothesized that most of that contamination could have happened after those with the club were told to vacate the space, and subsequently used the stairs when taking their equipment out of the building. However, Shaw said that a similar level of lead was likely to have regularly left the room while the range was in operation.

“When they’re shooting and down there and they’re coming and going, there has probably been for 40 years people tracking a little lead out into the hallways and stuff,” Shaw said. “There’s no doubt that that has been happening with that (level of) concentration.”

After the Parks and Recreation Department received the results of the lead test, officials were advised to do another test on the rest of the building, Shaw said. The results of that text came back this week and showed that samples taken from 11 areas throughout the building — including the community room, elevator, art room and gym — are all below the HUD hazard levels. All areas resulted in less than 10 micrograms per square foot.

“Unless it’s tracked out or actually gets in an air ventilation system, it usually doesn’t go very far,” Shaw said.

Cleanup

The Parks and Recreation Department is currently accepting bids for decontamination services to clean the room, and Shaw said he expects it to cost thousands of dollars. He noted that any porous surface, including a sand pit and foam padding, will also need to be removed. Tests of the sand found it to contain as much as 310,000 micrograms of lead per square foot. The HUD limit for soil or sand samples is 400 parts per million.

Shaw said that Community Building staff were never in charge of cleaning the room. And Shaw, whose office was in the building for several years, wasn't sure what level of cleaning was done by the club, but that he understood that some who frequented the range monitored the lead levels in their blood. The number previously listed for the gun range is no longer in service.

Titan Environmental Services conducted the testing. The company's website focuses on testing and removal of lead-based paint, as well toxins such as asbestos and radon and those found in meth labs. Kyle Gunion, a project manager for TES, said that while a firing range isn't a contamination area they commonly work with, it was expected that some level of lead contamination would be present. Gunion said that once the space is decontaminated, they will retest to ensure it is safe.

"It'll be cleaned to where either the contaminants discovered are below an acceptable threshold or cleaned up entirely," Gunion said. "We'll know more when the clearance testing is done."

Money to decontaminate the room wasn't a budgeted expense, but Shaw said it will have to be accounted for this year.

"When things like this happen that you don't plan for, you figure out what isn't going to get done in order to do that this year," Shaw said. "So that's what we'll have to do, depending on what the bid comes in at."

Shaw said once the room is decontaminated, the Parks and Recreation Department plans to use the space, perhaps for an archery range, golf range or spin room for stationary bikes. But until test results confirm is has been decontaminated, the basement room is remaining sealed.

"We'll see, once we get it cleaned up, what we want to use it for," Shaw said.

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Lead exposure at firing ranges—a review

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Abstract

Background

Lead (Pb) is a toxic substance with well-known, multiple, long-term, adverse health outcomes. Shooting guns at firing ranges is an occupational necessity for security personnel, police officers, members of the military, and increasingly a recreational activity by the public. In the United States alone, an estimated 16,000–18,000 firing ranges exist. Discharge of Pb dust and gases is a consequence of shooting guns.

Methods

The objectives of this study are to review the literature on blood lead levels (BLLs) and potential adverse health effects associated with the shooting population. The search terms “blood lead”, “lead poisoning”, “lead exposure”, “marksmen”, “firearms”, “shooting”, “guns”, “rifles” and “firing ranges” were used in the search engines Google Scholar, PubMed and Science Direct to identify studies that described BLLs in association with firearm use and health effects associated with shooting activities.

Results

Thirty-six articles were reviewed that included BLLs from shooters at firing ranges. In 31 studies BLLs > 10 μg/dL were reported in some shooters, 18 studies reported BLLs > 20 μg/dL, 17 studies > 30 μg/d, and 15 studies BLLs > 40 μg/dL. The literature indicates that BLLs in shooters are associated with Pb aerosol discharge from guns and air Pb at firing ranges, number of bullets discharged, and the caliber of weapon fired.

Conclusions

Shooting at firing ranges results in the discharge of Pb dust, elevated BLLs, and exposures that are associated with a variety of adverse health outcomes. Women and children are among recreational shooters at special risk and they do not receive the same health protections as occupational users of firing ranges. Nearly all BLL measurements compiled in the reviewed studies exceed the current reference level of 5 μg/dL recommended by the U.S. Centers for Disease Control and Prevention/National Institute of Occupational Safety and Health (CDC/NIOSH). Thus firing ranges, regardless of type and user classification, currently constitute a significant and unmanaged public health problem. Prevention includes clothing changed after shooting, behavioural modifications such as banning of smoking and eating at firing ranges, improved ventilation systems and oversight of indoor ranges, and development of airflow systems at outdoor ranges. Eliminating lead dust risk at firing ranges requires primary prevention and using lead-free primers and lead-free bullets.

Electronic supplementary material

The online version of this article (doi:10.1186/s12940-017-0246-0) contains supplementary material, which is available to authorized users.

Keywords: Blood, Lead, Poisoning, Shooting, Range, Firearms, Health, Effects, Expert shooter, Guns

Background

Most attention in the area of human health and guns has been rightly placed on shooting injuries and deaths [1]. However, decades of evidence indicate that substantial health risks are incurred by the shooters themselves in the form of lead exposure and subsequent poisoning. Indeed, as pointed out as early as 1994 by Ozonoff, based on high blood lead levels (BLLs) of shooters, "…firing ranges comprise one of the largest unregulated sources of occupational or para-occupational lead exposure for adults. The perils of firearms exist at both ends of the barrel." [2]. The past two decades have brought substantial improvements in firing range environmental oversight as well as analytical capabilities to detect lead in humans, but literature evidence indicates that we fall far short of human health safety criteria in firing ranges of all types, and among occupational and recreational shooters. This review fills a gap in the literature by compiling data from a broad range of recent studies of firing range users, employees, and their families, including indoor and outdoor ranges, in an attempt to document and clarify risks by firing range use, setting, and shooting behaviour. The emphasis of this review is on BLLs of shooters as a marker for adverse health effects among members of the shooting population.

Shooting statistics

In the United States alone an estimated 16,000–18,000 indoor firing ranges exist which employ tens of thousands of employees [3]. An estimated 1 million law enforcement officers train at indoor firing ranges [3]. In 2011 there were approximately 270 million civilian-owned firearms owners in the US and in 2007 there were approximately 650 million civilian-owned weapons globally [4] and 200

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million firearms owned by nation states worldwide [5]. In the United States approximately 20 million citizens practice target shooting as a leisure activity [6]. The National Sport Shooting Foundation (NSSF) [7] stated that in 2011 in the United States there were 13,049,050 handgun shooters, 13,170,417 rifle shooters, 9,713,033 shotgun shooters, and 3,730,567 muzzleloader shooters who participated in 156,790,412 handgun shooting days, 146,652,398 rifle shooting days, 113,866,661 shotgun shooting days and 29,042,237 muzzleloader shooting days. The global statistics regarding the number of firing ranges and shooting prevalence are not available, but it is likely there are a very large number of shooters at firing ranges. The United States Geological Survey (USGS) [8] calculated that in 2012 about 60,100 metric tonnes of lead were used in ammunition and bullets in the United States. Given that the dominant metal in bullets is lead, there are a large number of people globally who are exposed to lead from shooting at firing ranges.

Source of exposure from shooting lead bullets

There are several sources of potential lead exposure from shooting guns and firing ranges. Most bullet projectiles are made from lead, but a large amount of lead is also present in the primer, composed of approximately 35% lead styphnate and lead peroxide (and also contains barium and antimony compounds), that ignites in a firearm barrel to provide the propulsion for the projectile [9–13]. A portion of the lead bullet disintegrates into fine fragments while passing through the gun due to misalignments of the gun barrel [9]. The lead particles, along with dust and fumes originating from the lead primer and the bullet fragments are ejected at high pressures (18,000–20,000 psi; 124–128 mpa) from the gun barrel, a large proportion of which occurs at right angles to the direction of fire in close proximity to the shooter [9]. The shooter can inhale fine Pb particulates (mainly from the primer) which constitutes the proximal exposure pathway. Fine and coarse particulates from both the primer and bullet fragments also attach to the shooters hands, clothing, and other surfaces, and can be inadvertently ingested, providing another lead exposure pathway [14, 15]. When changing targets at outdoor firing ranges shooters can be exposed to lead that has accumulated in soil dust. Additionally, the shooters can then bring these particulates back to their home and expose their families as with other lead occupational hazards.

Firing range personnel are employed by the shooting galleries, and thus also receive proximal lead exposure. They are also charged with cleaning the ranges and removing lead particulates on floors, targets, and the ventilation systems (for indoor ranges). Furthermore, they work at firing ranges for extended hours during the working week, compounding potential lead exposure.

Finally, although not the focus of this review, there are environmental impacts arising from firing ranges. Emissions in firing ranges result in the accumulation of elevated lead concentrations in surface soils [16–18]. This is concerning because lead particles do not naturally biodegrade in soil as do some contaminants such as hydrocarbons. The half-life of lead in surface soil has been estimated as approximately 700 years [19]. Therefore, if not remediated following closure, lead contaminated surface soils at firing ranges could result in lead exposures for hundreds of years. Dust from lead contaminated soil can be resuspended into the atmosphere and transported from a firing range whether outdoor or indoor [20, 21]. Lead in soils and dusts at firing ranges are highly bioavailable [22]. Lead in soil could weather/oxidize and migrate down-gradient to underlying groundwater beyond the firing range boundaries [23]. The low solubility of lead in natural water (i.e., not mining related), however, limits off-site aquatic transport. The factors most likely to affect the amount of lead carried by the groundwater in solution are pH, depth to groundwater, soil chemistry, soil type and annual precipitation [24]. Soil-derived sediment discharged during rain events from lead contaminated firing range soils has the potential to migrate to surrounding properties and into waterways through runoff or storm drains.

Wildlife [25–27], biota [28] and humans can be exposed to lead contaminated soils, sediments and airborne particulates near firing ranges. Bellinger et al. (2013) [29] provided a consensus statement about the health risks arising from lead-based ammunition in the environment.

Health outcomes associated with blood lead levels (BLLs)

In 2012, The United States National Toxicology Program (NTP) published evidence regarding health effects associated with BLL exposure in adults and children [30]. For adult men and women there is "sufficient evidence" that BLLs <10 μg/dL are associated with essential tremor, hypertension, cardiovascular-related mortality and electrocardiography abnormalities, and decreased kidney glomerular filtration rate. For women there is "sufficient evidence" that BLLs <5 μg/dL are associated with reduced foetal growth. For adult men and women there is "limited evidence" that BLLs <10 μg/dL were associated with psychiatric effects, decreased hearing and cognitive function, incidence of amyotrophic lateral sclerosis, and increased spontaneous abortion in women. For adults there is "limited evidence" that BLLs <5 μg/dL were associated with incidence of essential tremor. For children with BLLs <5 μg/dL there is "sufficient evidence" of decreased academic achievement, intelligence quotient (IQ), specific cognitive measures, increased attention related behaviours, delayed puberty and reduced postnatal growth. For children with blood lead levels < 10 μg/dL there is "sufficient evidence" of decreased hearing. For children with BLLs < 5 μg/dL there is "limited evidence" of an association of decreased kidney glomerular filtration rate, and delayed puberty. For prenatal exposure with BLLs < 5 μg/dL there is "limited evidence" of decreases in measures of cognitive function. For prenatal lead exposure < 10 μg/dL there is "limited evidence" of decreased IQ, increased incidence of attention-related and problem behaviors and decreased hearing. For adult men and women there is "limited evidence" that BLLs between 15 and 20 μg/dL are associated with adverse sperm parameters and increased time to pregnancy in women. There is "limited evidence" that BLLs ≥10 μg/dL are associated with decreased fertility. There is "limited evidence" that spontaneous abortion occurs in female partners of men with BLLs ≥ 31 μg/dL. However, modern exposures are orders of magnitude larger than early hominids [31] with pre-industrial blood lead levels in humans estimated at 0.016 μg/dL [32]. Bellinger (2011) [33] noted that adverse health effects are continually being associated with decreasing exposures.

Methodology

The search engines Google Scholar, Pubmed and Science Direct were accessed for studies that provided information about BLLs associated with firearms using the search terms "blood lead", "lead poisoning", "lead exposure", "marksmen", "firearms", "shooting", "guns", "rifle" and "firing ranges". The literature regarding the health effects specifically associated with shooting lead bullets at firing ranges was also reviewed. Studies that reported BLLs associated with shooters at firing ranges were compiled into Table 1.

Table 1

Blood Lead Levels Observed Following Shooting Firearms at Shooting ranges

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Results - blood lead levels at firing ranges

The search identified 36 articles originating from 15 countries around the world published between 1975 and 2016 that included BLLs of shooters. Over half of the reports were from the U.S. The articles describe BLLs of law enforcement personnel, high school shooting coaches, and family members ranging from as young as 1-year-old to adult men and women.

Summary of blood lead levels reported

Data from collected studies reveals the widespread occurrence of BLL by occupational and recreational shooters. The vast majority of these articles reported at least one BLL that exceeded 10 μg/dL. About half of the studies further reported BLLs exceeding 20 μg/dL (18 articles), exceeding 30 μg/dL (17), and even exceeding > 40 μg/dL (15). Indeed, all 36 of the articles indicated BLLs of shooters exceeded 2 μg/dL. Considering that the geometric mean BLL of the U.S. adult population in 2009–2010 was 1.2 μg/dL [34], the BLLs among shooters provide stark evidence of significant exposure, particularly to recreational shooters who do not typically self-screen for BLL. Several key characteristics about BLLs and exposure variables arising from shooting are gleaned from the literature.

Baseline and post-shooting blood lead level relationships

Several studies focused on before-after comparisons of shooters, particularly shooters in military and police occupations, and found marked increases in BLL resulting from firing range activities. Tripathi et al. (1989) [9] measured BLLs in police cadets before, and 1, 2 and 5 days after starting shooting practice, and 69 days after the start of shooting. At 69 days after the start of shooting, the BLLs of the cadets remained above baseline levels prior to shooting. Rocha et al. (2014) [35] conducted a study of BLLs of police cadets before a shooting course and 3 days after the cessation of the shooting course. The mean BLL of cadets increased from 3.3 μg/dL (95% CI = 3.0–3.6 μg/dL) before the course to 18.4 μg/dL (95% CI 16–21 μg/dL) 3 days after completion of the course. In all cases the BLL increased significantly after the course ($p < 0.001$). Within 3 days, the BLLs of the course instructors increased from 3.6 μg/dL to 22.1 μg/dL in one case and from 7.7 μg/dL to 18.3 μg/dL in another. Fischbein et al. (1979) [36] conducted a study of 23 firearms instructors and reported that the BLLs increased measurably after firearms training. Vivante et al. (2008) [37] reported a statistically significant ($p < 0.001$) increase in BLLs of 29 Israeli soldiers from a baseline of 10.3 ± 2.0 μg/dL to 18.9 ± 3.6 μg/dL six weeks after training.

Decline in blood lead levels after shooting events

Several studies provide insight into the decline in BLLs following shooting events. Goldberg et al. (1991) [38] observed that average BLLs in 7 firing range instructors decreased from 45 μg/dL to 31 μg/dL 6 months after a training event. George et al. (1993) [39] observed that average BLLs in 52 small bore rifle recreational shooters declined from 54.7 μg/dL at the end of the indoor season to 33.1 μg/dL in 37 of the shooters by the preseason of the following year. Smart et al. (1994) [40] observed that average BLLs of 20 howitzer operators declined from 20.1 μg/dL to 11.9 μg/dL in 12 operators 8 weeks after ending the firing exercise. Tripathi et al. (1989) [9] observed that BLLs of 7 outdoor firing range police cadets had a baseline average of 6 μg/dL prior to commencing shooting training and an average BLL of 15 μg/dL at the end of training 5 days later. At follow up 69 days after training, the average BLL was 9 μg/dL. Thus, the results indicate that BLLs following shooting events can remain elevated for a considerable time after cessation of shooting, especially for participants with higher BLLs.

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Association between blood lead levels and bullets fired, caliber of weapon, copper jacketed or unjacketed bullets and air lead levels

Several characteristics such as shooting frequency, caliber of the gun, type of bullet, and air lead at firing ranges have been studied. Each of these variables relate to BLLs and can also be associated with environmental issues at firing ranges.

BLLs and frequency of shooting activity

Most studies reviewed indicate a strong positive correlation between the use frequency of shooters at firing ranges and their BLLs. Madrid et al. (2016) [41] reported that BLLs were higher ($p < 0.001$) in individuals who participated in greater than 12 shooting practice sessions per year (8.3 ± 2.4 μg/dL) compared with controls who shot less than 12 times per year (5.2 ± 2.5 μg/dL). Tripathi et al. (1989) [9] observed a positive association between the total number of rounds fired and BLLs (r = 0.84; $p < 0.02$) and personal-breathing-zone air lead levels ($r = 0.92$; $p < 0.001$). Air lead levels were also correlated with BLLs ($r = 0.85$; $p < 0.02$). Asa-Mäkitaipale et al. (2009) [42] reported a correlation between BLLs and bullets fired during the last month ($r = 0.71$; p 0.001) and the past year ($r = 0.55$; p 0.012). Betancourt (2012) [43] observed a linear relationship between air lead exposure and total number of rounds fired by caliber of weapon used.

Blood lead and gun caliber

Relationships between BLL and caliber of firearms have also been described. Demmeler et al. (2009) [44] observed that the larger the caliber of the weapon, the higher the shooters BLL. The following median BLLs were reported: airguns – 3.3 μg/dL (range 1.8–12.7 μg/dL); 0.22 caliber weapons – 8.7 μg/dL (range 1.4–17.2 μg/dL); 0.22 caliber and large caliber handguns (9 mm or larger) – 10.7 μg/dL (range 2.7–37.5 μg/dL); and large caliber handguns – 10.0 μg/dL (range 2.8–32.6 μg/dL). Demmeler et al. [44] also reported that shooters belonging to the International Practical Shooting Confederation (IPSC) had the highest median BLL of 19.2 μg/dL. Additionally, studies indicated a positive correlation between cumulative air lead exposure in firing ranges and BLL of shooters [40, 45].

BLLs and copper jacketed vs. unjacketed bullets

Tripathi et al. (1991) [46] compared the BLLs in firearm instructors using copper jacketed and non-jacketed bullets. One shooting instructor exhibited BLLs of 24.0 μg/dL and 22.0 μg/dL using non-jacketed bullets and copper-jacketed bullets, respectively. A second instructor exhibited BLLs of 14.1 μg/dL and 13.0 μg/dL using non-jacketed bullets and copper-jacketed bullets, respectively.

BLLs and air lead

Elevated BLLs especially arising from indoor firing ranges are the result of the greater absorption of lead from inhalation compared with ingestion and dermal absorption. For example, the amount of absorption of ingested lead by adults under non-fasting conditions ranges from 3 to 10% and in young children from 40 to 50% whereas inhaled lead lodging deep in the respiratory tract seems to be absorbed equally and totally, regardless of chemical form [47]. As shooting involves generation of extremely fine particles and gases, the high rate of absorption logically results in elevated BLLs. Outdoor ranges, presumably well-ventilated by natural flow and large air volumes, do not necessarily prevent lead exposure from shooting activities. The following sections discuss the implications of the results.

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Discussion

The results in Table 1 must be evaluated in the context of BLL recommendations, special need populations, air lead measured at firing ranges, and prevention. The use of ventilation to manage exposure at firing ranges and prevent lead exposure of shooters is appraised.

Blood lead level recommendations from public and occupational health communities

Several United States (US) governmental agencies have developed recommendations regarding BLLs. The Centers for Disease Control and Prevention (CDC) makes health recommendations to protect public health whereas the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) focus on worker health. The trend for BLL recommendations has been declining over several decades since regulations were first established.

CDC and NIOSH

The CDC [34] makes the following statement regarding recommended BLLs in adults:

> *"In 2015, NIOSH designated 5 µg/dL (five micrograms per deciliter) of whole blood, in a venous blood sample, as the reference blood lead level for adults. An elevated BLL is defined as a BLL ≥5 µg/dL. This case definition is used by the ABLES program, the Council of State and Territorial Epidemiologists (CSTE), and CDC's National Notifiable Diseases Surveillance System (NNDSS). Previously (i.e. from 2009 until November 2015), the case definition for an elevated BLL was a BLL ≥10 µg/dL. The U.S. Department of Health and Human Services recommends that BLLs among all adults be reduced to <10 µg/dL. The U.S. Occupational Safety and Health Administration (OSHA) Lead Standards require workers to be removed from lead exposure when BLLs are equal or greater than 50 µg/dL (construction industry) or 60 µg/dL (general industry) and allow workers to return to work when the BLL is below 40 µg/dL….*
>
> *OSHA Lead Standards give the examining physician broad flexibility to tailor special protective procedures to the needs of individual employees. Therefore, the most current guidelines for management of lead-exposed adults should be implemented by the medical community at the current CDC/NIOSH reference BLL of 5 µg/dL. Recommendations for medical management are available from the Association of Occupational and Environmental Clinics, California Department of Public Health, and the Council of State and Territorial Epidemiologist (CSTE) Occupational Health Surveillance Subcommittee."*

Council of state and territorial epidemiologists (CSTE)

The CSTE is an organization of member states and territories representing public health epidemiologists in the United States. The CSTE [48] makes the following recommendations actions for various blood lead levels in adults (Table 2):

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Table 2

Council of State and Territorial Epidemiologists Management Recommendations for Adult Blood Lead Levels

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Ideally, recommendation triggering immediate cessation of exposure at shooting ranges should not be based on a single blood lead level measurement. The duration of an elevated BLL over multiple BLL measurements should determine the nature of the intervention. Current public health recommendations call first for education and attention to risk factors that can mitigate future exposures.

Occupational health and safety administration (OSHA) and the new science-based recommendations

For occupational shooters and firing range workers, the U.S. OSHA Lead Standards require general industry workers to be removed from lead exposure when BLLs are equal or greater than 60 μg/dL, and allows them to return to work when their BLL is below 40 μg/dL [34]. Based on the recommended BLLs by the CDC/NIOSH [34], the CSTE [48] and the comprehensive compilation of health effects of low level lead exposure by the NTP [30], the OSHA regulation that allows workers to return to work with BLLs greater than 40 μg/dL seems nonsensical as a health risk avoidance guideline, and should be lowered in line with the Council of State and Territorial Epidemiologists (CSTE) recommendations, as shown in Council of state and territorial epidemiologists (CSTE).

Special needs of women and children

Lead exposure of women and children have special characteristics that must be taken into account. The needs relate to the effect of lead on future generations. For women the needs are related to the effect of lead on the developing fetus and post-natal exposure associated with breast-feeding. For children the special needs for low exposure are related to the extraordinary sensitivity of the developing organs of children. These concerns indicate the need for a margin of safety.

The special lead risks of women

The risk to women exposed to lead at firing ranges is of particular concern because, once absorbed, a proportion of the lead is deposited in the skeleton and more than 90% of lead in adults is stored in their bones. Bone storage takes place because due to their similar ionic radius and charge lead is substituted for calcium. Furthermore, when a woman becomes pregnant the fetus requires calcium and, depending on the dietary intakes, a proportion of calcium is derived from remodelling of the bones. Skeletal lead stores are released from the remodelling exposing the fetus during critical development windows [49–51]. Even modestly elevated BLL's have been associated with serious neurological disorders such as autism [52]. Lead released from a woman's bones during pregnancy is associated with foetal developmental problems [53]. Another consideration for female shooters is that when their BLL becomes elevated, they can pass the lead on to their children through breast milk [54, 55]. Given the known lead contamination at firing ranges, intending-to- conceive, pregnant women, and nursing mothers should curtail exposure from shooting activities (employed in the security, military and police, and recreational shooters) and observe precautionary prevention.

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Health risks related to children shooters

The CDC (2005) [56] reported that children (aged 7-18) shooting bullets at multiple firing ranges in Alaska exhibited highly elevated BLLs (see Table 1). Shannon (1999) [57] reported that children (aged 14–16) who were competitive marksmen exhibited an average BLL of 21.3 μg/dL (range 18–28 μg/dL). Blood lead levels observed in children from shooting activities are within the range known to cause long-term detrimental health effects [30]. Exposure of young females to lead is of particular concern because it is stored in their bones and can then be transferred to their developing fetus many years later when they become pregnant [49–51].

Health-related lead issues and law enforcement personnel

Law enforcement includes a number of services to protect and ensure the safety of citizens and the community. The public requires law enforcement personnel to be "calm, cool and collected" when in service conducting their duties. However, the adverse health effects, especially on the nervous system that are associated with elevated BLLs arising from firearm use are inconsistent with these ideals.

Air lead levels at firing ranges

The OSHA 8-h air lead time weighted average (TWA) action level is 30 μg/m^3 and the OSHA permissible exposure limit (PEL) is 50 μg/m^3 [58]. The California Department of Public Health Occupational Lead Poisoning Prevention Program (CDPH-OLPPP) recommended 8 h TWA PEL is 0.5 to 2.1 μg/m^3 [59]. Based on this guideline, the CDPH-OLPPP states "*At a PEL of 0.5 μg/m^3, 95% of workers would have a BLL less than 5 μg/dL over a 40 year working lifetime. At a PEL of 2.1 μg/m^3, 95% of workers would have a BLL less than 10 μg/dL and 57% would have a BLL less than 5 μg/dL over their working lifetime*." Wang et al. (2016) [60] conducted a review of studies of airborne lead concentrations and possible exposure at firing ranges (Additional file 1). Wang et al. [60] found that the OSHA 8 h TWA PEL is exceeded in many studies, and even more noteworthy, the California PEL is exceeded in *all* of the studies. It must be noted that the recommended PEL and action levels are not the only paths to controlling lead exposures.

Biomonitoring and primary prevention

Kosnett et al. (2007) [61] recommend that: "*individuals be removed from occupational lead exposure if a single blood lead concentration exceeds 30 microg/dL or if two successive blood lead concentrations measured over a 4-week interval are > or = 20 microg/dL. Removal of individuals from lead exposure should be considered to avoid long-term risk to health if exposure control measures over an extended period do not decrease blood lead concentrations to < 10 microg/dL or if selected medical conditions exist that would increase the risk of continued exposure*." A more conservative approach are the recommendations by CSTE in Council of state and territorial epidemiologists (CSTE). A critical issue is that biomonitoring is not primary prevention. Biomonitoring only assesses the degree of exposure and potential health damage after exposure has taken place. Primary prevention requires curtailing lead exposure and maintenance of air quality. Several steps have been proposed above to minimize lead exposure. Recommendations to prevent occupational lead poisoning by shooters are provided by U.S. Government [62]. The recommendations appear as topics in school rifle team programs [63].

One of the challenges in a biomonitoring program is the frequency which shooters should have their BLLs monitored. The Australian organisation Safe Work Australia has recently carefully made recommendations for multiple scenarios of blood lead testing frequency for workers exposed to lead in the work place [64]. Similar BLL testing frequency recommendations could be adopted for shooters

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exposed to lead in occupational settings such as law enforcement, military, security and shooting range workers. Recreational shooters that shoot frequently could voluntarily use these blood lead testing frequency recommendations as a guide if they wanted to protect their health.

Potential health risks from 'take home lead'

In contrast to occupational environments where work clothes should not be taken home, lead dust can adhere to shooters clothes and potentially contaminate vehicles and homes. The CDC (1996) [65] measured carpet dust lead concentrations in FBI student dormitory rooms and in 14 non–student dormitory rooms at a firing range and training facility. They observed that student dormitory rooms had significantly higher lead levels than non–student dormitory rooms, suggesting that the FBI students were contaminating their living quarters with lead. 'Take home lead' has been described mostly for occupational settings [66–68] but given the fine particle nature and lead concentrations of dust associated with shooting, the 'take home lead' pathway of exposure from shooting must be recognized and curtailed.

Prevention of lead aerosols with ventilation improvements

The air lead table from Wang et al. 2016 [60] (Additional file 1) and the National Research Council [69] are the only compilations of air Pb levels at shooting ranges that were identified. Wang et al. do not discuss the ventilation practices in the various studies that may account for lower air lead levels. A 1975 NIOSH study found that at all 9 ranges studied, the air lead guideline was exceeded at the time (200 μg/m^3) [70]. A 2009 NIOSH review describes a case study on air lead exposure of law enforcement trainees and reports that the mean airborne lead concentration of >2000 μg/m^3 was reduced by 94–97% to 60–120 μg/m^3 but this was still above the OSHA PEL of 50 μg/m^3. Commercial ventilation companies claim they can meet guidelines (i.e. Camfil air filters) but no published studies supporting this achievement at firing ranges were located.

There is a "lack of evidence" gap in the literature demonstrating that ventilation systems can maintain air lead levels at indoor ranges below the current OSHA (50 μg/m^3) or California (0.5–2.2 μg/m^3) guideline. The literature gap raises questions about whether or not the guidelines can actually be achieved, especially the California guideline. Further, as discussed in Special needs of women and children, meeting the guideline does not necessarily provide a margin of safety from lead exposure.

Primary prevention requires eliminating lead in primers and bullets

Lead from projectile primers is a significant proximal source of lead exposure and uptake. The development of primers is described by Brede et al. [71]. During the 19th century primers were composed of mercury fulminate; however, the mercury fulminate was found to be too toxic to shooters. In the early 20th Century, Dynamit Nobel developed the primer SINOXID which was formulated with lead and became a universal primer. By "…the 1960s exposure of shooters and firing range supervisors to lead reached intolerably high levels, as evidenced by the elevated blood lead values [71]." Dynamit Nobel developed SINTOX, a Pb-free (as well as Sb and Ba free) primer [71]. However, the results of some tests of the lead-free primers have proven disappointing, with significant variations in ignition timing, peak blast pressure, higher barrel frictions, and reliability in different climate conditions, compared with their lead-based equivalents [72]. The performance of lead-free primers are being tested by the U.S. Department of Defense (DoD) and North Atlantic Treaty Organisation (NATO) to reduce exposure of personnel to known lead sources [73].

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Despite the critical observations, there is lead-free ammunition on the market. SINTOX is NATO approved and outlets for lead-free ammunition are available [74, 75]. Some states are taking the issue seriously and require lead-free (or non-toxic "NT") ammunition at firing ranges [76]. Widespread acceptance of the need to replace lead must take place, and until this happens one of the most significant health risks to shooters will remain lead-rich primers.

"Green bullets" have also been proposed as a preventative measure that could minimize lead exposure to participants and the environment. These bullets consist of copper rather than lead bullets. Bismuth has been proposed as a substitute for lead bullets but its environmental health impacts are poorly understood [77]. It is clear that firing lead-free bullets results in dramatic decreases in airborne lead exposures at firing ranges [78]. The use of copper-jacketed lead bullets does not appear to be a solution to a reduction in lead exposure because it results in only minor reductions in BLLs (see Tripathi et al. (1991, Table 1) [46]. The United States Department of Defence (DoD) is aware of the health threat posed by lead exposure from small arms [69] and efforts are underway to test and replace lead in both primer and bullets [73, 79].

Table 1 provides evidence-based information about the BLL sensitivity of shooters to lead dust at firing ranges. The major gap in preventing risk of lead exposure at firing ranges are the fundamental lead-bearing materials used for the explosive power and bullet projectiles. Primary prevention requires eliminating all lead materials in primers and bullets in order to end the dispersal of lead dust at firing ranges.

Conclusions

Shooting lead bullets at firing ranges results in elevated BLLs at concentrations that are associated with a variety of adverse health outcomes and the topic of health risk is an ongoing topic of study. Of major concern is the number of women and children among recreational shooters, who are not afforded similar health protections as occupational users of firing ranges. Nearly all BLL measurements compiled in the reviewed studies exceed the level of 5 μg/dL recommended by the U.S. CDC/NIOSH, and thus firing ranges, regardless of type and user classification, constitute a significant and currently largely unmanaged public health concern. Primary prevention of this risk requires development of lead-free primers and projectile bullets. Prevention includes better oversight of ventilation systems in indoor ranges and development of airflow systems at outdoor ranges, protective clothing that is changed after shooting, and cessation of smoking and eating at firing ranges. The mismatch between what is recommended for individuals by the U.S. CDC is in stark contrast to the allowable levels for occupational exposure, and there are no real systematic biomonitoring programs for firing range users to measure cumulative health effects caused by persistent low and even high-level lead exposure. Recreational shooters and the general public are provided no legal protections from lead exposures at firing ranges. In conclusion, while the past two decades have brought substantial improvements in analytical capabilities to detect lead in humans the literature evidence indicates that we fall far short of human health safety criteria in firing ranges of all types, and among occupational and recreational shooters.

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Authors' contributions

ML conducted the initial literature review and wrote the first draft. HM, GF, BG, and AB reviewed and edited the subsequent drafts of the manuscript. All authors read and approved the final manuscript.

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The authors declare they have no actual or potential competing financial interests.

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Abbreviations

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ABLES	Adult blood lead and epidemiology surveillance
BLLs	Blood lead levels
CDC	Centers for disease control and prevention
CDPH-OLPPP	California department of public health occupational lead poisoning prevention program
CSTE	Council of state and territorial epidemiologists
DOD	Department of defence
IPSC	International practical shooting confederation
IQ	Intelligence quotient
NATO	North atlantic treaty organisation
NIOSH	National institute for occupational safety and health
NNDSS	National notifiable diseases surveillance system
NSSF	National sports shooting foundation
NT	Non-toxic
NTP	National toxicology program
OSHA	Occupational safety and health administration
Pb	Lead
PEL	Permissible exposure level
US	United States
USGS	United States geological survey

Additional file

Additional file 1:(20K, docx)

Summary of Studies on Airborne Lead Exposure and Concentration from Shooting Activities, by Chronological Orders (modified from Wang et al., 2016). (DOCX 19 kb)

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References

1. Swedler DI, Simmons MM, Dominici F, Hemenway D. Firearm prevalence and homicides of law enforcement officers in the United States. Am J Public Health. 2015;105:2042–2048. doi: 10.2105/AJPH.2015.302749. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

2. Ozonoff D. Lead on the range. Lancet. 1994;343:6–7. doi: 10.1016/S0140-6736(94)90871-0. [PubMed] [CrossRef] [Google Scholar]

3. Beaucham C, Page E, Alarcon WA, Calver GM, Methner M, Schoonover TM. Indoor firing ranges and elevated BLLs - United States, 2002- 2013. MMWR Morb Mortal Wkly. 2014;63:347–51. [PMC free article] [PubMed] [Google Scholar]

4. Small Arms Survey (SAS) Small arms survey research notes, number 9, September 2011. 2011. Estimating civilian owned firearms. [Google Scholar]

5. Small Arms Survey (SAS). 2007. Completing the Count: Civilian Firearms. Graduate Institute Geneva. 2007. http://www.smallarmssurvey.org/publications/by-type/yearbook/small-arms-survey-2007.html. Accessed 2 Sept 2016.

6. Ochsmann E, Göen T, Schaller KH, Drexler H. Lead–still a health threat for marksmen. Int J Hyg Environ Health. 2009;212:557–61. doi: 10.1016/j.ijheh.2008.11.001. [PubMed] [CrossRef] [Google Scholar]

7. National Shooting Sports Foundation (NSSF) Target shooting in America. 2013. [Google Scholar]

8. U.S. Geological Survey (USGS): Mineral industry surveys: lead in January 2013. http://minerals.usgs.gov/minerals/pubs/commodity/lead/mis-201301-lead.pdf Accessed 23 Oct 2016.

9. Tripathi RK, Llewellyn GC. Deterioration of air quality in firing ranges: A review of airborne lead exposures. In: Biodeterioration Research 1989;445-457.

10. Haw CK, Jayaprakasha PT, Hooib YC, Abdullaha AF. Health concern on lead encountered during firing practices: a review. Health Environ J. 2010;1:24–29. [Google Scholar]

11. Basu S. Formation of gunshot residues. J Forensic Sci. 1982;27:72–91. doi: 10.1520/JFS11453J. [CrossRef] [Google Scholar]

12. Caddy B, Meng HH. Gunshot residue analysis—a review. J Forensic Sci. 1997;42:553–570. [Google Scholar]

13. Romolo FS, Margot P. Identification of gunshot residue: a critical review. Forensic Sci Int. 2001;119:195–211. doi: 10.1016/S0379-0738(00)00428-X. [PubMed] [CrossRef] [Google Scholar]

14. Dalby O, Butler D, Birkett JW. Analysis of Gunshot Residue and Associated Materials—A Review. J Forensic Sci. 2010;55:924–943. doi: 10.1111/j.1556-4029.2010.01370.x. [PubMed] [CrossRef] [Google Scholar]

15. Mathee A, de Jager P, Naidoo S, Naicker N. Exposure to lead in south African shooting ranges. Environ Res. 2017;153:93–8. doi: 10.1016/j.envres.2016.11.021. [PubMed] [CrossRef] [Google Scholar]

16. Murray K, Bazzi A, Carter C, Ehlert A, Kopec M, Richardson J, Sokol H. Distribution and mobility of lead in soils at an outdoor shooting range. Soil Sediment Contam. 1997;6:79–93. doi: 10.1080/15320389709383547. [CrossRef] [Google Scholar]

17. Chen M, Daroub SH, Ma LQ, Harris WG, Cao X. Characterization of lead in soils of a rifle/pistol shooting range in central Florida, USA. Soil Sediment Contam. 2002;11:1–7. doi: 10.1080/20025891107221. [CrossRef] [Google Scholar]

18. Fayiga AO, Saha UK. Soil pollution at outdoor shooting ranges: health effects, bioavailability and best management practices. Environ Pollut. 2016;216:135–45. doi: 10.1016/j.envpol.2016.05.062. [PubMed] [CrossRef] [Google Scholar]

19. Semlali RM, Dessogne JB, Monna F, Bolte J, Azimi S, Navarro N, Denaix L, Loubet M, Chateau C, Van Oort F. Modeling lead input and output in soils using lead isotopic geochemistry. Environ Sci Technol. 2004;38:1513–21. doi: 10.1021/es0341384. [PubMed] [CrossRef] [Google Scholar]

20. Laidlaw MA, Zahran S, Mielke HW, Taylor MP, Filippelli GM. Re-suspension of lead contaminated urban soil as a dominant source of atmospheric lead in Birmingham, Chicago, Detroit and Pittsburgh, USA. Atmos Environ. 2012;49:302–10. doi: 10.1016/j.atmosenv.2011.11.030. [CrossRef] [Google Scholar]

21. Laidlaw MA, Zahran S, Pingitore N, Clague J, Devlin G, Taylor MP. Identification of lead sources in residential environments: Sydney Australia. Environ Pollut. 2014;184:238–46. doi: 10.1016/j.envpol.2013.09.003. [PubMed] [CrossRef] [Google Scholar]

22. Bannon DI, Drexler JW, Fent GM, Casteel SW, Hunter PJ, Brattin WJ, Major MA. Evaluation of small arms range soils for metal contamination and lead bioavailability. Environ Sci Technol. 2009;43(24):9071–6. doi: 10.1021/es901834h. [PubMed] [CrossRef] [Google Scholar]

23. Hardison DW, Ma LQ, Luongo T, Harris WG. Lead contamination in shooting range soils from abrasion of lead bullets and subsequent weathering. Sci Total Environ. 2004;328:175–183. doi: 10.1016/j.scitotenv.2003.12.013. [PubMed] [CrossRef] [Google Scholar]

24. United States Environmental Protection Agency (USEPA). Best Management Practices for Lead at Outdoor Shooting Ranges. EPA-902-B-01-001. Revised 2005. https://www.epa.gov/sites/production/files/documents/epa_bmp.pdf. Accessed 17 Jan 2017.

25. Lewis LA, Poppenga RJ, Davidson WR, Fischer JR, Morgan KA. Lead toxicosis and trace element levels in wild birds and mammals at a firearms training facility. Arch Environ Contam Toxicol. 2001;41:208–14. doi: 10.1007/s002440010239. [PubMed] [CrossRef] [Google Scholar]

26. Johnson MS, Major MA, Casteel SW. Lead accumulation in woodchucks (Marmotamonax) at small arms and skeet ranges. Ecotoxicol Environ Saf. 2004;59:232–6. doi: 10.1016/j.ecoenv.2003.07.008. [PubMed] [CrossRef] [Google Scholar]

27. Pain DJ, Fisher IJ, Thomas VG. Ingestion of lead from spent ammunition: implications for wildlife and humans. 2009. A global update of lead poisoning in terrestrial birds from ammunition sources. [Google Scholar]

28. Labare MP, Butkus MA, Riegner D, Schommer N, Atkinson J. Evaluation of lead movement from the abiotic to biotic at a small-arms firing range. Environ Geol. 2004;46:750–4. doi: 10.1007/s00254-004-1097-x. [CrossRef] [Google Scholar]

Environ Health

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29. Bellinger DC, Burger J, Cade TJ, Cory-Slechta DA, Finkelstein M, Hu H, et al. Health risks from lead-based ammunition in the environment. EHP. 2013;121(6):A 178–9. doi: 10.1289/ehp.1306945. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

30. National Toxicology Program . NTP monograph: health effects of Low-level lead. 2012. [PubMed] [Google Scholar]

31. Patterson C, Ericson J, Manea-Krichten M, Shirahata H. Natural skeletal levels of lead in Homo sapiens sapiens uncontaminated by technological lead. Sci Total Environ. 1991;107:205–36. doi: 10.1016/0048-9697(91)90260-L. [PubMed] [CrossRef] [Google Scholar]

32. Flegal AR, Smith DR. Lead levels in preindustrial humans. N Engl J Med. 1992;326:1293–4. [PubMed] [Google Scholar]

33. Bellinger D. The protean toxicities of lead: New chapters in a familiar story. Int J Environ Res Public Health. 2011;8:2593–2628. doi: 10.3390/ijerph8072593. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

34. Centers for Disease Control and Prevention (CDC). Adult Blood Lead Epidemiology and Surveillance (ABLES) – Program Description. https://www.cdc.gov/niosh/topics/ables/description.html Accessed 18 Jan 2017.

35. Rocha ED, Sarkis JE, Maria de Fátima HC, dos Santos GV, Canesso C. Occupational exposure to airborne lead in Brazilian police officers. Int J Hyg Environ Health. 2014;217:702–4. doi: 10.1016/j.ijheh.2013.12.004. [PubMed] [CrossRef] [Google Scholar]

36. Fischbein A, Rice C, Sarkozi L, Kon SH, Petrocci M, Selikoff IJ. Exposure to lead in firing ranges. JAMA. 1979;241(11):1141–4. doi: 10.1001/jama.1979.03290370045027. [PubMed] [CrossRef] [Google Scholar]

37. Vivante A, Hirshoren N, Shochat T, Merkel D. Association between acute lead exposure in indoor firing ranges and iron metabolism. Isr Med Assoc J. 2008;10:292. [PubMed] [Google Scholar]

38. Goldberg RL, Hicks AM, O'Leary LM, London S. Lead exposure at uncovered outdoor firing ranges. J Occup Med. 1991;33:718–9. doi: 10.1097/00043764-199106000-00013. [PubMed] [CrossRef] [Google Scholar]

39. George PM, Walmsley TA, Currie D, Wells JE. Lead exposure during recreational use of small bore rifle ranges. New Zealand Med J. 1993;106:422–4. [PubMed] [Google Scholar]

40. Smart DA, Parmer DL, Young JY, Hoffmann F, Langford RE. 1994. Biological responses of 155mm Howitzer crewmen to airborne lead. Walter Reed Army Inst Res Washington DC. C; 1994 Oct 21 https://scholar.google.com/scholar?q=Biological+responses+of+155mm+Howitzer+crewmen+to+airborne+lead&btnG=&hl=en&as_sdt=0%2C24 Accessed 1 Oct 2016.

41. Madrid GA, Téllez-Cárdenas L, Juárez-Pérez CA, Haro-García LC, Mercado-García A, Gopar-Nieto R, Cabello-López A. Blood lead determinants and the prevalence of neuropsychiatric symptoms in firearm users in Mexico. Int J Occup Med Environ Health. 2016;1:219–28. [PubMed] [Google Scholar]

42. Asa-Mäkitaipale S, Jehkonen M, Uitti J, Vilkki J. Memory functions in recreational pistol sport shooters: does lead matter? Environ Health Insights. 2009;3:13. [PMC free article] [PubMed] [Google Scholar]

43. Betancourt JR. Determinants of airborne lead exposure during special operations training for United States Marines. Masters Thesis. San Diego State University. 2012. http://sdsu-dspace.calstate.edu/bitstream/handle/10211.10/3454/Betancourt_Juan.pdf?sequence=1 Accesssed 18 Jan 2017.

44. Demmeler M, Nowak D, Schierl R. High BLLs in recreational indoor-shooters. Int Arch Occup Environ Health. 2009;82:539–42. doi: 10.1007/s00420-008-0348-7. [PubMed] [CrossRef] [Google Scholar]

45. Valway SE, Martyny JW, Miller JR, Cook M, Mangione EJ. Lead absorption in indoor firing range users. Am J Public Health. 1989;79:1029–32. doi: 10.2105/AJPH.79.8.1029. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

46. Tripathi RK, Sherertz PC, Llewellyn GC, Armstrong CW. Lead exposure in outdoor firearm instructors. Am J Public Health. 1991;81:753–5. doi: 10.2105/AJPH.81.6.753. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

47. Agency for Toxic Substances and Disease Registry (ATDSR). Tox Guide For Lead. CAS# 7439-92-1. 2007. https://www.atsdr.cdc.gov/toxguides/toxguide-13.pdf Accessed 19 Jan 2017.

48. Council of State and Territorial Epidemiologists (CSTE). Management Guidelines for Blood Lead Levels in Adults. http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/OccupationalHealth/ManagementGuidelinesforAdult.pdf Accessed 18 Jan 2017.

49. Gulson BL, Mizon KJ, Korsch MJ, Palmer JM, Donnelly JB. Mobilization of lead from human bone tissue during pregnancy and lactation: a summary of long-term research. Sci Total Environ. 2003;303:79–104. doi: 10.1016/S0048-9697(02)00355-8. [PubMed] [CrossRef] [Google Scholar]

50. Gulson B, Mizon K, Korsch M, Taylor A. Revisiting mobilisation of skeletal lead during pregnancy based on monthly sampling and cord/maternal blood lead relationships confirm placental transfer of lead. Arch Toxicol 2015;1-2. [PubMed]

51. Gulson B, Taylor A, Eisman J. Bone remodeling during pregnancy and post-partum assessed by metal lead levels and isotopic concentrations. Bone. 2016;89:40–51. doi: 10.1016/j.bone.2016.05.005. [PubMed] [CrossRef] [Google Scholar]

52. Kim KN, Kwon HJ, Hong YC. Low-level lead exposure and autistic behaviors in school-age children. Neurotoxicology. 2016;53:193–200. doi: 10.1016/j.neuro.2016.02.004. [PubMed] [CrossRef] [Google Scholar]

53. Bellinger D, Leviton A, Sloman J, Rabinowitz M, Needleman H, Waternaux C. Low-level lead exposure and Children's cognitive function in the preschool years. Pediatrics. 1991;87:219–227. [PubMed] [Google Scholar]

54. Gulson BL, Jameson CW, Mahaffey KR, Mizon KJ, Patison N, Law AJ, Korsch MJ, Salter MA. Relationships of lead in breast milk to lead in blood, urine, and diet of the infant and mother. Environ Health Perspect. 1998;106(10):667. doi: 10.1289/ehp.98106667. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

55. Li PJ, Sheng YZ, Wang QY, Gu LY, Wang YL. Transfer of lead via placenta and breast milk in human. Biomed Environ Sci. 2000;13:85–9. [PubMed] [Google Scholar]

Environ Health

56. Centers for Disease Control (CDC) Lead exposure from indoor firing ranges among students on shooting teams - Alaska, 2002—2004. MMWR Morb Mortal Wkly Rep. 2005;54:577–579. [PubMed] [Google Scholar]

57. Shannon M. Lead poisoning in adolescents who are competitive marksmen. N Engl J Med. 1999;341(11):852. doi: 10.1056/NEJM199909093411118. [PubMed] [CrossRef] [Google Scholar]

58. Occupational Safety and Health Administration (OSHA). Regulation standards – 29CFR: Standard Number 1910.1025. 2016. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10030. Accessed 17 Jan 2017).

59. California Department of Public Health (CDPH-OLPPP), 2013 http://www.cdph.ca.gov/programs/olppp/documents/leadstdpelrec.pdf. Accessed 10 Jan 2017.

60. Wang J, Li H, Bezerra ML. Assessment of shooter's task-based exposure to airborne lead and acidic gas at indoor and outdoor ranges. Journal of Chemical Health and Safety. 2016(in press). http://dx.doi.org/10.1016/j.jchas.2016.11.003

61. Kosnett MJ, Wedeen RP, Rothenberg SJ, Hipkins KL, Materna BL, Schwartz BS, Hu H, Woolf A. Recommendations for medical management of adult lead exposure. Environ Health Perspect. 2007;115:463–71. doi: 10.1289/ehp.9784. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

62. DHHS (NIOSH) Preventing occupational exposures to lead and noise at indoor firing ranges publication number 2009–136. 2009. [Google Scholar]

63. Connecticut Department of Public Health (CPDH) Fact sheet: shoot a healthy 200: lead safety for rifle teams. 2011. [Google Scholar]

64. Safe Work Australia . Decision regulation impact statement managing risks associated with lead in the workplace: blood lead removal levels and workplace exposure standard. 2016. [Google Scholar]

65. Centers for Disease Control (CDC) Health hazard evaluation report 91–0346–2572 FBI academy Quantico, Virginia. 1996. [Google Scholar]

66. Gulson BL, Mizon KJ, Korsch MJ, Howarth D. Importance of monitoring family members in establishing sources and pathways of lead in blood. Sci Total Environ. 1996;188:173–182. doi: 10.1016/0048-9697(96)05170-4. [PubMed] [CrossRef] [Google Scholar]

67. Chiaradia M, Gulson BL, MacDonald K. Contamination of houses by occupationally-exposed workers from a lead-zinc-copper mine and impact on blood leads in the families. Occup Environ Med. 1997;54:117–124. doi: 10.1136/oem.54.2.117. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

68. James M, Gulson BL. Engine reconditioning workshops: lead contamination and the potential risk for workers - a pilot study. Occup Environ Med. 1999;66:429–431. doi: 10.1136/oem.56.6.429. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

69. National Research Council (NRC). Potential health risks to DoD firing-range personnel from recurrent lead exposure. Washington: National Academies Press. ISBN 978-0-309-26736-6, 2012. 178 pp. http://www.eenews.net/assets/2012/12/04/document_daily_01.pdf. Accessed 10 Jan 2017.

70. Anania, T.L., Seta, J.A. 1975. Lead exposure and design considerations for indoor firing ranges. 0HEW Publication No. (NIOSH) 76-130. https://www.cdc.gov/niosh/docs/76-130/

71. Brede U, Hagel R, Redeker KH, Weuter W. Primer compositions in the course of time: from black powder and SINOXID to SINTOX compositions and SINCO booster. Propellants Explos Pyrotech. 1996;21:113–1 17. doi: 10.1002/prep.19960210302. [CrossRef] [Google Scholar]

72. Courtney E, Courtney A, Summer P, Courtney M. Performance testing of lead free primers: blast waves, velocity variations, and environmental testing. 2014. [Google Scholar]

73. TechLink . MIC lead-free primer for ammunition and cartridge/propellant actuated devices. 2016. [Google Scholar]

74. Lead-free hunting . Lead free bullet types. 2016. [Google Scholar]

75. Tampa Bay Conservation League . Environmentally-friendly (100% lead-free) ammunition. 2014. [Google Scholar]

76. New York State Brochure . Aim at lead safety. 2016. [Google Scholar]

77. Jenkins, Joel A., "Viability of Bismuth as a Green Substitute for Lead in Jacketed .357 Magnum Revolver Bullets" 2015.*Graduate Theses and Dissertations*.http://scholarcommons.usf.edu/etd/5511. Accessed 1 Oct 2016.

78. Bonanno J, Robson MG, Buckley B, Modica M. Lead exposure at a covered outdoor firing range. Bull Environ Contam Toxicol. 2002;68:315–23. doi: 10.1007/s001280256. [PubMed] [CrossRef] [Google Scholar]

79. Cameron EJ. Comparative Analysis of Airborne Chemical Exposure to Air Force Small Arms Range Instructors. Air Force Inst Tech Wright-Patterson AFB. OH School Engineering Management 2006. http://www.dtic.mil/dtic/tr/fulltext/u2/a450111.pdf. Accessed 7 Sept 2016.

80. Chau TT, Chen WY, Hsiao TM, Liu HW. Chronic lead intoxication at an indoor firing range in Taiwan. J Toxicol Clin Toxicol. 1995;33:371–2. doi: 10.3109/15563659509028926. [PubMed] [CrossRef] [Google Scholar]

81. Centers for Disease Control and Prevention (CDC). Health hazard evaluation report: lead exposure at a firing range and gun store. HETA 2013-0119-3219. 2014. https://www.cdc.gov/niosh/hhe/reports/pdfs/2013-0119-3219.pdf. Accessed 17 Jan 2017.

82. Fisher-Fischbein J, Fischbein A, Melnick HD, Bardin CW. Correlation between biochemical indicators of lead exposure and semen quality in a lead-poisoned firearms instructor. JAMA. 1987;257:803–5. doi: 10.1001/jama.1987.03390060093031. [PubMed] [CrossRef] [Google Scholar]

83. Fischbein A. Lead poisoning: I. Some clinical and toxicological observations on the effects of occupational lead exposure among firearms instructors. Isr J Med Sci. 1992;28:560–72. [PubMed] [Google Scholar]

84. Landrigan PJ, McKinney AS, Hopkins LC, Rhodes WW, Price WA, Cox DH. Chronic lead absorption: result of poor ventilation in an indoor pistol range. JAMA. 1975;234:394–7. doi: 10.1001/jama.1975.03260170030020. [PubMed] [CrossRef] [Google Scholar]

85. Lofstedt H, Selden A, Storeus L, Bodin L. Blood lead in Swedish police officers. Am J Ind Med. 1999;35:519–22. doi: 10.1002/(SICI)1097-0274(199905)35:5<519::AID-AJIM9>3.0.CO;2-N. [PubMed] [CrossRef] [Google Scholar]

Environ Health

86. Novotny T, Cook M, Hughes J, Lee SA. Lead exposure in a firing range. Am J Public Health. 1987;77:1225–6. doi: 10.2105/AJPH.77.9.1225. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

87. Park WJ, Lee SH, Lee SH, Yoon HS, Moon JD. Occupational lead exposure from indoor firing ranges in Korea. J Korean Med Sci. 2016;31:497–501. doi: 10.3346/jkms.2016.31.4.497. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

88. Abudhaise BA, Alzoubi MA, Rabi AZ, Alwash RM. Lead exposure in indoor firing ranges: environmental impact and health risk to the range users. Int J Occup Med Environ Health. 1996;9:323–9. [PubMed] [Google Scholar]

89. Smith DL. Lead absorption in police small-arms instructors. Occup Med. 1976;26:139–40. doi: 10.1093/occmed/26.4.139. [PubMed] [CrossRef] [Google Scholar]

90. Torres MA. Characterizing Lead Exposure at a US Coast Guard Indoor Firing Range. 2014. (Doctoral dissertation, University of Washington). https://dlib.lib.washington.edu/researchworks/bitstream/handle/1773/26339/Torres_washington_0250O_13279.pdf?sequence=1&isAllowed=y. Accessed 1 Oct 2016.

91. Di Lorenzo L, Borraccia V, Corfiati M, Mantineo GA, Petrillo MR, Soleo L. [Exposure to low doses of inorganic lead and arterial pressure among fire arm instructors of the Italian state police] G Ital Med Lav Ergon. 2006;28:194–5. [PubMed] [Google Scholar]

92. Mancuso JD, McCoy J, Pelka B, Kahn PJ, Gaydos JC. The challenge of controlling lead and silica exposures from firing ranges in a special operations force. Mil Med. 2008;173:182–6. doi: 10.7205/MILMED.173.2.182. [PubMed] [CrossRef] [Google Scholar]

93. Gelberg KH, DePersis R. Lead exposure among target shooters. Arch Environ Occup Health. 2009;64:115–20. doi: 10.3200/AEOH.64.2.115-120. [PubMed] [CrossRef] [Google Scholar]

94. Greenberg N, Frimer R, Meyer R, Derazne E, Chodick G. Lead exposure in military outdoor firing ranges. Mil Med. 2016;181:1121–6. doi: 10.7205/MILMED-D-15-00454. [PubMed] [CrossRef] [Google Scholar]

95. Moore RS, Ducatman AM. Home on the range: childhood lead exposure due to family occupation. Arch Pediatr Adolesc Med. 1995;149:1276–7. doi: 10.1001/archpedi.1995.02170240094017. [PubMed] [CrossRef] [Google Scholar]

96. Svensson BG, Schütz A, Nilsson A, Skerfving S. Lead exposure in indoor firing ranges. Int Arch Occup Environ Health. 1992;64:219–21. doi: 10.1007/BF00378278. [PubMed] [CrossRef] [Google Scholar]

97. White SA, Narula AA. A complication of indoor pistol shooting. J Laryngol Otol. 1996;110:663–4. [PubMed] [Google Scholar]

98. Cook JM, Sakr CJ, Redlich CA, DeLoreto AL. Elevated BLLs related to the use of firearms. Occup Environ Med. 2015;57:136–8. doi: 10.1097/JOM.0000000000000553. [PubMed] [CrossRef] [Google Scholar]

99. Gulson BL, Palmer JM, Bryce A. Changes in blood lead of a recreational shooter. Sci Total Environ. 2002;293:143–50. doi: 10.1016/S0048-9697(02)00003-7. [PubMed] [CrossRef] [Google Scholar]

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A SEATTLE TIMES INVESTIGATION

Lead endangers officers

Police agencies across the country have put their officers in harm's way by using lead-polluted shooting ranges and by not educating them about safe practices.

LINDSEY WASSON / THE SEATTLE TIMES

Amy Crawford was one of five Kirkland officers overexposed to lead in 2007 while training at the Issaquah police range, where the ventilation wasn't working. "You literally couldn't see one arm's length in front of you," she said. Here she shoots at an Everett range.

By CHRISTINE WILLMSEN APRIL 10, 2015

It was one of the most important weeks in Amy Crawford's law-enforcement career.

Like tens of thousands of other police officers, Crawford had to become an expert at shooting a gun. Her job as a Kirkland corrections officer — and even her life — depended on it.

On her fifth day of training at Issaquah's indoor police shooting range, she passed the firearms tests. But she felt sick and had no idea why.

Like so many other officers across the country, Crawford had gotten lead poisoning from shooting in an unsafe gun range.

The Seattle Times' ongoing investigation "Loaded with Lead" has found that city, county and federal police agencies across the country have put their officers in harm's way by failing to clean their indoor ranges, replace dilapidated ventilation and educate their employees about the risks of lead.

In hazy, dirty gun ranges, officers fired lead-based ammunition, unknowingly spreading lead vapor and dust, which they then inhaled, ingested or absorbed through skin contact.

In Largo, Fla., a range master at the police shooting range says lead exposure caused his teeth to fall out and he now suffers from neuropathy. In Londonderry, N.H., a 35-year-old police sergeant died of lead poisoning just days after training his fellow officers at a private indoor-gun range.

Cases like these have spanned decades, despite a litany of reports and warnings about the dangers of lead in police gun ranges.

In the Seattle area, Issaquah, Kirkland and Bellevue police departments have

violated workplace-safety laws about lead, all saying they were unaware of some of the rules. Even so, the state had warned Issaquah about lead problems in the past. As of this month, the city still hasn't fixed the ventilation.

Lead contamination at police-operated ranges has gone unchecked for years because federal and state regulators rarely scrutinize them, The Times has found. Inspectors usually only show up after someone files a complaint, or after it's too late — when a blood test shows an employee already has lead poisoning.

"It was totally preventable," Crawford, 40, said about her lead-poisoning case and others she's heard about. "That's the worst part of all."

Law enforcement's long history with lead

For more than a half-century, studies showed officers were overexposed and even poisoned by lead contamination at law-enforcement gun ranges. Despite these cases and overwhelming evidence of the dangers of lead, police departments have continued to put officers in harm's way.

1962 — Michigan

Michigan Department of Health alerts the public that indoor ranges can be a health hazard, stating "many lead poisoning cases have been reported among police and range personnel traceable to improper range ventilation."

1973 — Kansas

Two Kansas City police officers suffered severe lead poisoning after working several months at the indoor-gun range in the basement of City Hall. Both retired on disability because of the lead.

READ MORE

Record number of violations

Just last year, a concerned police-firearms instructor complained to Maryland state safety officials about lead hazards at Baltimore County's gun range — where more than 1,900 county officers train and requalify — to prove their proficiency with a service firearm.

In February 2014, after officials with Maryland Occupational Safety and Health (MOSH) inspected the gun range, they found 27 violations, 16 related to lead. It was the first safety inspection of Baltimore County's nearly half-century-old facility, they said.

Baltimore County police set a record — the most lead violations for a law-enforcement agency in the past decade, according to a Times analysis of available federal Occupational Safety and Health Administration records.

Maryland inspectors found problems with poor ventilation and inadequate cleaning at the Lutherville range. And in talking to several Baltimore County firearms instructors, inspectors learned that the lead problems were getting worse.

The instructors revealed they had been tested a few times for lead levels in their blood, and the most recent results were getting higher, records show. One instructor had an elevated lead level of at least 25 micrograms per deciliter, a MOSH supervisor said.

Organ damage and other health problems can occur at a level as low as 10 micrograms, according to the Centers for Disease Control and Prevention. Lead exposure is particularly dangerous because damage can occur even though symptoms may not appear.

While instructors and SWAT teams spend the most time in a range, other

officers are required to qualify up to four times annually and to practice as needed.

Baltimore County's most dangerous problem was the toxic air that instructors inhaled while working in the range.

They were exposed to air that had lead concentrations up to three times higher than the allowable limit, MOSH documents show. The ventilation and air quality were so awful that the instructors, by law, should have been wearing respirators, protective coveralls and bootees while training.

Police administrators had no idea of the problems until the state inspection, said spokeswoman Elise Armacost.

"A lot of these were a result of sloppy housekeeping, not wiping surfaces properly," she said. "The larger issue was ventilation, and that's not a minor issue."

More than a year after the inspection, the range still isn't in compliance.

Armacost said the county will spend $500,000 to replace the ventilation system and abate the lead contamination by the end of the summer. Currently, police are advised to use the outdoor range but still are allowed to shoot for short periods of time in the indoor range, Armacost said.

Cole Weston, president of Baltimore County Fraternal Order of Police, Lodge No. 4, said: "The job of law enforcement is difficult enough with calls for service. The hazards aren't supposed to be in the training location where you are trying to be proficient in doing the job out on the street."

WASHINGTON DEPARTMENT OF LABOR & INDUSTRIES

Last year, seven years after Kirkland officers were overexposed to lead, the state found contamination at the Issaquah police range where they had trained in 2007.

Poisoned in Issaquah

Two of the most important ways to prevent lead poisoning is to educate shooting instructors and trainees about lead hazards and to properly ventilate the range. In the case of three Kirkland correctional officers, they got neither.

In 2007 the Kirkland police's Corrections Department decided its officers needed to carry firearms. Without a shooting range, Kirkland used the Issaquah police indoor-firing range that March to train and qualify the officers.

Two Kirkland firearms instructors conducted a five-day training and qualification course for Crawford and two other corrections officers. After a day in the classroom, they spent the next four days firing .45-caliber handguns in the range.

Crawford, who had been a corrections officer for two years, said there was little discussion about the risks of lead exposure and how to avoid it.

On the final day, as they started qualifications testing — timed and untimed drills of shooting at targets from different distances — the range became cloudy.

Kirkland Police Sgt. Nathan Rich, a SWAT member and one of the firearms instructors, had tried to turn on the ventilation, which would move the lead-contaminated air away from shooters. But it didn't operate.

Despite no air flow and a noticeable haze in the range, Rich ordered Crawford and her colleagues to continue firing because he said he wanted to avoid rescheduling the qualifications.

"It's a paramilitary environment," Crawford said. "You've got rank and file, you follow orders and you trust them."

They all coughed but continued firing up to 1,000 rounds over five hours, not realizing they were inhaling dangerous amounts of lead. "You literally couldn't see one arm's length in front of you," she said.

Crawford went home feeling nauseated and weak, with a headache and a sweet metallic taste in her mouth. The two other corrections officers complained of similar flu-like symptoms — classic signs of lead exposure.

After one complained to Kirkland police, they were sent to have their blood tested for lead.

The two instructors and three corrections officers all had elevated levels of lead in their blood, according to records from Washington Labor and Industries (L&I), which enforces workplace-safety rules. Their results ranged from 25 to 33 micrograms of lead per deciliter — more than 20 times the average adult level of 1.2.

In as little as a few days, officers in a poorly ventilated range can develop lead levels that can cause fatigue and miscarriages as well as permanent damage to the brain and kidneys.

Crawford recalled having the highest reading, 33.

“I was scared — I didn’t know the ramifications,” said Crawford, who now works for a biometrics company. “I didn’t know if it was going to have an effect on my ability to have kids.”

Rich said he received little training about the dangers of lead when he became a firearms instructor in 2001.

“I felt bad for the officers that I got them sick,” he said. He is concerned his decision to keep shooting that day may later have repercussions on their health.

One reason he moved to the patrol division was to reduce the amount of time he was exposed to lead in the range.

“As we get older, we may have some neurological-function issues, some organ issues that you can’t predict and see right away,” Rich said.

WASHINGTON DEPARTMENT OF LABOR & INDUSTRIES

A 2014 inspection at the Issaquah police firing range showed air flow was too slow in some firing lanes and too fast in others while two Police Department employees were using the range.

Issaquah chief resists

The police shooting range where the Kirkland officers were overexposed is tucked under Issaquah's redbrick City Hall.

Because of the Kirkland case, L&I inspected the Issaquah range in 2007 and issued two lead-related citations.

Then in 2008 and 2009, Issaquah requested help from L&I through

“consultations.” The state uses this voluntary process as an informal, private way to get employers into compliance with state safety regulations.

After one of the consultations, L&I told Issaquah police they must conduct lead training and minimize surface contamination.

But in April 2014, an L&I inspection showed contamination on classroom tables, the floor and a carpeted area outside the range, which had lead concentrations 22 times higher than what’s acceptable.

Air flow in some of the firing lanes was too turbulent, swirling dirty air back on shooters.

Nine law-enforcement agencies, as well as the public and members of two private firearms academies, shot in the range, unaware of the hazardous conditions.

“Sgt. (Paul) Fairbanks stated that the officer’s primary duty is to protect the citizens and that the range duties (i.e. cleaning) were additional tasks they tried to fit in their schedule,” an industrial hygienist wrote after talking to the part-time range master.

When L&I confronted the department over the violations, some Issaquah police officials were uncooperative.

In June, they refused to allow the hygienist to collect samples and take airflow readings and photos while police sorted the spent lead from the berm for recycling. When a hygienist wanted to interview several officers, Police Chief Scott Behrbaum refused.

“At this time none of the employees that I have spoken to have indicated the need to speak with you, nor [are they] having any concerns,” Behrbaum said in an Aug. 8 email to an L&I hygienist. “As a result I am not going to schedule any

interviews."

After L&I threatened to use subpoenas to compel private interviews with employees, the chief relented.

L&I issued 15 citations, nine related to lead. The city of Issaquah appealed some of them as well as the $3,000 fine, saying it would rather use the money to fix the problems than pay the state. A hearing officer concluded all the violations had occurred, but lowered the total fine to $2,700.

Issaquah corrected nearly all of the violations. It hasn't fixed the ventilation, but Fairbanks said it doesn't pose a significant health risk.

"I'm not taking any of this lightly," Fairbanks said. "I'm very concerned about my officers' safety and that doesn't mean just on the street, but also when they are training."

Decades of warnings

Well before the government banned lead-based household paint in 1978, medical journals and state health publications dating to the early 1960s warned that police officers were suffering from lead poisoning due to working in gun ranges.

But police departments often ignored those warnings and rarely passed them down to the rank and file.

Two Kansas City, Kan., police officers suffered severe lead poisoning in 1973 after working several months in a new indoor-gun range in the basement of City Hall. A faulty ventilation system recirculated airborne lead.

The city settled lawsuits brought by the two, paying $100,000 each to the officers. They said they had to retire on disability because of the lead exposure, according to The Kansas City Star.

The National Institute for Occupational Safety and Health (NIOSH) studied nine indoor law-enforcement gun ranges and found many deficiencies, in particular “health hazards in the forms of lead poisoning due to improper ventilation control,” a 1975 report said.

NIOSH also wrote a technical manual about reducing lead hazards for law-enforcement officials to follow.

Despite the research and warnings, some departments didn’t take lead hazards seriously.

In Florida, Edmund Danielewicz went to work in 1980 at the Largo Police Department’s indoor range, which had a history of employees getting lead poisoning from faulty ventilation. After a year there, he lost 45 pounds, his teeth and eventually most of the feeling in his legs, he said. The physician for the city told him he had lead poisoning and to drink orange juice and water to feel better, he recalled.

By 1981 Danielewicz claimed the shooting range poisoned him. But the department denied it and fired him, he said. After a legal battle, he said he settled for $100,000.

“It’s disheartening,” he said. “They should have known better.”

ARAM BOGHOSIAN / SPECIAL TO THE SEATTLE TIMES

Pat Kelly shows her late husband's police badge, uniform patch and driver's license. They had a 21-month-old son and a daughter on the way.

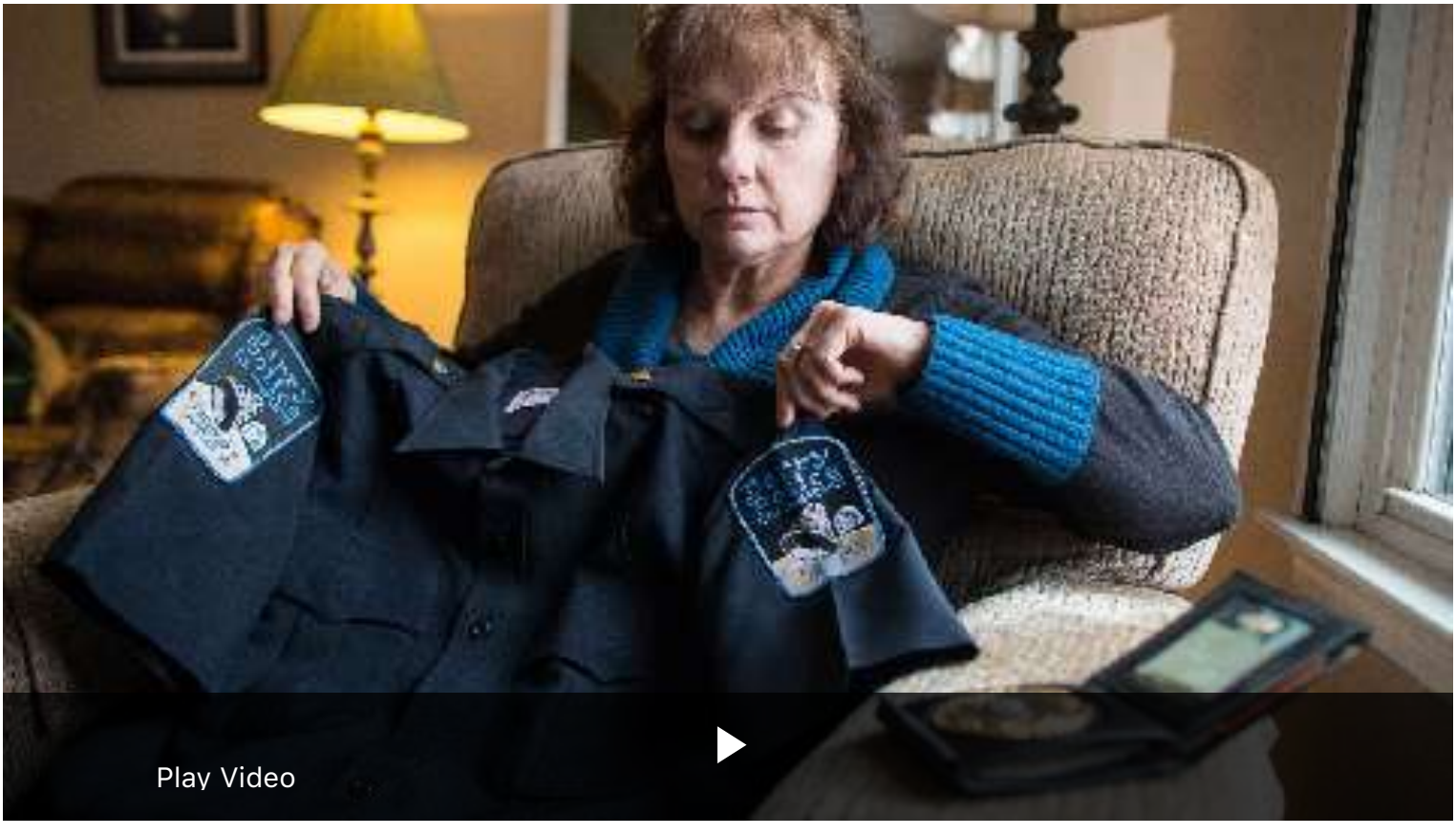
A young sergeant gone

For Pat Kelly, that sunny Sunday morning was like any other at their Londonderry, N.H., home. She awoke to 21-month-old son David crawling into his parents' bed and wanting to play with his father. But when he didn't respond to the boy's giggles, she leaned closer to her husband — and discovered his body was cold.

Thomas Kelly, a 35-year-old police sergeant, was dead.

His death on Sept. 17, 1989, stunned officers at the Derry Police Department,

where he'd worked for more than nine years. Pat was devastated: She was six weeks pregnant, had a toddler, her mother was dying of cancer, and the love of her life had suddenly and mysteriously died.



Derry Police Chief Ed Garone said as a sergeant and training supervisor, Kelly, was a natural leader, teacher and visionary. Garone approved Kelly's request to train all the officers who had been using revolvers to shoot new semiautomatic handguns.

"It was frankly a morale booster, increasing the safety of the officers and the greater protection for our citizens," Garone said.

Without an indoor police range, Kelly looked for nearby ranges where the 45 officers could train and qualify over that one week in September. He found Chester Rod and Gun Club, just 10 miles down the road. Kelly had assurances from the private club that the ventilation worked properly and the range was

safe, Garone recalled.

But Kelly had unknowingly stepped into a death chamber.

ARAM BOGHOSIAN / SPECIAL TO THE SEATTLE TIMES

Derry, N.H., police had assurances from the Chester Rod & Gun Club that its indoor range was safe, but officers recall it being smoky.

Each day, he stood beside officers as they fired hundreds of rounds of ammunition at the targets. But the ventilation system failed to keep up, and smoke laced with lead lingered in the air, officers said.

“It got so thick that you got to the point where you just could not see,” said Barry Charewicz, a Derry officer at the time.

Dan Pelletier, then a Derry detective and firearms instructor, said, “I had that metallic, leady taste in the back of my mouth, and at the end of the day I’d have a pretty good headache too.” A blood test showed he had an elevated lead level.

Unlike other officers who would train and leave, Kelly was in the range almost the entire time as police fired 24,300 rounds of ammunition that week.

During breaks and each night, Kelly swept the floor with a dry broom, picked up spent casings and put them in buckets. Sometimes he wore a paper mask to avoid breathing the dust in the air, but he was unaware it contained potentially lethal amounts of lead, Pelletier said.

The day after certifying all the officers, Kelly came home after a long shift and told Pat: “I’m beat, I’m going to bed. Goodnight.” Those were his last words.

About a month after Kelly’s death, an autopsy revealed he had died from acute respiratory failure and severe pulmonary edema due to prolonged exposure to toxic heavy metals and gases at a firing range. Tests showed he had dangerously high concentrations of lead in his blood at 48 micrograms per deciliter.

Pat still misses the smell of leather and the feel of the bulletproof vest under her husband’s stiffly pressed uniform when she hugged him.

She occasionally shows his uniform, badge (No. 3) and gun belt to their 24-year-old daughter, Laura, when she’s curious about the father she never met.

Pat sued the Chester Rod and Gun Club and settled for an undisclosed amount years ago.

Everyone realizes his death was preventable.

“If I were to do it again, I would have daily air monitoring done and certified by a third party,” Garone said. His officers now shoot at their outdoor range.

ARAM BOGHOSIAN / SPECIAL TO THE SEATTLE TIMES

Laura Kelly, left, never met her father; her mother, Pat, was six weeks pregnant when Sgt. Thomas Kelly died in his sleep in 1989 in New Hampshire. “I want people to take it seriously that you can have a loved one die from this,” Pat Kelly said.

Charewicz blames the club for Kelly’s death. The nearby Sandown Police Department has been shooting there since 2011. Kevin Williams, president of the club, didn’t return calls for comment.

Today at the Derry Police Department, a training room is named in Kelly’s honor and a painting of him, smiling in uniform, hangs on a wall. But outside of New Hampshire, few have ever heard of Kelly’s death and its cause.

“I want people to take it seriously that you can have a loved one die from this,” Pat Kelly said.

ARAM BOGHOSIAN / SPECIAL TO THE SEATTLE TIMES

In Derry, N.H., Police Chief Ed Garone shows the framed uniform of Sgt. Thomas Kelly, who died in 1989 after a week of exposure to lead. Training officers on new handguns, Kelly was in the shooting range almost the entire time 24,300 rounds were fired.

Lead exposure continues

Two decades after Kelly's death, inspections and evaluations show police across the country are still ignorant of workplace-safety laws and lack fundamental training. Currently, there are more than 1.1 million federal, state and local law-enforcement workers in the U.S., according the Bureau of Justice Statistics.

In Bellevue, the Police Department shut down its range for two years because of its inadequate ventilation system.

A year after it reopened with a new system in 2012, L&I found contaminated surfaces and inadequate training during an inspection. It issued nine citations, six related to lead.

In South Central Washington, the Kennewick Police Department doesn't educate its officers at all about lead hazards.

"We do not provide training on lead exposure," Kennewick spokeswoman Evelyn Lusignan said. "We are not required to. For that type of outdoor-firing range we don't have the exposure risk."

But Washington Administrative Code says, "Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees" and train them about lead. This includes all indoor and outdoor ranges.

While the risk of lead exposure is greatly reduced when officers shoot outdoors, it's not eliminated.

Officers can track lead home on their clothing and shoes, contaminating their homes and putting their children at risk.

After evaluating the Lima, Ohio, Police Department's indoor-gun range in 2012, NIOSH told the police chief to shut it down until a faulty ventilation system was fixed. It had pumped lead vapor and dust into its garage and a maintenance office where an employee breathed in contaminated air and suffered lead poisoning.

NIOSH evaluates work conditions at the request of a concerned employee or employer, but cannot force a company or government agency to abide by its recommendations.

Lima Police Chief Kevin Martin didn't follow NIOSH's advice. He bought a new

vacuum cleaner and better filters, he said.

When asked why he didn't close the range, Martin replied:

"Quite honestly, we have to qualify to continue to function as police officers. And another location — nothing is available to us."

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Lead-free ammunition may save money in the long run

MARK HARRISON / THE SEATTLE TIMES

Police Sgt. Daniel Willson, Kirkland's senior firearms instructor, sweeps up spent casings at the department's lead-free firing range in the Totem Lake area.

By CHRISTINE WILLMSEN

This month, Kirkland police opened what it believes is the first lead-free indoor-shooting range in Washington state, an eight-lane facility costing $1.3 million.

One reason for the expenditure: Five of its officers were overexposed to lead while training at the Issaquah police range in 2007.

Kirkland Sgt. Daniel Willson, senior firearms instructor, said police feel safer in the new range. “It’s better, easier cleanup and it’s healthier,” he said.

They’re no longer concerned about lead on their hands and face and the need to change clothes to prevent tracking the toxin into their homes where family could be overexposed.

Willson said police departments reluctant to go lead-free because the ammunition is costlier should take the long view.

“The big elephant in the room is probably the cost, because it does cost more,” he said. “But in the long run, it ends up paying for itself.”

Lead-free ammunition, primarily made of copper, costs the Kirkland Police Department about $375 for 1,000 pistol rounds, $100 more than the lead version. For rifles, it pays $595 per 1,000, $295 more.

Concerns that lead-free bullets are less accurate just aren’t warranted, Willson said.

“It’s so minimal in the handguns that we’re shooting,” he said. “…You’re not going to notice a difference.” Police still rely on lead bullets when on

regular duty.

Amy Crawford, a former Kirkland corrections officer poisoned at the Issaquah range, said ranges should be inspected annually by workplace-safety agencies.

Restaurants and gas-station pumps are routinely checked out and have notices of inspection, she pointed out. “Shouldn’t there be something similar to that on a gun range?”

Police chiefs in North Dakota, Connecticut, New York and other states have shuttered their ranges in recent years as the last resort, after realizing their old ranges are too contaminated and dilapidated for use.

In North Dakota, Valley City Police Chief Fred Thompson told city officials during a 2012 job interview that he would have to close its filthy basement gun range, calling it a “Superfund site.”

Just months into the job, he closed the range. The city paid $100,000 to clean the basement, haul out contaminated equipment and remove 18,000 pounds of lead.

The range had been used for years by a local rifle and pistol club. “I got a lot of people mad,” Thompson said. “It was the only indoor range around.”

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< Part 3: Young shooters at risk

Part 5: Toxic ranges win federal contracts >

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OSHA® FactSheet

Protecting Workers from Lead Hazards at Indoor Firing Ranges

Using lead bullets or lead-containing primers at indoor firing (shooting) ranges can expose workers to lead and result in unsafe levels of lead in their blood. Lead enters the body through inhalation or ingestion. Once in the bloodstream, lead can damage various organs and cause health problems.

Firing range employers must protect their workers from the hazards of lead exposure. The Occupational Safety and Health Administration (OSHA) Lead Standard (29 CFR 1910.1025) requires that in a workplace with potential lead exposure, the employer conduct an initial determination of workers airborne exposure to lead. If a worker is exposed at or above the action level (AL) or above the permissible exposure limit (PEL) for lead, additional requirements apply. This fact sheet provides firing range employers with information on how their workers can be exposed to lead and summarizes the provisions and requirements of the Lead Standard that apply to firing ranges. For more complete information on lead and detailed requirements under the Lead Standard, visit OSHA's Safety and Health Topics Page on Lead.

How lead exposure can occur:

- Shooting firearms with lead bullets or lead-containing primer creates airborne lead in the gun smoke.
- Lead bullet deformation and fragmentation can cause lead exposure at hard surface bullet trap systems.
- A building's standard HVAC system may not adequately remove airborne lead particles from the range.
- Handling spent cartridges or cleaning firearms can contaminate the hands and skin with lead.
- Improper range cleaning methods (dry sweeping; compressed air; non-high-efficiency particulate air (HEPA) filtered vacuums) or inadequate cleaning of lead-contaminated surfaces.
- Recovering lead bullets from traps, emptying bullet trays, or casting lead bullets can create lead dust and fumes.
- Bringing and consuming food and drinks in the range area. Not washing hands and face before eating, drinking, or smoking.
- Lack of handwashing facilities for workers to remove lead.
- Wearing contaminated work clothes in eating and office areas or wearing these clothes home.

Photo: NIOSH

NIOSH estimates there are 16,000 to 18,000 indoor firing ranges in the U.S.

Firing Ranges and the OSHA Lead Standard

The following section highlights selected OSHA requirements, along with recommendations, that can help employers both comply with the Lead Standard and implement best practices. For all employer requirements under the standard, see OSHA's Lead Standard (29 CFR 1910.1025).

Exposure Monitoring

Required

- An initial determination – Collect full-shift personal air samples to determine if employee exposure is at or above the AL of 30 µg/m^3 or exceeds the PEL of 50 µg/m^3.
- If employee exposure is at or above the AL >30 days a year, employers must offer medical surveillance, including blood lead level monitoring to affected employees.
- Repeat monitoring is required at various intervals if exposures are at or above the AL or above the PEL. *See* 29 CFR 1910.1025(d)(6).
- If exposure is above the PEL >30 days a year, then employers must implement engineering and work practice controls to reduce exposure to or below the PEL (see box below for recommended exposure controls for firing ranges).
- When ventilation is used to control exposure, ensure effective operation of the ventilation system with scheduled (every 3 months) inspections and routine maintenance.

RECOMMENDED EXPOSURE CONTROLS FOR FIRING RANGES

Eliminate/Substitute: Use jacketed or lead-free bullets and non-lead primer.

Engineering Controls: Provide a separate "push/pull" ventilation system (not connected to the general HVAC system) with supplied and exhausted air flow designed to move lead emissions downrange from the source (firearm) toward the filtered exhaust area at/or behind the bullet trap:

- Electrically interlock supply and exhaust fans for simultaneous operation when the range is in use.
- Use HEPA filters in the ventilation exhaust system to prevent lead from entering the outside environment.

Work Practice Controls: Use a closed bag system to empty bullet trays and debris. Use a water mist spray or other type of wet method to keep lead dust from becoming airborne.

Housekeeping

Required

- Keep all surfaces as free of lead accumulations as practical.
- Ensure that workers do not use compressed air to clean floors or other surfaces where lead may accumulate.
- Ensure that workers do not shovel, dry-sweep, or brush lead-bullet debris unless vacuuming or other equally effective methods have been tried and found not to eliminate the hazard. *See* 29 CFR 1910.1025(h)(2)(ii).

Recommended

- Use a HEPA filtered vacuum and/or wet methods for cleaning.
- Perform housekeeping and cleaning procedures on a frequent basis.
- Wipe sample detection of lead is a useful tool to evaluate a housekeeping program (surfaces and floors including eating areas) and hygiene practices (employee hands) by identifying lead contamination. Colorimetric wipes for on-the-spot detection of lead are now readily available.

Respiratory Protection

Required

- Provide appropriate, NIOSH-approved respirators when engineering and work practice controls are not sufficient to reduce lead exposure to or below the PEL.
- For more information on respiratory protection program requirements, including fit testing, see OSHA's Respiratory Protection standard (29 CFR 1910.134) and visit OSHA's Safety and Health Topics webpage on Respiratory Protection.

Recommended

- Even when exposure is below the PEL, provide workers with appropriate respiratory protection for short-term, high lead exposure work tasks such as cleaning bullet traps, changing ventilation system filters, or disposing of vacuum-collected dust.

Protective Work Clothing and Equipment

Required

- Provide full-body work clothing (coveralls or disposable suits), gloves, head and foot covering, face shield, and vented goggles to workers exposed to lead above the PEL.

- Ensure that workers do not use compressed air or similar methods to remove lead dust from range floors, other surfaces, or clothing.

Recommended

- Provide protective work clothing and equipment for employees while performing range cleaning or maintenance.

Hygiene Facilities and Practices

Required

- Prohibit food, drink, eating, tobacco, and the use of cosmetics in areas with lead exposure above the PEL.
- Change rooms, separate storage lockers, and showers must be provided when worker exposures to lead are above the PEL.

Recommended

- Provide readily available handwashing stations.
- Do not allow any food, drinks, or tobacco products in the range area.
- Consider using lead decontamination wipes in addition to soap and water to remove lead from hands after cleaning firearms and picking up spent casings and before eating, drinking, or smoking.
- Provide a clean change area and separate storage lockers for employees with lead hazards in their work area, regardless of exposure levels.

Medical Surveillance and Medical Removal Protection

Required

- Implement a medical surveillance program for workers exposed to lead at or above the AL >30 days a year.
- Make available blood lead and zinc protoporphyrin testing to workers exposed to lead at or above the AL at frequencies specified in the Lead Standard. *See* 29 CFR 1910.1025(j)(2).
- Remove employees from work who have a lead exposure at or above the AL if their blood lead level meets or exceeds the criteria specified in the Lead Standard, or if a physician determines removal is needed. *See* 29 CFR 1910.1025(k)(1).

Recommended

- Offer blood lead testing for employees with lead hazards in their work area, regardless of exposure levels.
- Blood lead levels at or above 5 micrograms of lead per deciliter of blood (µg/dL) are considered elevated.

Employee Lead Hazard Training and Hazard Communication

Required

- Inform workers with potential lead exposure of the content of Appendices A and B of the Lead Standard.
- Provide initial and annual training to all employees exposed to lead at or above the AL on the content of the Lead Standard and work activities that could result in lead exposure.
- Post warning signs with the language specified in the Lead Standard in each work area where the PEL is exceeded.
- OSHA's Hazard Communication standard (29 CFR 1910.1200) requires employers to provide information and training for all employees with lead hazards in their work areas.

Additional Information

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.

- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page (www.osha.gov/workers).

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

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