

Reviewer 1

Dear Sirs,

I reviewed the NIOSH alert guidance on indoor firing ranges with some interest. It is very well researched and should be valuable to the many smaller ranges without good access to occupational safety and health professionals. I've made a few comments for your consideration. Please note that these comments cannot be considered "official" Navy positions, but just my professional input. I will also forward to colleagues.

Mark. B. Geiger, M.S., CIH, CSP
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Reviewer (organization and contact information)	Page	Section Subject-Title	Observation	Recommendation remarks	Authors' Response
Mark. B. Geiger, M.S., CIH, CSP OPNAV Safety Liaison Office Building NC-1 Suite 7400 2511 Jefferson Davis Highway Arlington, VA 22202 703 602-5020 (W) 703 602-4786 (F)	2	Engineering and administrative controls	Does not include a recommendation for hand-washing and shower facilities	Add recommendation: Facilities should be equipped with hand washing facilities and their use made mandatory after shooting.	Moved bullet 4 from the previous section to the Engineering and administrative control section, the bullet is modified to read "Provide workers with cleaning facilities and lockers and develop a mandatory washing and hygiene program for shooters and workers to limit personal and take-home contamination."

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Mark.Geiger1@navy.mil	5-6	ACGIH limits	Description of solvent and noise exposure risks doesn't describe the relevance of this issue to firing ranges		Solvents are used in cleaning weapons. Noise exposure is a major component of this Alert.
	10	Sound attenuation by protective equipment	The sound attenuation evaluation described was conducted on manikins and represents ideal conditions. Actual sound level attenuation by field users is markedly less.	Describe the limitations of PPE in "real world" settings and include more information on proper fitting, care de-rating of protective equipment per OSHA, NIOSH and other guidelines.	The paragraph was re-written to address the issues of fitting and incompatibility of hearing protection devices: "NIOSH recommended several noise abatement strategies and modifications to the firing range structure to reduce the transmission of airborne and structural borne sounds; the use of double-hearing protection to ensure maximum protection against impulsive noise and improper fitting and other incompatibility with other protective equipment; and the establishment of a hearing conservation program."
	14	Exhaust ventilation	Discussion of distribution and velocity of airflow is good.	Consider recommending visualization of airflow via smoke tube	We have, the following statement is at the bottom of page 14 of the Exhaust Ventilation section:

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	14	Air filtration	Doesn't mention compliance with environmental regulations. Should also discuss potential for use of pre-filters (save money as HEPA filters are very expensive).	Discuss EPA/CAA regulatory compliance as appropriate. Discuss use of pre-filters.	"This can easily be evaluated using a chemical smoke tube to visually evaluate pressurization at doors, windows, etc. that are slightly open to the flow of air." Both comments have been addressed already on page 14 and 15. EPA best management practices guideline is mentioned on page 14 under Air Filter Recommendations, and pre-filter change-out was discussed on page 15, 1 st bullet under Filter System Maintenance Recommendations.
	14	Filter maintenance	Doesn't mention design of filters for easy access and safe removal by approaches that minimize dispersion of dust.	Mention these design considerations include space for access to filtration system	The design of the filters is beyond the scope of this Alert. However, 2 nd Bullet under Filter System Maintenance Recommendations mentions that "filter change-out should be performed by personnel trained in the removal of dirty filters and in lead safety"
	12-16	General	Application of "clothesline" target retrieval systems was not discussed.	Discuss of remote target retrieval systems.	A bullet was added to the "Reducing lead contamination inside the firing range" section on page 17. The bullet will read: "The firing range should be equipped with automatic target

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	18	Preventing take-home lead exposures	Personal hygiene was discussed along with the need to change clothes, cleaning clothes or manage disposable coveralls.	Recommend also suggesting a washer and drier on-site for laundry. May wish to consider water filtration, if technology is readily available.	<p>retrieval systems to allow shooters to examine their performance without crossing the firing line.”</p> <p>Bullet 4, page 18, mentions this solution though does not explicitly specify that a washer and dryer should be installed on site. Some range operators may decide to purchase their own washing machines, but others may find it more practical to wash workers' clothing at a professional facility. Bullet 4 reads:</p> <p>“Workers' non-disposable outer protective clothing should be laundered by the employer or a contractor. It should not be laundered by the employee at home. Non-employees who take contaminated clothing home should bag the clothes before leaving the range. Contaminated clothing should be washed separately from the family's clothing.”</p>

Reviewer 2

Name
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Comments

I am writing from the perspective of a project manager and mechanical engineer involved with design, construction, and operations of various federal agency law enforcement training small arms firing ranges and as a private consultant for a variety of firing range design and construction projects spanning the last 20 years.

Your expanded recommendations will be helpful to the industry. The acknowledgement of problems associated with lead contaminated surfaces and improved monitoring guidelines are needed. The promotion of educational awareness and establishment of thresholds and procedures for monitoring lead levels and hearing conservation is needed.

However, in some instances your draft recommendations seem to adopt reference design guide information which is not current, accurate, or considerate of the multitude of circumstances which govern the spectrum of range design, maintenance, operational considerations. Economy is always a factor and some recommendations seem to neglect cost considerations.

The document would be more useful if source information references were included to support and permit verification of many of the recommendations.

Comments follow:

Lead – Supply Ventilation System Recommendations:

Page 13, 2nd paragraph: Reference source of information NIOSH used to determine that use of a perforated wall plenum “ensures optimum airflow distribution across the firing line”. Perforated 90-180 degree radial air diffusers mounted at ceiling height prevalent, practical and economical and have been widely tested and demonstrated effective in meeting established industry and regulatory airflow criteria. Request NIOSH reference source of test data on radial plenum or wall plenum construction demonstrating that 15 feet is needed from the plenum to the firing line?
Please cite testing sources including description of the constructed conditions.

Page 14, 1st para: One of the biggest contributors to airflow disruption is shooting booths/dividers. Obstruction such as these can defeat the best engineered laminar airflow system.

Exhaust Ventilation System Recommendations:

Page 14, 1st para: “Exhausting 10% more air than supplied is a general recommendation for maintaining appropriate negative pressure in the firing range.” This figure is high and represents significant energy costs and air handling equipment capacity. The recommendation seems arbitrary and tends to neglect economy, Federal energy policy and LEED goals. What is the source(s) of this recommendation and was energy usage considered as a factor?

Air Filtration Recommendations:

Page 14, 2nd para: “If lead-contaminated air..., the exterior walls of the building and surrounding grounds (ADD- and waterways) can become contaminated.” Runoff of lead contaminated water is a problem (Clean Water Act).

Lead released outdoors... can be re-aerosolized and result in subsequent contamination of the firing range, (ADD – persons exposed to this lead), or other buildings.....”

Page 15, 1st para: All filters (Add- potentially exposed to lead contaminated air) should be equipped with side and face gaskets.....”

Recognize and differentiate that supply filters are commonly used in these systems but do not necessarily require gasketed filters in a 100% exhaust type design.

Filter System Maintenance Recommendations:

Page 15, 2nd para: "Dirty filters should be (ADD-transported and) disposed of properly"

Control system Recommendations:

Page 15, 2nd para: "Exhaust and supply fans should be interlocked so that all fan systems operate at the same time (ADD-during active range use)."

Here again, your sources are imposing recommendations without considering the spectrum of range operating conditions and constraints. Mechanical systems "interlocks" should implement dependent upon the full range of operating conditions. Operation costs and energy conservation warrants that a HVAC system operate in an economical "unoccupied setback" mode, even on firing ranges. In this economy mode air temperature inside the range is being maintained at a more economical setting. More importantly, to also conserve energy range owners/designers will design dampered air handler systems which recirculate the conditioned air in the unoccupied mode (no shooting) rather than exhaust it. Dependent upon system architecture, a hard supply and exhaust fan system interlock serves to defeat this unoccupied mode of operation.

"Air flow from the fans should be monitored (DELETE – at the firing range operator's station) and interlocked with a critical firing range operating systems to" Suffice it to say monitor it but refrain from telling people 'where' to monitor it. System monitoring and control locations are dependent on the design and operational protocol of the range operator.

Direct digital control (DDC) systems are used which are able to automatically shut the system down in the event a system operating parameter is violated. And, a DDC system generated signal can notify the range officer by a variety of means.

Page 15, 3rd para: Inclusions of safety recommendations outside the realm of lead and noise issues seem beyond the scope of this document and should be avoided.

Last para: "Exhaust air from the firing range should not be recirculated back into the range." I disagree with your logic. Realize there are folks who really don't concern themselves with the huge potential energy waste attributed to this philosophy. Properly designed range HVAC systems move an inordinately high volume of air. If the exhausted air is cooled or heated it represents substantial energy waste. As a Federal agency, NIOSH should consult the current Federal energy policy and consider the energy use implications of your recommendations. Various engineering controls are available to allow saving energy and recirculating some range air at significant operating cost savings. Folks need to be thinking about recirculation with engineering controls.

The document goes on to say, "It is important to note that the recirculated air systems often require a high amount of maintenance and expense." This seems a statement of relative opinion. What is the "expense" (in terms of resources and the environment) of dumping huge quantities of conditioned air to the atmosphere vs. the cost of installing and maintaining a filter system with engineering controls which permit energy saving recirculation of some air. I have experience with such recirculation ranges which have operated successfully for years without instance of elevated BL. Yes, they are imperfect and do have to be properly maintained. Please reference any hard data you have demonstrating through life cycle operational cost analyses that 100% exhaust systems are superior to recirculation systems. Suggest NIOSH qualify or delete any comments and recommendations not based upon accurate and verifiable information.

Noise:

Page 16, second bullet – The inclusion of a statement that observation rooms should be constructed with bullet resistant glass seems to be a recommendation outside the scope of this document. Ballistic protection recommendations are not the subject of your document. On the other hand, NIOSH should add the pertinent recommendation to use sound rated wall, door, and window assemblies suitable to attain the desired acoustical controls and performance.

Page 16, last paragraph extending onto page 17: The NIOSH comments seem biased towards the promotion of rubber bullet traps and exclude mention of other trap technologies and their respective considerations. Traps have multiple purposes. Acoustical tests and reports are available which say the noise generated by bullet impact on a steel bullet trap is not perceptible to the range users. So, of what hearing conservation advantage is a quiet trap? Rubber traps also become compacted with bullets in the strike zone which creates lead particulate (and a backscatter hazard). Is NIOSH familiar with other methods employed in conjunction with steel traps to control lead and are you familiar with the equipment costs, service, and maintenance considerations attributed to various traps? Rubber traps burn (Military design guides disallow their use), create a lead contaminated media, and they require frequent maintenance placing workers in contact with lead contaminated material.

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Bill Metcalf	13	Supply Ventilation System Recommendations	Reference source of information NIOSH used to determine that use of a perforated wall plenum "ensures optimum airflow distribution across	Primary reference is given in the paragraph just above that section [Crouch et al. 1991]. NIOSH HHE references are provided in
Metcalf Range Consulting				

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<p>519 Wesley Oak Circle St. Simons Island, GA 31522 metcalfbill@bellsouth.net</p>	<p>14</p>	<p>2nd Paragraph Supply Ventilation System Recommendations</p>	<p>the firing line". Perforated 90-180 degree radial air diffusers mounted at ceiling height prevalent, practical and economical and have been widely tested and demonstrated effective in meeting established industry and regulatory airflow criteria. Request NIOSH reference source of test data on radial plenum or wall plenum construction demonstrating that 15 feet is needed from the plenum to the firing line? Please cite testing sources including description of the constructed conditions.</p>	<p>the reference section of the Alert. These references and source data can be obtained by contacting the CDC/NIOSH help line at: 1-800-CDC-INFO. We basically agree with the comment about the practicality for using radial air diffusers, and added that language to the Supply Ventilation System Recommendations section. It now reads: "Introduce supply air as far up range as possible. A perforated wall plenum has been shown to provide uniform air distribution at the firing line. Perforated radial air diffusers mounted at ceiling height have been tested and demonstrated effective in meeting established industry and regulatory airflow criteria. Diffusers that produce jets of air can create turbulence at the firing line." We agree, however we cannot recommend that no booths/dividers be installed because that would defeat the</p>

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	14	1 st Paragraph Exhaust Ventilation System Recommendations 1 st Paragraph	laminar airflow system. "Exhausting 10% more air than supplied is a general recommendation for maintaining appropriate negative pressure in the firing range." This figure is high and represents significant energy costs and air handling equipment capacity. The recommendation seems arbitrary and tends to neglect economy, Federal energy policy and LEED goals. What is the source(s) of this recommendation and was energy usage considered as a factor?	purpose and functionality of many firing ranges, not to mention personal safety concerns. We have replaced the language to remove the 10% requirement.
	14	Air Filter Recommendations 2 nd Paragraph	If lead-contaminated air..., the exterior walls of the building and surrounding grounds (ADD- and waterways) can become contaminated." Runoff of lead contaminated water is a problem (Clean Water Act).	Modified as suggested
	15	Air Filter Recommendations	Lead released outdoors... can be re-aerosolized and result in subsequent contamination of the firing range, (ADD – persons exposed to this lead), or other buildings...."). All filters (Add- potentially exposed to lead contaminated air) should be	We added the following sentence: "and present unwanted hazards to humans if the range is in a populated area." Modified as suggested.

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			<p>equipped with side and face gaskets.....” Recognize and differentiate that supply filters are commonly used in these systems but do not necessarily require gasketed filters in a 100% exhaust type design.</p>	
	15	<p>Filter System Maintenance Recommendations 2nd Paragraph</p>	<p>“Dirty filters should be (ADD-transported and) disposed of properly”</p>	<p>Added as suggested. This bullet was modified substantially according to another reviewer's recommendation.</p>
	15	<p>Control System Recommendations 2nd Paragraph</p>	<p>“Exhaust and supply fans should be interlocked so that all fan systems operate at the same time (ADD – during active range use).” Here again, your sources are imposing recommendations without considering the spectrum of range operating conditions and constraints. Mechanical systems “interlocks” should implemented dependent upon the full range of operating conditions. Operation costs and energy conservation warrants that a HVAC system operate in an economical “unoccupied setback” mode, even on firing ranges. In this economy mode air temperature inside the range is being maintained at a more economical setting. More</p>	<p>Added as suggested.</p>

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	15	Control System	<p>importantly, to also conserve energy range owners/designers will design dampened air handler systems which recirculate the conditioned air in the unoccupied mode (no shooting) rather than exhaust it. Dependent upon system architecture, a hard supply and exhaust fan system interlock serves to defeat this unoccupied mode of operation.</p> <p>“Air flow from the fans should be monitored (DELETE – at the firing range operator’s station) and interlocked with a critical firing range operating systems to....”</p> <p>Suffice it to say monitor it but refrain from telling people ‘where’ to monitor it. System monitoring and control locations are dependent on the design and operational protocol of the range operator.</p> <p>Direct digital control (DDC) systems are used which are able to automatically shut the system down in the event a system operating parameter is violated. And, a DDC system generated signal can notify the range officer by a variety of means.</p> <p>Inclusions of safety</p>	<p>Deleted as suggested.</p> <p>3rd Bullet deleted</p>

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		Recommendations 3 rd Paragraph	recommendations outside the realm of lead and noise issues seem beyond the scope of this document and should be avoided.	
	15	Control System Recommendations Last Paragraph	<p>“Exhaust air from the firing range should not be recirculated back into the range.” I disagree with your logic. Realize there are folks who really don't concern themselves with the huge potential energy waste attributed to this philosophy. Properly designed range HVAC systems move an inordinately high volume of air. If the exhausted air is cooled or heated is represents substantial energy waste. As a Federal agency, NIOSH should consult the current Federal energy policy and consider the energy use implications of your recommendations. Various engineering controls are available to allow saving energy and recirculating some range air at significant operating cost savings. Folks need to be thinking about recirculation with engineering controls.</p> <p>The document goes on to say, “It is important to note that the recirculated air systems often require a high</p>	<p>NIOSH first and foremost concerns are the health and safety of the workers. The operating cost analyses of recirculated vs. non-recirculated exhaust systems are beyond the scope of this Alert. We mention in the next statement that if air is to be recirculated, a particle detection system must be installed and demonstrated to be effective so in case of failure, the air will not be contaminated and subject the workers to hazardous exposures. We have qualified the initial statement by including the words “when economically feasible” to provide for some flexibility for the operators.</p> <p>We have deleted this last sentence and added the following:</p>

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			<p>amount of maintenance and expense." This seems a statement of relative opinion. What is the "expense" (in terms of resources and the environment) of dumping huge quantities of conditioned air to the atmosphere vs. the cost of installing and maintaining a filter system with engineering controls which permit energy saving recirculation of some air. I have experience with such recirculation ranges which have operated successfully for years without instance of elevated BLL. Yes, they are imperfect and do have to be properly maintained. Please reference any hard data you have demonstrating through life cycle operational cost analyses that 100% exhaust systems are superior to recirculation systems. Suggest NIOSH qualify or delete any comments and recommendations not based upon accurate and verifiable information.</p>	<p>"ANSI/ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality, [ANSI/ASHRAE 2007] provides dilution ventilation guidelines for recirculating clean and breathable air in an energy-efficient manner."</p>
	16	Noise Second Bullet	<p>The inclusion of a statement that observation rooms should be constructed with bullet resistant glass seems to be a recommendation outside the scope of this document. Ballistic protection recommendations</p>	<p>This requirement is important to a major target audience of this Alert, law enforcement officers and wanted to differentiate the type of glass available that would also provide some noise</p>

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	16	Noise Last Paragraph	<p>are not the subject of your document. On the other hand, NIOSH should add the pertinent recommendation to use sound rated wall, door, and window assemblies suitable to attain the desired acoustical controls and performance.</p> <p>The NIOSH comments seem biased towards the promotion of rubber bullet traps and exclude mention of other trap technologies and their respective considerations. Traps have multiple purposes. Acoustical tests and reports are available which say the noise generated by bullet impact on a steel bullet trap is not perceptible to the range users. So, of what hearing conservation advantage is a quiet trap? Rubber traps also become compacted with bullets in the strike zone which creates lead particulate (and a backscatter hazard). Is NIOSH familiar with other methods employed in conjunction with steel traps to control lead and are you familiar with the equipment costs, service, and maintenance considerations attributed to various traps? Rubber traps burn (Military design guides disallow their use), create a lead</p>	<p>attenuations. We do provide recommendations on selecting appropriate acoustically-rated walls, doors, and windows.</p> <p>The comment contains no bias for rubber traps, just another viable option that is now preferred by law enforcement agencies.</p>

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			contaminated media, and they require frequent maintenance placing workers in contact with lead contaminated material.	

Reviewer 3

From: MICHAEL BURKE [BURKE@EHS.PSU.EDU]
Sent: Friday, May 02, 2008 12:20 PM
To: NIOSH Docket Office (CDC)
Subject: 128 - Firing Ranges Alert

Good Afternoon,

I would like to offer one comment on the recent draft NIOSH Alert - Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges (NIOSH Docket 128).

In addition to our exhaust ventilation and cleaning practices, we covered our bullet traps with 4'x8' sheets of masonite to prevent dust and debris from escaping the target area. As the sheets become perforated with bullets we either tape over the holes or replace the cover materials depending on extent of wear. Other materials could be easily substituted. Note, our ranges are for .22 caliber and air rifles only.

Please let me know if you have any questions.
Thanks

Mike Burke, Program Manager
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<p>Mike Burke Program Manager Penn State University - Environmental Health and Safety</p> <p>6 Eisenhower Parking Deck University Park, PA 16802 Phone: (814) 865 - 6391 Fax: (814) 863 - 7427 Burke@ehs.psu.edu</p>			<p>In addition to our exhaust ventilation and cleaning practices, we covered our bullet traps with 4x8' sheets of masonite to prevent dust and debris from escaping the target area. As the sheets become perforated with bullets we either tape over the holes or replace the cover materials depending on extent of wear. Other materials could be easily substituted. Note, our ranges are for .22 caliber and air rifles only.</p>	<p>The reviewer is making a comment regarding their own practices; we acknowledge that the use of masonite sheets at the bullet traps may represent some advantages for certain firing ranges.</p>

Reviewer 4

From: graz235@lmi.wa.gov
Sent: Wednesday, May 07, 2008 12:16 PM
To: NIOSH Docket Office (CDC)
Cc: Chen, Jihong (Jane) (CDC/NIOSH/EID) (CTR); Doyle, Glenn (CDC/NIOSH/EID)
Subject: 128 - FiringRangesAlert Comments

Name

Nadine B. Grady, MS, CIH

Organization

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USA

Comments

Firing range owners should also ensure that if they hire contractors to do work in the facility, they inform them about the potential lead exposure hazard.

In 2007 Washington State's OSHA program investigated a complaint from an employee of a cleaning company which was hired to clean ventilation ducts at a firing range. The firing range owners did not mention lead hazards to the cleaning company owner. The cleaning company had never done work at a firing range before.

The cleaning company employees did have potential exposure to lead, and were experiencing some flu-like symptoms. Although their employer had looked up some lead information from EPA, he had not provided all the appropriate training and protection for his

workers. Fortunately, he had found and implemented procedures for wet cleaning and HEPA vacuuming. Our sampling showed his employees' airborne lead exposure was just at the action level (30 ug/m3). Additional exposure by ingestion was a distinct possibility, Citations were issued, and the violations were ultimately corrected.

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<p>Nadine B. Grady, MS, CIH Washington State Dept. of Labor & Industries / DOSH 901 N. Monroe St., Ste 100 Spokane, WA 99201-2148 Email: graz235@lmi.wa.gov</p>			<p>In 2007 Washington State's OSHA program investigated a complaint from an employee of a cleaning company which was hired to clean ventilation ducts at a firing range. The firing range owners did not mention lead hazards to the cleaning company owner. The cleaning company had never done work at a firing range before.</p> <p>The cleaning company employees did have potential exposure to lead, and were experiencing some flu-like symptoms. Although their employer had looked up some lead information from EPA, he had not provided all the appropriate training and protection for his workers. Fortunately, he had found and implemented procedures for wet cleaning and HEPA vacuuming. Our sampling showed his employees' airborne lead exposure was just at the action level (30 ug/m3). Additional exposure by ingestion was a distinct</p>	<p>The reviewer is making a comment regarding their own practices; we acknowledge the need for proper training for personnel involved in the cleaning of firing ranges and have emphasized this issue in several places in this Alert.</p>

NIOSH Alert: Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges, NIOSH Docket Number NIOSH-128.
<http://www.cdc.gov/niosh/review/public/128/> Comments due June 30, 2008

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			possibility, as employees were eating and drinking in the work area. Citations were issued, and the violations were ultimately corrected.	

Reviewer 5

The Alert contains the following statement regarding surface decontamination on page 17:

"Floor and horizontal surfaces inside the firing range should be cleaned routinely with a detergent or cleanser designed for lead decontamination. EPA studies show that general all-purpose cleaners are adequate for both general cleaning and post-intervention cleaning [EPA 1997, Lewis et al. 2006]."

This statement appears to be to be contradictory in that the first sentences states "surfaces...should be cleaned routinely with a detergent or cleanser designed for lead decontamination" whereas the second sentence indicates that "EPA studies show that general all-purpose cleaners are adequate for both general cleaning and post-intervention cleaning." Should cleansers be designed for lead decontamination as stated in the first sentence or are general all-purpose cleaners adequate for surface decontamination as stated in the second sentence?

Please do not hesitate to contact me if you have any questions.

Richard Melville, CIH
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Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
Richard Melville, CIH Global Well-being Services Building 320A-2, Zip 4C1/Fishkill Telephone: (845)894-8018	17	Work Practice and Administrative Controls	The Alert contains the following statement regarding surface decontamination on page 17: "Floor and horizontal surfaces inside the firing range should be cleaned routinely with a detergent or cleanser	The statement may appear to be confusing, we have changed it to read: "Floor and horizontal surfaces inside the firing range should be cleaned

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			<p>designed for lead decontamination. EPA studies show that general all-purpose cleansers are adequate for both general cleaning and post-intervention cleaning [EPA 1997, Lewis et al. 2006]."</p> <p>This statement appears to be to be contradictory in that the first sentences states "surfaces...should be cleaned routinely with a detergent or cleanser designed for lead decontamination" whereas the second sentence indicates that "EPA studies show that general all-purpose cleansers are adequate for both general cleaning and post-intervention cleaning." Should cleansers be designed for lead decontamination as stated in the first sentence or are general all-purpose cleansers adequate for surface decontamination as stated in the second sentence?</p>	<p>routinely with a detergent, or in some specific and tough cases, a cleanser designed for lead decontamination. EPA studies show that general all-purpose cleansers are adequate for both general cleaning and post-intervention cleaning [EPA 1997, Lewis et al. 2006]. "</p>

Reviewer 6

Name

Mark Cameron, CIH

Organization

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USA

Comments

With regard to the draft NIOSH Alert regrading firing ranges:

1. Providing medical monitoring is recommended. I evaluated our law enforcement firearm examiners (report can be found at: <http://www.cci.ca.gov/Reference/Lead.pdf>)

Our blood lead levels were 5 microgm/dl or less for all our examiners. To require annual or on-going medical monitoring for individuals using a firing range is excessive. Outside of range masters who are at a range daily (appropriate candidates for medical monitoring), normal police officers only use a range every 3 months, and then to fire 75-150 rounds.

My experience in the law enforcement community is that this is not adequate to require medical monitoring. I recommend this section note medical monitoring may be appropriate for personnel who have routinely have high exposure and not occasional users.

2. You cite a 1989 report to justify high lead levels at firing ranges.

That report is 19 years old! Why not cite your 1997 HHE for Forest Park PD? There are over exposures there. Or the 2005 HHE for Immigration and Naturalization Firing Range? Perhaps you should also note that many of your studies have shown exposures within acceptable levels and this is not always a problem? (St Bernard PD, 1992; Dartmouth PD 1996; New Hampshire Police Stds Unit, 1996)

3. You cite the 1991 FBI Firing Range report to indicate that range instructors were exposed to up to 51.7 micrograms Pb/m³. You didn't note that that was for 178 min: 8 hr TWA would be about 19 microgm Pb/m³. You could note that the exposure happened at a OUTDOOR firing range.

4. All the discussion is about indoor ranges. However, your own data as well as other published papers indicates overexposure is possible at outdoor ranges as well. Though a ventilation system cannot be included, personnel should be warned of the possibility and consider monitoring to evaluate exposure possibilities. See: "Lead Exposure in (covered) Outdoor Firearm Instructors", Tripathi et.al, Am Jr Pub Hlth 81 (6), 1991, p 753-755 "Lead Exposure at Uncovered Outdoor Firing Ranges", Goldberg et. al., Jr Occupational Medicine 33 (6), 1991, p 718-719 "Overexposures to Lead at a Covered Outdoor Firing Range", Tripathi, et.al., Jr of the American College of Toxicology, 8 (6), 1989, p1189-1195

I personally have done outdoor monitoring and experienced personnel being overexposed when shooting for as little as 30 minutes (and exceeding the 8 hr PEL). I will be presenting my data at the 2008 American Industrial Hygiene Conference in Minneapolis next month.

Sincerely,
 Mark Cameron, MS, CIH
 Senior Industrial Hygienist
 CA Dept of Justice

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Mark Cameron, CIH CA Dept of Justice 4944 Broadway, Rm A104 Sacramento, CA 95820 mark.cameron@doj.ca.gov	19	Worker exposure and medical health monitoring	1. Providing medical monitoring is recommended. I evaluated our law enforcement firearm examiners (report can be found at: http://www.cci.ca.gov/Reference/Lead.pdf) Our blood lead levels were 5	We do not specify in the Alert a requirement that all workers should receive medical monitoring annually or on-going basis. The OSHA requirements and the AOEC recommendations in the Alert specify that employers should monitor

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			<p>microgm/dl or less for all our examiners. To require annual or on-going medical monitoring for individuals using a firing range is excessive. Outside of range masters who are at a range daily (appropriate candidates for medical monitoring), normal police officers only use a range every 3 months, and then to fire 75-150 rounds.</p> <p>My experience in the law enforcement community is that this is not adequate to require medical monitoring. I recommend this section note medical monitoring may be appropriate for personnel who have routinely have high exposure and not occasional users.</p>	<p>workers only if they determine that their workers are exposed at the action level or higher (or those who handle or distribute materials with a significant lead content). The AOEC recommendations indicate that monitoring can be reduced if BILs remain below 10 ug/dL.</p> <p>We have added the sentence “especially those who routinely use or work at these ranges” to first bullet on page 20.</p>
	6	Case Reports – Case 1	<p>You cite a 1989 report to justify high lead levels at firing ranges. That report is 19 years old! Why not cite your 1997 HHE for Forest Park PD? There are over exposures there. Or the 2005 HHE for Immigration and Naturalization Firing Range? Perhaps you should also note that many of your studies have shown exposures within acceptable levels and this is not always a problem? (St Bernard PD, 1992; Dartmouth PD 1996; New Hampshire Police Stds</p>	<p>The case reports were carefully selected to show the range of available studies on firing ranges. We have referenced the 1997 HHE report in Case 3, and the 2005 HHE in Case 5. We acknowledge that not all studies show overexposure, however, the objective of using the case reports is to highlight the potential problems that exist at firing ranges.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	8	Case Reports – Case 4	<p>Unit, 1996)</p> <p>You cite the 1991 FBI Firing Range report to indicate that range instructors were exposed to up to 51.7 micrograms Pb/m³. You didn't note that that was for 178 min: 8 hr TWA would be about 19 microgram Pb/m³. You could note that the exposure happened at a OUTDOOR firing range.</p>	<p>We did not use TWA to describe the instructors' exposure levels, just the high ranges for the instructors, technicians, and gunsmiths. We did mention that the FTU consists of an indoor range, a testing range, and 7 outdoor ranges.</p>
			<p>All the discussion is about indoor ranges. However, your own data as well as other published papers indicates overexposure is possible at outdoor ranges as well. Though a ventilation system cannot be included, personnel should be warned of the possibility and consider monitoring to evaluate exposure possibilities. Sec: "Lead Exposure in (covered) Outdoor Firearm Instructors", Tripathi et.al, Am Jr Pub Hlth 81 (6), 1991, p 753-755 "Lead Exposure at Uncovered Outdoor Firing Ranges", Goldberg et. al., Jr Occupational Medicine 33 (6), 1991, p 718-719 "Overexposures to Lead at a Covered Outdoor Firing Range", Tripathi, et.al., Jr of the American College of</p>	<p>We do acknowledge that overexposure occur at outdoor firing ranges but the scope of this Alert is limited to indoor firing ranges. However, we have added the following sentence with the recommended references highlighted by this reviewer to the introduction section.</p> <p>"Although the scope of this Alert is specifically targeted at indoor firing ranges, overexposures to lead and noise at outdoor firing ranges have been documented in several studies [Tripathi et al. 1991; Goldberg et al. 1991; Murphy 2007]. Many of the recommendations that are outlined in this Alert can also be</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>Toxicology, 8 (6), 1989, p1189-1195. I personally have done outdoor monitoring and experienced personnel being overexposed when shooting for as little as 30 minutes (and exceeding the 8 hr PEL). I will be presenting my data at the 2008 American Industrial Hygiene Conference in Minneapolis next month.</p>	<p>applied to protecting workers and shooters who use outdoor and covered firing ranges."</p>

Reviewer 7

Name
 David Sharrow

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Comments

This document needs to specify that the hazards depicted are for indoor gunpowder-actuated firearms and not air-rifle or air-pistol programs. The hazards for indoor air-rifle/pistol programs are not primarily health issues as the lead does not become aerosolized and there are no adverse noise levels associated with their firing.

The lack of specificity can create adverse media reaction leading to wasteful expenditure of public sector funds.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
David Sharrow Anchorage School District 5530 E. Northern Lights Blvd. Anchorage, AK 99504			This document needs to specify that the hazards depicted are for indoor gunpowder-actuated firearms and not air-rifle or air-pistol programs. The hazards for indoor air-rifle/pistol programs are not primarily health issues as the lead does not become	This Alert is aimed most at law enforcement officers and those who use firing ranges in the occupational setting. Most of the air-rifle/pistol programs are recreational in general and do not fall within

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
Sharrow_David@asdk12.org			<p>aerosolized and there are no adverse noise levels associated with their firing.</p> <p>The lack of specificity can create adverse media reaction leading to wasteful expenditure of public sector funds.</p>	<p>the scope of this Alert. The title of this Alert uses the word "Occupational" and since this is a NIOSH product, this should alleviate any potential for false alarms that this is a product aimed at the general public and the recreational market.</p>

Reviewer 8

Hi

I am aware NIOSH focuses on work areas, however, the largest danger is to small children and pregnant women, not workers. Lead dust levels can be astronomical and present a grave danger to small children who go with mom or dad to the firing range. I have found lead dust levels of 500,000 micrograms per square foot in cafeteria and play areas, the residential standard is 40 ug/ft2. This is a bigger problem than you have indicated and it should be addressed.

+++

Mark Veckman, CIH, CSP, LBP Risk Assessor/Project Designer
 Comprehensive Environmental Assessments
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 MarkGV@CEAinc.com

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Author's Response
Mark Veckman, CIH, CSP, LBP Risk Assessor/Project Designer Comprehensive Environmental Assessments 12124 Triple Crown Road Darnestown, MD 20878 703-698-8344 (office/cell) / 349-5555 fax			I am aware NIOSH focuses on work areas, however, the largest danger is to small children and pregnant women, not workers. Lead dust levels can be astronomical and present a grave danger to small children who go with mom or dad to the firing range. I have found lead dust levels of 500,000 micrograms per square foot in cafeteria and play areas, the residential standard is 40 ug/ft2 This is a bigger problem than you	The reviewer is obviously aware that NIOSH's products are mainly aimed at occupational hazards and exposures. We do provide recommendations (page 17&18) on preventing "take-home" lead exposure that may address some of the concerns raised by the reviewer and should provide workers with the awareness about potential lead

Reviewer 9

Name

Private Person

Organization

Email

Address

Comments

I appreciate the efforts made to complete this document. It is well researched, designed and the key points are well stated.

In the opening statements on recommended controls, the document does not emphasize the need for double hearing protection, availability of sanitary facilities or waterless handwipes to clean hands and face, and the use of lead free or full metal jacketed bullets to significantly reduce exposure to noise and lead. The document does research all three aspects, but does not fully address them in the opening or summary as to the effectiveness of implementing these three leading methods of reducing hazardous exposures. Rather these three issues are more important than informing someone on the recognition of an acute exposure in this situation which is extremely rare if not unknown, verses the chronic exposure. Also, the relationship on exposure to cleaning solvents and use of appropriate solvent resistant gloves is poorly made.

There is a statement regarding dip coated copper bullets, metal jacketed and copper clad bullets that is ambiguous, and it's conclusion that one is not as effective as the other, and is subject to wearing off in the barrel exposing the lead core. This statement should be verified with various bullet manufacturers, particular as to the definitions of each. Generally I have found metal jacket bullets with heeled bases (the copper jacket is formed like a cup, and the lead core is sealed to the jacket with an epoxy) has the lowest potential for lead exposure with common law enforcement hollow point ammunition and is the most commonly provided by the largest suppliers). Practice ammunition using a dip coated full metal jacket (without an open heeled base exposing the lead core) has the lowest potential of lead exposure. Copper clad bullets having the copper wear off is manufacturer dependant.

Irregardless, the use of lead bullets in indoor ranges is clearly a significant hazard compared to any of the three types of bullets. Dip coated bullets reduce exposures only fractionally compared to full metal jacket open based bullets and copper clad. There is very little

"burn" on the base of lead bullet that volatilizes lead fumes, the primary exposure comes from over-sized soft lead bullets and the friction and cutting action caused by the lands and grooves of the barrel.

The discussion on double hearing protection needs to be expanded to the use of ear plugs and electronic hearing protection. As a safety matter, it is extremely important to hear range commands. Electronic Hearing Protection offered by several vendors provide automatic noise suppression when noise exceeds 80 dbA. The current vendors of electronic hearing protection should be contacted for current specifications of equipment.

As an aside, I would strongly recommend that these vendors provide a behind the neck style of electronic ear muffs designed for the law enforcement officer and the range of head ware (hats, ball caps, helmets).

In the document, NIOSH states that it has a unique hand cleanser that removes lead, under the patent process and looking for a vendor. While the usefulness of such a product is clearly needed, I'm not sure this document is the appropriate venue.

Please feel free to contact me if you having any questions regarding these comments.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Author's Response
Private Person Address			In the opening statements on recommended controls, the document does not emphasis the need for double hearing protection, availability of sanitary facilities or waterless handwipes to clean hands and face, and the use of lead free or full metal jacketed bullets to significantly reduce exposure to noise and lead. The document does research all three aspects, but does not fully address them in the opening	We do mention the need to use double hearing protection (1st bullet under Protect yourself), the need to wash and clean face and hands (1st bullet under Use good work practices..) As the use of lead-free or metal jacketed bullets, this is not a universal recommendation because some range operators may opt against ammunition

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>or summary as to the effectiveness of implementing these three leading methods of reducing hazardous exposures. Rather these three issues are more important than informing someone on the recognition of an acute exposure in this situation which is extremely rare if not unknown, verses the chronic exposure. Also, the relationship on exposure to cleaning solvents and use of appropriate solvent resistant gloves is poorly made.</p>	<p>substitutes. As far as using solvent resistant gloves, we do mention it in the 3rd bullet of Protect yourself section.</p>
			<p>There is a statement regarding dip coated copper bullets, metal jacketed and copper clad bullets that is ambiguous, and it's conclusion that one is not as effective as the other, and is subject to wearing off in the barrel exposing the lead core. This statement should be verified with various bullet manufactures, particular as to the definitions of each. Generally I have found metal jacket bullets with heeled bases (the copper jacket is formed like a cup, and the lead core is sealed to the jacket with an epoxy) has the lowest potential for lead exposure with common law enforcement hollow point</p>	<p>We acknowledge the reviewer's first-hand experience with the metal-jacketed bullets with heeled bases as well as the dip-coated bullets but the information provided in this Alert is based on documented research or published studies.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>ammunition and is the most commonly provided by the largest suppliers). Practice ammunition using a dip coated full metal jacket (without an open heeled base exposing the lead core) has the lowest potential of lead exposure. Copper clad bullets having the copper wear off is manufacturer dependant.</p> <p>Irregardless, the use of lead bullets in indoor ranges is clearly a significant hazard compared to any of the three types of bullets. Dip coated bullets reduce exposures only fractionally compared to full metal jacket open based bullets and copper clad. There is very little "burn" on the base of lead bullet that volatilizes lead fumes, the primary exposure comes from over-sized soft lead bullets and the friction and cutting action caused by the lands and grooves of the barrel.</p>	<p>On Page 18, 1st bullet under personal protective equipment, we say the following:</p> <p>"For shooters requiring improved communication, NIOSH</p>
			<p>The discussion on double hearing protection needs to be expanded to the use of ear plugs and electronic hearing protection. As a safety matter, it is extremely important to hear range commands. Electronic</p>	

NIOSH Alert: Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges, NIOSH Docket Number NIOSH-128.
<http://www.cdc.gov/niosh/review/public/128/> Comments due June 30, 2008

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
MarkGV@CEAinc.com			have indicated and it should be addressed.	contamination for their family members.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>Hearing Protection offered by several vendors provide automatic noise suppression when noise exceeds 80 dbA. The current vendors of electronic hearing protection should be contacted for current specifications of equipment. As an aside, I would strongly recommend that these vendors provide a behind the neck style of electronic ear muffs designed for the law enforcement officer and the range of head ware (hats, ball caps, helmets).</p>	<p>recommends using a sound restoration earmuff with earplugs."</p> <p>We have expanded this bullet to read as follows:</p> <p>"For shooters requiring improved communication, NIOSH recommends using electronic level-limiting or sound restoration earmuffs with passive earplugs. In addition to the electronic earmuffs, commercially available communication headsets exist that would permit the range master to transmit instructions via short range radio to the shooter's headset. Shooters should also be encouraged to wear eye protection in the form of safety glasses or goggles that are compatible with hearing and other head protection devices. NIOSH research has shown that wearing earmuffs on top of safety glasses created a leakage in the seal of the earmuff cushions with the ear and reduced the effectiveness and peak noise level reduction of the earmuffs.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	4	NIOSH Recommendations, 3 rd paragraph	<p>In the document, NIOSH states that it has a unique hand cleanser that removes lead, under the patent process and looking for a vendor. While the usefulness of such a product is clearly needed, I'm not sure this document is the appropriate venue.</p>	<p>NIOSH recommends that shooters wear the safety glasses over the top of the earmuff cushions, or use glasses with a strap or low profile stem. Ideally, the safety glasses should be an integral part of the earmuff or other head protection devices. A training program in the appropriate use and fitting of hearing and eye protection should be implemented by firing range training staff. "</p> <p>We agree, after reviewing the statement, we have removed the wording about the patent-pending and availability for commercial licensing.</p>

Reviewer 10

Comments submitted on behalf of Navy Marine Corps Public Health Center--Navy Hearing Conservation Program Manager, Tom Hutchinson

1. Almost no comment about the synergistic effects of noise and lead exposure. Recommend introductory paragraph describing the potential ototoxic effects of lead. Also should include ototoxic effects of cleaning agents they might use in maintaining a range facility. Also no mention of asphyxiants.
2. They do mention earplugs relative to noise protection and they also mention hand hygiene in relation to dermal and oral exposure but there is no mention of hand hygiene prior to insertion of plugs (especially disposable plugs with foam-like texture) nor was there mention of cleaning and care of non-disposable plugs and/or muffs to reduce contamination.
3. There is separate citations on monitoring for blood leads and monitoring for noise exposure but no mention of monitoring hearing with elevated blood leads.

Very Respectfully,

Denise

"Teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results." --Andrew Carnegie

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Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
<p>Denise M. Mullins, RN, COHN Occupational Health Nurse Consultant Navy and Marine Corps Public Health Center Occupational & Environmental Medicine Directorate (OEM) 620 John Paul Jones Circle, Bld, 215, Suite 1100 Portsmouth, VA 23708- 2103 Fax (757) 953-0670 Office (757) 953-0785</p>		<p>Personal Protective Equipment</p>	<p>Almost no comment about the synergistic effects of noise and lead exposure. Recommend introductory paragraph describing the potential ototoxic effects of lead. Also should include ototoxic effects of cleaning agents they might use in maintaining a range facility. Also no mention of asphyxiants.</p>	<p>Evidence about synergistic effects of lead and noise exposure show no significant association. The potential for ototoxic effects of lead are described in detail in various sections of this Alert. We also make several recommendations for personnel involved in using cleaning agents. Asphyxiates have not been found to be a major issue at any firing range.</p>
			<p>They do mention earplugs relative to noise protection and they also mention hand hygiene in relation to dermal and oral exposure but there is no mention of hand hygiene prior to insertion of plugs (especially disposable plugs with foam-like texture) nor was there mention of cleaning and care of non-disposable plugs and/or muffs to reduce contamination.</p>	<p>We do mention in several sections the need for personal hygiene and washing before any contact with the face. We do not have any evidence of lead exposure through the ear canal, but on Page 18, Personal Protective Equipment, we say: “A training program in the appropriate use and fitting of hearing protection should be implemented by firing range</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Author's Response
		Worker exposure and medical health monitoring	There is separate citations on monitoring for blood leads and monitoring for noise exposure but no mention of monitoring hearing with elevated blood leads.	<p>training staff.”</p> <p>We have added the following paragraph to Worker exposure and medical health monitoring section:</p> <p>“Occupational exposure to lead can have an additive or potentiating effect on the auditory system and increase the potential for hearing loss. Pure-tone audiometric testing may conceal certain hearing difficulties caused by exposure to lead or other chemicals. Professionals who review the audiometric results should be alerted to this issue and should consider a referral for further testing and medical evaluation [Morata, 2007].”</p> <p>Morata, TC [2007]. Promoting hearing health and the combined risk of noise-induced hearing loss and ototoxicity. <i>Audiological Medicine</i>, 5 (1): 33 – 40.</p>

Reviewer 11

Name

Richard Rabin

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Comments

The section that is directed specifically to workers should be titled as such more prominently. Perhaps you could also make it a stand-alone document.

Symptoms of lead: hearing loss should be included. Also state that damage to health can occur even when there are no symptoms.

Controls (in the 2-page summary for employers): employers should consider using non-lead ammunition.

The medical monitoring section of the OSHA lead standard is 29 CFR 1910.1025(j) – not (d).

In the “OSHA Regulations” section, state that medical removal is at 60 µg/dl for one test, plus a confirmation.

In the “US Government Agencies/Military Industrial Hygiene Standards and Guidelines for Firing Ranges” section, the HUD guidelines given for surface dust are out-of-date. EPA has more recent and protective regulations.

It would be helpful to give a case study that shows lead exposure specifically for an outdoor range.

In the “Association of Occupational and Environmental Clinics” section, the phrase “the AOEC has determined ... the OSHA action level;” is unclear.

In the “Preventing the potential for lead exposure by ingestion and by avoidance of skin contamination and appropriate decontamination” section, the advice for surface cleaning is contradictory. It says both that “a detergent or cleanser designed for lead decontamination” should be used and that “EPA studies show that general all-purpose cleaners are adequate.”

In the “Worker health monitoring” section, it should be recommended that the employer’s medical monitoring program be supervised by a physician trained and experienced in occupational medicine.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Author’s Response
Richard Rabin Mass. Dept. of Labor 1001 Watertown St. Newton, MA 02465 rick.rabin@state.ma.us			<p>The section that is directed specifically to workers should be titled as such more prominently. Perhaps you could also make it a stand-alone document.</p> <p>Symptoms of lead: hearing loss should be included. Also state that damage to health can occur even when there are no symptoms.</p> <p>Controls (in the 2-page summary for employers): employers should consider using non-lead ammunition.</p>	<p>There’s a standard layout for NIOSH Alert documents and we must follow that format. The section will be tearable and will be a stand-alone document if needed.</p> <p>Added as suggested. Page 19, under Employer and worker education (4th Bullet).</p> <p>We have recommended using non-lead ammunition in the Alert This is not a universal recommendation and will depend on range and training</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	20		The medical monitoring section of the OSHA lead standard is 29 CFR 1910.1025(j) – not (d).	Corrected.
	2		In the “OSHA Regulations” section, state that medical removal is at 60 µg/dl for one test, plus a confirmation.	The statement in the Alert is correct, the reviewer comment pertains to another OSHA requirement for removal.
	4		In the “US Government Agencies/Military Industrial Hygiene Standards and Guidelines for Firing Ranges” section, the HUD guidelines given for surface dust are out-of-date. EPA has more recent and protective regulations.	The new EPA guidelines have been added to this section. We have not removed the HUD guidelines because our intention is to show the range of guidelines and standards that are available from the various government agencies.
	8		It would be helpful to give a case study that shows lead exposure specifically for an outdoor range.	Case 4 includes information about an outdoor range but since the scope of this Alert deals mainly with indoor ranges, we believe the case reports are adequate.
			In the “Association of Occupational and Environmental Clinics” section, the phrase “the AOEC has determined ... the OSHA action level;” is unclear.	The AOEC recommendations go a step beyond the OSHA regulations in recommending more stringent guidelines.
			In the “Preventing the potential for lead exposure by ingestion and by avoidance of skin contamination and appropriate decontamination”	This was mentioned by reviewer 6 and was clarified as follows: “Floor and horizontal surfaces

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>section, the advice for surface cleaning is contradictory. It says both that "a detergent or cleanser designed for lead decontamination" should be used and that "EPA studies show that general all-purpose cleaners are adequate."</p>	<p>inside the firing range should be cleaned routinely with a detergent, or in some specific and tough cases, a cleanser designed for lead decontamination. EPA studies show that general all-purpose cleaners are adequate for both general cleaning and post-intervention cleaning [EPA 1997, Lewis et al. 2006]. "</p>
			<p>In the "Worker health monitoring" section, it should be recommended that the employer's medical monitoring program be supervised by a physician trained and experienced in occupational medicine.</p>	<p>Added as suggested.</p>

Reviewer 12

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Comments

I have reviewed the NIOSH Alert regarding lead and noise. I would like to point out that this document is depicting photo's and product of a particular corporation.

This can be construed as the CDC is supporting this corporation and or that this corporation meets the NIOSH standards and is approved by the CDC.

This corporate name and product can clearly be seen on your cover, the "warning page", and on page 9.

I would suggest that the corporate name and product clearly visible be removed from this publication.

Thanks for your time in this serious matter.

Vincent Greiner
Director of Marketing
Meggitt Training Systems.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
<p>Vincent Greiner Director of Marketing Meggitt Training Systems 296 Brogdon Road Suwanee, GA 30024</p> <p>Email: vincent.greiner@meggitt.com</p>		<p>Front cover and Pictures in the Alert</p>	<p>I have reviewed the NIOSH Alert regarding lead and noise. I would like to point out that this document is depicting photo's and product of a particular corporation.</p> <p>This can be construed as the CDC is supporting this corporation and or that this corporation meets the NIOSH standards and is approved by the CDC. This corporate name and product can clearly be seen on your cover, the "warning page", and on page 9.</p> <p>I would suggest that the corporate name and product clearly visible be removed from this publication.</p>	<p>The pictures were taken by NIOSH researchers during their studies. We believe that cropping the pictures to remove the electronic retrieval system or using Photoshop or other graphic design packages to alter the original pictures would be distracting and lessen the importance of the overall content of the intended pictures.</p> <p>We have a disclaimer on the front of the Alert to make sure that any pictures or mention of specific products in the Alert is not construed incorrectly:</p> <p>“Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH).”</p>

Reviewer 13

Name
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Comments

Page 3 of the document, you talk about earplugs and earmuffs, most people on a firing range also wear eye protection. Eye protection impacts the fit of earmuffs. Need to ensure that the proper training of personnel to wear these is conducted and you may want to go over eye protection a little bit just to cover your bases.

Page 23 - You state that after use the floor of the firing range should be thoroughly cleaned with an explosion proof HEPA vacuum cleaner. It should read a HEPA "filtered" vacuum cleaner. Our experience with firing ranges leads us to believe that they will not get a HEPA vacuum, let alone an explosion proof one. So we have utilized pump up sprayers with lead cleaning chemicals and squeegees. Works just as well as a HEPA, better actually, cheap, effective, and less time consuming.

Page 24 - Due to lead dust being so easily transferrable, we have utilized step-off-pads at the entrance to the firing range to help reduce the amount of contamination on peoples feet. The booties are great while on the range, but there is contamination throughout the area and the pads just help reinforce to people to keep the area clean.

I would also highly recommend that personnel cleaning the firing range backstops have no exposed bare skin.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
<p>David T. Woods Fibertec Industrial Hygiene Services, Inc. 1914 Holloway Drive Holt, MI 48842 Email: dwoods@fibertecihs.com</p>	<p>3</p>		<p>Page 3 of the document, you talk about earplugs and earmuffs, most people on a firing range also wear eye protection. Eye protection impacts the fit of earmuffs. Need to ensure that the proper training of personnel to wear these is conducted and you may want to go over eye protection a little bit just to cover your bases.</p>	<p>We have revised the first bullet in the Personal Protective Equipment section to include information about eye protection for shooters and their proper fitting, the new bullet now reads: “All shooters and workers should be required to use dual hearing protection devices (earmuffs and earplugs) when the range is in use. For shooters requiring improved communication, NIOSH recommends using electronic level-limiting or sound restoration earmuffs with passive earplugs. In addition to the electronic earmuffs, commercially available communication headsets exist that would permit the range master to transmit instructions via short range radio to the shooters’ headset. Shooters should also be encouraged to wear eye protection in the form of safety glasses or goggles that are compatible with hearing and other head protection devices. NIOSH research has shown that wearing earmuffs on top of safety glasses created a leakage in the</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	17	Reducing lead contamination inside the firing range	<p>You state that after use the floor of the firing range should be thoroughly cleaned with an explosion proof HEPA vacuum cleaner. It should read a HEPA "filtered" vacuum cleaner. Our experience with firing ranges leads us to believe that they will not get a HEPA vacuum, let alone an explosion proof one. So we have utilized pump up sprayers with lead cleaning chemicals and squeegees. Works just as well as a HEPA, better actually, cheap, effective, and less time consuming.</p>	<p>Revised as suggested.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	18	Preventing take-home lead exposure	<p>Page 24 - Due to lead dust being so easily transferrable, we have utilized step-off-pads at the entrance to the firing range to help reduce the amount of contamination on peoples feet. The booties are great while on the range, but there is contamination throughout the area and the pads just help reinforce to people to keep the area clean.</p>	<p>We have modified the last bullet to include the use of the pads as follows:</p> <p>“Leave shoes worn on the firing range at the range or bag them before leaving the range to prevent lead from being tracked into cars and onto home floors and carpets. As an alternative, use step-off cleaning pads at the exit of the firing range to help reduce the amount of lead contamination on shoes. Disposable shoe coverings can also be used while firing and cleaning, then discarded upon leaving the range.”</p> <p>We do specify in the second bullet under Personal Protective Equipment that personnel should wear full protective outer clothing.</p>
			<p>I would also highly recommend that personnel cleaning the firing range backstops have no exposed bare skin.</p>	

Reviewer 14

June 26, 2008

Docket Number NIOSH-128

Comments to DRAFT NIOSH Alert: Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges.

Dear NIOSH:

Thank you for developing this publication. This agency has assisted municipal police departments handle lead contamination throughout their entire buildings due to an indoor firing range located in the basement.

Please consider revising the draft document to include:

- **Picture diagram of sources of Lead in a bullet to include bullet and primer.** Many firing range operators refuse to recognize lead in primer. In addition, some "Lead-free" bullets can still contain Lead primer. Highlight your fact on page 11 that jacketed and non-lead bullets can reduce lead emissions by 80%. See attached "sources of Lead dust" from the Texas Department of Health.
- **Picture diagram of location of Lead Dust contamination in the building.** Floor, counters, coffee maker, duct.
- **Picture diagram of a good ventilation system.**
- **Picture diagram of Lead poisoning.** Include the sperm, this always gets them to listen.
- **Sideline chart of HUD wipe sample clearance standards.**
- **Sideline chart of expected Noise levels in a firing range, for each type of gun.** Show how they are all above the reference number of 85 dB and 140 dB.
- **Tell me about the backstop and maintenance.** The NSSF guide says that poor maintenance has caused most of their poisonings that they have evaluated.








Thank You!

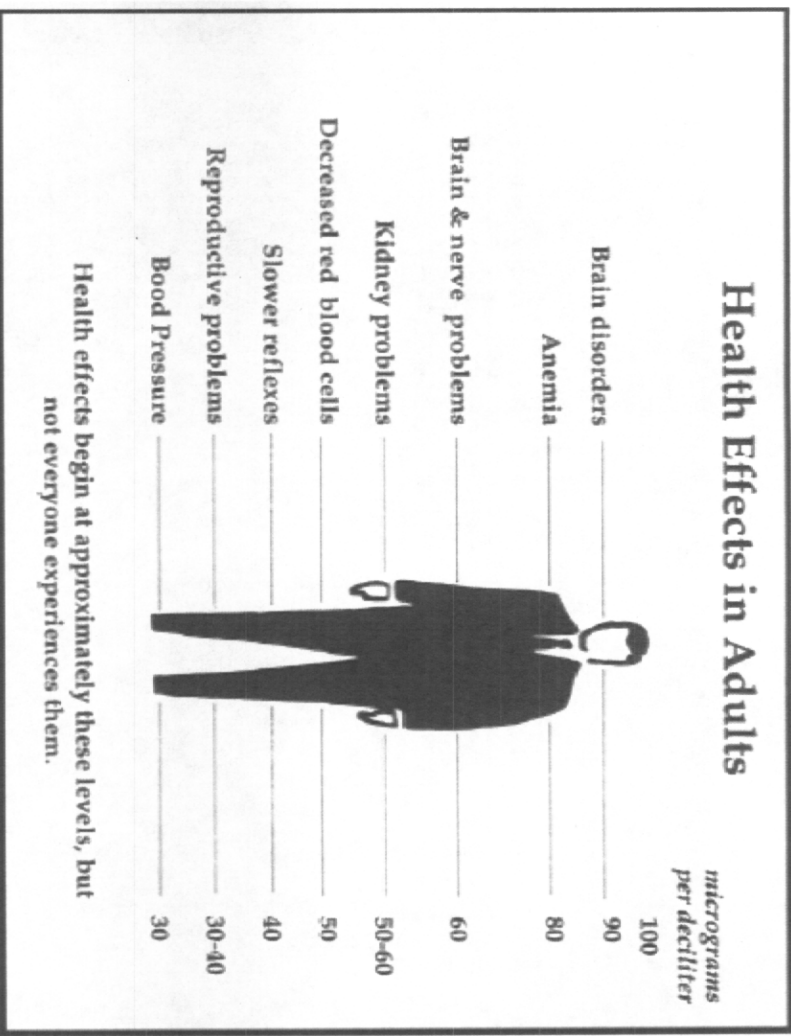
Mary Dozois, CIH

Massachusetts Consultation Program
Division of Occupational Safety
1001 Watertown Street
West Newton, MA 02465
phone (617) 969-7177 x301
fax (617) 727-4581

From the Texas Department of Health:

Airborne lead dust is created by:

-  Exploding lead styphnate primers
-  Friction from the lead slug against the gun barrel
-  Lead slugs hitting the bullet trap, walls, floors, or ceiling of the range
-  Spent bullets and settled dust
-  Improper range-cleaning methods disturbing settled dust
-  Poor indoor range ventilation
-  Outdoor weather conditions



Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
Mary Dozois, CIH Massachusetts Consultation Program Division of Occupational Safety	11	General Comment Ammunition Substitution	Picture diagram of sources of Lead in a bullet to include bullet and primer. Many firing range operators refuse to recognize lead in primer. In addition, some "Lead-free" bullets can still contain Lead primer.	The reviewer is requesting the addition of several figures and diagrams to the Alert document. We believe the level of pictures and diagrams are adequate for such a document and believe that adding more diagrams and

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
<p>1001 Watertown Street West Newton, MA 02465 phone (617) 969-7177 x301 fax (617) 727-4581</p> <p>Email: Mary.Dozois@state.ma.us</p>			<p>Highlight your fact on page 11 that jacketed and non-lead bullets can reduce lead emissions by 80%. See attached "sources of Lead dust" from the Texas Department of Health.</p>	<p>figures will clutter the Alert with unwanted material and dilute the intended purpose. We have, however, decided to add one additional figure to illustrate noise levels as suggested below.</p> <p>We have to adhere to a specific format in the Alert and highlighting statements is not such an option.</p>
			<p>Picture diagram of location of Lead Dust contamination in the building. Floor, counters, coffee maker, duct.</p>	<p>Not necessary, see above comment.</p>
			<p>Picture diagram of a good ventilation system.</p>	<p>Not necessary, see above comment.</p>
			<p>Picture diagram of Lead poisoning. Include the sperm, this always gets them to listen.</p>	<p>Not necessary, see above comment.</p>
			<p>Sideline chart of HUD wipe sample clearance standards.</p>	<p>Not necessary, see above comment.</p>
			<p>Sideline chart of expected Noise levels in a firing range, for each type of gun. Show how they are all above the reference number of 85 dB and 140 dB.</p>	<p>Added a chart of noise levels encountered from various weapons on page 16 in the Noise section.</p>
			<p>Tell me about the backstop and maintenance. The NSSF guide says</p>	<p>We discuss the bullet trap/backstop maintenance issues</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>that poor maintenance has caused most of their poisonings that they have evaluated.</p>	<p>on page 8, Case #3; page 12 under Ammunition Substitution; page 14 under Exhaust Ventilation; and page 18 under Personal Protective Equipment.</p>

Reviewer 15

National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention
Docket Office
VIA Fax: 513-533-8285
and Email: nioshdocket@cdc.gov

SUBJECT: Comments to NIOSH Docket Number 128

To Whom It May Concern:

Thank you for the opportunity to comment on the draft NIOSH Alert- "Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges"—NIOSH docket number 128.

The National Association of Shooting Ranges (NASR), is dedicated to promoting and protecting shooting facilities by providing leadership through science-based information and partnerships.

According to the American Sports Data Superstudy, nearly 20,000,000 Americans participate in target shooting every year and target shooting is one of the fastest growing sports in the country. Shooting ranges are critically important to providing a safe venue of participation for these enthusiasts, and a place where all Americans can learn and practice the safe handling of firearms. The result of more people, shooting more often, is fewer accidents. The number of firearm-related accidents and accidental fatalities has been steadily declining for the last 25 years—down to 600 accidental fatalities in 2006. While we still have work to do, it is important to note that this is the lowest number of accidental fatalities since the National Safety Council began keeping records in 1903. Firing ranges have played a critical role in this success.

Our focus is on firearm safety. This includes all aspects of safety—including the health of range operators, employees, shooting sports enthusiasts and their families. We are proud of the partnership we formed with the Occupational Safety and Health Administration (OSHA). The focus of this alliance is to provide guidance on the proper management of airborne lead at indoor ranges. We have worked closely with OSHA, the National Institute for Occupational Safety and Health (NIOSH), and the Sporting Arms and Ammunition Manufacturers' Institute (SAAAMI) to create a guidance document entitled "Airborne Lead Management and

NIOSH Alert: Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges, NIOSH Docket Number NIOSH-128.
<http://www.cdc.gov/niosh/review/public/128/> Comments due June 30, 2008

OSHA Compliance for Indoor Shooting Ranges.” We are actively educating range operators, regulators and industrial hygienists through seminars co-sponsored with OSHA.

NASR welcomes another document that focuses on science-based management practices. In general, the draft NIOSH Alert provides good general information, but we do have a number of comments and technical corrections. Attached is a word document that identifies the specific wording from the draft, our proposed changes, and an explanation of why we recommend the change.

I look forward to any opportunity to continue our dialogue as we work together to promote safety.

Please don't hesitate to call with any questions or comments.

Regards,

R. Richard Patterson
Executive Director
National Association of Shooting Ranges
11 Mile Hill Road
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Phone: 203-426-1320

Fax: 203-426-1087

www.rangeinfo.org

www.wheretoshoot.org

Review and Comments on NIOSH Docket Number 128 “Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges”

**Submitted by the National Association of Shooting Ranges (NASR)
11 Mile Hill Road, Newtown, CT 067470**

Page numbers do not exist on the first six pages (including the cover page). For simplicity, we will refer to these using lower-case roman numerals with the cover being "page i."

Page iii.

"2. Protect yourself." Second bullet point.

Delete "lead clean-up" replace with "range maintenance."

Reason: Any range maintenance could potentially increase lead exposure, not just cleaning.

Page v.

"2. Provide (delete "workers and shooters," replace with "employees") with personal protective equipment and other protective equipment.

Reason: The NIOSH Alert addresses *Occupational* exposures. Recreational shooters are beyond the scope of this Alert. Furthermore, it is unreasonable to expect commercial ranges to provide eye and ear protection to all their customers. We do suggest they require use of eye and ear protection on the range and offer this protective equipment for sale or rent.

Second bullet point.

Delete "and NIOSH approved respirators."

Reason: There is no evidence that cleaning supplies pose a risk. This puts the range operator in a position of having to create a time-consuming and costly respirator program where it may not be needed.

Third bullet point.

Delete.

Reason: While this may be a good idea under some circumstances—particularly if the range hasn't been cleaned in awhile and dust has had a chance to accumulate—it is not a one-size-fits-all solution and should not be given such a blanket recommendation.

Fourth bullet point.

Delete.

Reason: Establishes a practice that is both a) beyond the scope of regulations (unless the facility exceeds the PEL), and b) that most ranges do not have the physical capability of providing.

Page 1.

Paragraphs 1 and 4.

Delete "17 million" and replace with "20 million"

Reason: The sport is seeing significant growth and more people are participating.

Page 2

Paragraph 1.

Delete "Most are small operations and are often family run. Many are operated without the benefit of sufficient environmental and occupational health controls in place to effectively protect the health of shooters and firing range personnel from the adverse exposure to lead, noise and other contaminants."

Reason: There is no justification for such a broad and sweeping generalization.

Paragraph 1.

"The hazards from exposure to lead (both airborne and skin), noise, and other..." Delete "skin" and replace with "ingested."

Reason: dermal absorption is not a risk at firing ranges. Accidental and incidental ingestion may be a risk. This change further clarifies the potential risks and gives a clearer focus on the issues of concern.

Page 3.

Last paragraph

"In addition to inhalation exposures...discharge can be (insert "ingested after being") transferred to people's skin, especially the hands..."

Reason: Again, this is a clarification of the risk of ingestion.

Page 4

Paragraph 1.

“...presence of lead contamination and lead (delete “in gunshot,” replace with “from”) residues (delete “from,” insert “emitted during”) firearms usage.”

Reason: Clearer wording.

Paragraph 5.

Delete the two sentences “The U.S. Department of Housing and Urban Development...for window troughs and exterior concrete or other rough surfaces [HUD 1995].”

Reason: These are for residential exposure to organo-lead compounds in residences. Firing ranges are primarily a metallic (elemental) form of lead in a completely different exposure pathway model. While it's probably great information for old houses, it does not apply to commercial and industrial scenarios such as firing ranges.

Page 5.

Paragraph 4.

Delete the entire paragraph entitled “Department of Housing and Human Services”

Reason: This is irrelevant and conflicts with existing regulations. Certainly there are organizations that propose lower thresholds for lead (and other chemicals). There are also organizations that suggest some thresholds are already too low. This should be part of a science-based national dialogue that includes academia, stakeholders and government agencies, not part of a NIOSH Alert presented to the public on how to prevent lead exposures on firing ranges.

Page 6.

Paragraph 2.

Delete the entire paragraph “Association of Occupational and Environmental Clinics.”

Reason: Again, this is conflicting with existing regulations and therefore irrelevant.

Paragraph 4. Last sentence.

“Airborne lead concentrations were reduced substantially...by using (delete “alternative”) ammunition (delete “such as,” and replace with “that had”) nylon-coated and copper-jacketed bullets.”

Reason: Lead ammunition with some sort of protective jacket has been used for centuries (cloth and paper gave way to copper as velocities increased)and is not considered “alternative ammunition.”

Page 8.

Paragraph 1. Last sentence.

Delete “ammunition substitution”

Reason: Using lead-free ammunition in addition to the other lead management practices is redundant and overly burdensome to the firing range.

Paragraph 3.

“Results of carpet dust sampling collected...higher lead concentrations found in students’ rooms...The presence of lead in carpet samples suggests that...from the firing range.”

Suggest deletion of this section of the case studies.

Reason: There are many sources of lead and unless there was a complete evaluation, suggesting it came from the range could be a false assumption. Just as an example, how old was the facility? Did it contain lead-based paint? Did the property and training grounds have a former use that included deposition of lead compounds? etc. Unless this was thoroughly evaluated, the conclusion that it must have come from the range is invalid.

Page 9.

Paragraph 2.

Delete “ammunition substitution.”

Reason: See comment for Page 8, Paragraph 1 about the redundancy of using lead free ammunition AND adopting lead management practices.

Page 10.

Paragraph 1.

Just a question/comment on placement of the microphone. Where was the microphone located when the testing was done? The sound energy wave from firing activities is directional. The measurements are only valid if taken at the ear of firing range employees.

Paragraph 3.

“...increased risk for inhalation and (delete “skin,” and replace with “ingestion”) lead exposure hazards...” also later in the paragraph
“...identifying (delete “skin,” replace with “ingestions”) exposures.

Reason: Clarifies the potential exposure risks. See earlier comments.

Paragraph 4.

These points need to be highlighted, put in bold letters, and should really be emphasized in the introduction. This is the heart of what should be done to prevent lead exposures at indoor firing ranges.

Paragraph 5.

“...by using proper sound measuring instruments (insert “and microphone location”) and the importance of...”

Reason: See comments for Page 10, Paragraph 1.

Page 11.

Paragraph 6.

Add the following sentence: “Further, mixing spent lead bullets with metals from non-lead alternatives may render the material unfit for recycling and therefore require costly and otherwise unnecessary disposal of the spent ammunition as a hazardous waste.”

Page 12.

Paragraph 1.

“...while some jacketed bullets present no airborne lead hazard (delete “the US EPA still considers lead from expended bullets to be toxic,” replace with “at the firing line, impact with the bullet trap may generate lead dust at the trap. This lead dust may present a source of lead exposure”) to people conducting range maintenance...” Also, delete the “[EPA 2005]” reference at the end of the sentence.

Reason: Clarifies the message, and eliminates a mis-quote of the 2005 EPA document.

First bullet point.

The first sentence is exactly reversed. It should read: “Use jacketed lead bullets (as opposed to dip-coated copper plating) to minimize...”

Reason: Jackets are the thicker material.

Page 13.

Paragraph 1.

Delete “...where the projectile has a fluted copper jacket combined with a cast zinc alloy core.”

Reason: Most frangible ammunition is a sintered material. It's likely that any bullet with a jacket would not qualify as “frangible” because the jacket would constitute a single mass of metal that would be less likely to fragment on impact.

First bullet point.

“...operators who depend on using (delete “ammunition,” replace with “lead”) substitutes...”

Reason: Clarifying the message. It's not substituting the ammunition, it's substituting the material used to make the ammunition.

“...ensure that (add “firing ranges and”) firearms previously used with lead ammunition are (add “appropriately”) cleaned (delete “thoroughly,” replace with “and evaluated”) before being used with the new type of ammunition.

Reason: Mixing different metals may create recycling problems, so an appropriate cleaning prior to implementation is advisable. Also, the equipment must be evaluated to ensure safety and compatibility with the new type of ammunition.

Second bullet point.

Delete

Reason: Proper and thorough training requires live ammunition. We are asking men and women in uniform to step into harms way. We have a responsibility not to cut corners in their training for the sake of convenience.

Paragraph 6 (First bullet point under "Lead")

Delete "This is called parallel air flow."

Reason: Wordsmithing. The way it's worded, it sounds like reverse airflow back to the firing line is called 'parallel air flow,' which is not correct.

Paragraph 7 (Second bullet point under "Lead")

(delete "A minimum distance of 15 feet is needed from the wall to the firing line. Some experts consider diffusers to be least desirable since they produce jets of air that can produce" replace with "Diffusers that produce jets of air can create") turbulence at the firing line.

Reason: Different diffuser systems have different distance requirements. The distance is dependant on many variables and is specific to the building and the system. In general, the more directed the air (ie: "jets of air") are more likely to create turbulence unless there is an appropriate distance between the diffuser and the firing line.

Page 15

Paragraph 5 (second bullet point under "Filter System Maintenance Recommendations:")

"Loaded filters will (insert "likely") contain lead (delete "contain gun powder, making the waste toxic and potentially explosive. Dirty," replace with "in sufficient quantity to classify the used filter as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). A Toxicity Characteristics Leaching Procedure (TCLP) test will determine whether the filter is a regulated hazardous waste under the RCRA regulation. If the filter does not meet the criteria of a hazardous waste, it can be disposed of as normal solid waste. However, if the filter does have sufficient lead to be considered a hazardous waste there are two options: first is to recycled or reuse the filter, in which case it is NOT considered a waste (RCRA recycling exemption 40 CFR 261.4(a)(13)) and there are no hazardous waste handling procedures required. If the filter is not recycled, and it fails the TCLP, then it must be disposed of properly and according to Federal, State and local regulations."

Reason: filters are not shown to contain gun powder, and even if they did, gun powder is NOT an explosive. Refer to the Sporting Arms and Ammunition Manufacturers' Institute, Inc. (SAAMI) DVD "Sporting Ammunition and the Firefighter" for more information. Also, the proposed new text accurately reports on the RCRA recycling exemption.

Page 16

Second bullet point (towards the end)

"Observation room windows should be (insert "located behind the firing line and") designed to (delete "withstand bullet impacts and to") maximize sound reduction. The glass should be laminated (delete "and certified as bullet impact resistant"). If double panes of glass (delete "can be," replace with "are") used, then the glass that is in the firing range should be (delete "bullet impact resistant and") of a different thickness than the interior pane to increase noise reduction."

Reason: The bullets go the other direction and a requirement for bullet proof glass behind the firing line is excessive.

Page 17.

First bullet point under "Preventing the potential for lead exposure..."

Delete "or adjacent areas."

Reason: redundant and unduly restrictive.

Second bullet point

Is there justification for a lead exposure from handling spent cases? If not, delete.

Third bullet point

Same question as second bullet point.

Page 18

Paragraph 2 (First bullet point)

(delete "Shooters and") workers should shower, whenever possible, and change clothes at firing range facilities after (delete "shooting or") performing maintenance or cleaning activities at the range."

Reason: Refer to previous comments about the scope of the issue and this Alert not including the shooting sports participant.

Paragraph 6

“...limiting the length of time (delete “shooters,” replace with “employees are on”) the firing range...”

Reason: Administrative controls are only relevant to employees.

Paragraph 8 (First bullet point under “Personal Protective Equipment”)

“For (delete “shooters,” replace with employees”) requiring improved communication...”

Reason: Refer to previous comments on the scope.

Paragraph 2

“...protective outer clothing (which may be disposable). (Insert “If respirators are part of the lead management plan,”) firing range operators must develop...”

Reason: There is no requirement for the use of respirators unless the air level exceeds the PEL.

Page 19

Last paragraph (First bullet point under “Exposure Monitoring)

“...linking results to worker records (insert “while complying with HPPA”) should be clearly outlined.”

Reason: HPPA creates strict rules that must be followed—and severe penalties for mishandling confidentiality of healthcare records.

Page 20

Second column (First bullet point under “Worker Health Monitoring”)

“The OSAH general industry lead standard contains provisions for the medical monitoring of workers exposed to lead (29 CFR 1910.1025 (d)). NIOSH supports using these provisions for firing range workers (delete the rest of the bullet point unless it summarizes the OSHA general lead standard as it applies to firing ranges).”

Reason: Again, this discussion may be worthwhile, but this is not the place. The guidance must be consistent with the current regulations.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
<p>R. Richard Patterson Executive Director National Association of Shooting Ranges 11 Mile Hill Road Newtown, CT 06470-2359 Phone: 203-426-1320 Fax: 203-426-1087 Email: rpatterson@nssf.org</p>	iii	<p>"2. Protect yourself."</p>	<p>Second bullet point. Delete "lead clean-up" replace with "range maintenance." Reason: Any range maintenance could potentially increase lead exposure, not just cleaning.</p>	<p>Replaced as suggested.</p>
	v	<p>"2. Provide (delete "workers and shooters," replace with "employees") with personal protective equipment and other protective equipment.</p>	<p>"2. Provide (delete "workers and shooters," replace with "employees") with personal protective equipment and other protective equipment. Reason: The NIOSH Alert addresses <i>Occupational</i> exposures. Recreational shooters are beyond the scope of this Alert. Furthermore, it is unreasonable to expect commercial ranges to provide eye and ear protection to all their customers. We do suggest they require use of eye</p>	<p>This Alert is not aimed at recreational shooters or commercial firing ranges. The word "shooters" is used to address occupational users of the firing range, whether they are employed by the range or simply use the range for practice. No changes made.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			and ear protection on the range and offer this protective equipment for sale or rent.	
	v	2. Provide "employees" with personal	<p>Second bullet point. Delete "and NIOSH approved respirators."</p> <p>Reason: There is no evidence that cleaning supplies pose a risk. This puts the range operator in a position of having to create a time-consuming and costly respirator program where it may not be needed.</p>	<p>This bullet is intended to address hazards to those involved in cleaning lead, and we agree that respirators might not be needed to clean weapons, so we removed the last part of that sentence. NIOSH-approved respirators are needed for anyone involved in cleaning lead-contaminated areas. We have rewritten that bullet to read:</p> <p>"Provide skin protection, eye protection, and NIOSH-approved respirators for workers involved in cleaning lead-contaminated surfaces and areas."</p>
	v	2. Provide "employees" with personal	<p>Third bullet point. Delete.</p> <p>Reason: While this may be a good idea under some circumstances—particularly if the range hasn't been cleaned in awhile and dust has had a chance to accumulate—it is not a one-size-fits-all solution and should not be given such a blanket recommendation.</p>	<p>We added the words "when necessary" to the bullet instead of deleting it completely.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	v	2. Provide "employees" with personal	<p>Fourth bullet point. Delete.</p> <p>Reason: Establishes a practice that is both a) beyond the scope of regulations (unless the facility exceeds the PEL), and b) that most ranges do not have the physical capability of providing.</p>	<p>The Alert is meant to be a guidance document and has no bearing on regulations. The major stakeholders of this document are the law enforcement agencies who should have certain capabilities to provide their employees with lockers and cleaning facilities. However, we decided to add the words "If feasible" to the beginning of the bullet.</p> <p>Replaced as suggested.</p>
	1	Paragraphs 1 and 4.	<p>Delete "17 million" and replace with "20 million"</p> <p>Reason: The sport is seeing significant growth and more people are participating.</p>	<p>We deleted "Most are small operations and are often family run." We replaced the word "Many" with "Some" as we have encountered on several of our health hazard evaluations.</p>
	2	Background, Paragraph 1	<p>Page 2 Paragraph 1. Delete "Most are small operations and are often family run. Many are operated without the benefit of sufficient environmental and occupational health controls in place to effectively protect the health of shooters and firing range personnel from the adverse exposure to lead, noise and other contaminants."</p> <p>Reason: There is no justification for</p>	<p>We deleted "Most are small operations and are often family run." We replaced the word "Many" with "Some" as we have encountered on several of our health hazard evaluations.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	2	Background, Paragraph 1	such a broad and sweeping generalization. "The hazards from exposure to lead (both airborne and skin), noise, and other..." Delete "skin" and replace with "ingested." Reason: dermal absorption is not a risk at firing ranges. Accidental and incidental ingestion may be a risk. This change further clarifies the potential risks and gives a clearer focus on the issues of concern.	Lead can in fact penetrate the skin and our research shows chronic elevation in BLL as a result. No changes made.
	3	NIOSH Recommendations 2 nd Paragraph	"In addition to inhalation exposures...discharge can be (insert "ingested after being") transferred to people's skin, especially the hands..." Reason: Again, this is a clarification of the risk of ingestion.	Lead can be ingested or absorbed by the skin, no changes made.
	4	NIOSH Recommendations, 1 st Paragraph	"...presence of lead contamination and lead (delete "in gunshot," replace with "from") residues (delete "from," insert "emitted during") firearms usage." Reason: Clearer wording.	Replaced as suggested.
	4	U.S. Government Agencies, 5 th Paragraph	Delete the two sentences "The U.S. Department of Housing and Urban Development...for window troughs	Deleted as suggested.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>and exterior concrete or other rough surfaces [HUD 1995].”</p> <p>Reason: These are for residential exposure to organo-lead compounds in residences. Firing ranges are primarily a metallic (elemental) form of lead in a completely different exposure pathway model. While it's probably great information for old houses, it does not apply to commercial and industrial scenarios such as firing ranges.</p>	
	5	Department of Health and Human Services	<p>Delete the entire paragraph entitled “Department of Housing and Human Services”</p> <p>Reason: This is irrelevant and conflicts with existing regulations. Certainly there are organizations that propose lower thresholds for lead (and other chemicals). There are also organizations that suggest some thresholds are already too low. This should be part of a science-based national dialogue that includes academia, stakeholders and government agencies, not part of a NIOSH Alert presented to the public on how to prevent lead exposures on firing ranges.</p>	<p>We believe it's important to highlight the various governmental standards and guidance documents. No changes made to that paragraph.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	6	Association of Occupational and Environmental Clinics	<p>Delete the entire paragraph "Association of Occupational and Environmental Clinics."</p> <p>Reason: Again, this is conflicting with existing regulations and therefore irrelevant.</p>	<p>The AOEC recommendations are important and pertinent. This Alert serves a guidance document and has no bearing on existing regulations. No changes made to that paragraph.</p>
	6	Case Reports, Case 1	<p>Last sentence. "Airborne lead concentrations were reduced substantially...by using (delete "alternative") ammunition (delete "such as," and replace with "that had") nylon-coated and copper-jacketed bullets."</p> <p>Reason: Lead ammunition with some sort of protective jacket has been used for centuries (cloth and paper gave way to copper as velocities increased) and is not considered "alternative ammunition."</p>	<p>Replaced as suggested.</p>
	8	Case Reports, Case 3	<p>Last sentence. Delete "ammunition substitution"</p> <p>Reason: Using lead-free ammunition in addition to the other lead management practices is redundant and overly burdensome to the firing range.</p>	<p>We Agree, however, those recommendations were provided by NIOSH as general guidelines and typically are not all implemented, so it's important to give a recommendation for ammunition substitution if changes to the ventilation system were less than ideal, for example.</p>
	8	Case Reports,	"Results of carpet dust sampling	Those were the conclusions of the

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	9	Case 4	<p>collected...higher lead concentrations found in students' rooms...The presence of lead in carpet samples suggests that....from the firing range." Suggest deletion of this section of the case studies.</p> <p>Reason: There are many sources of lead and unless there was a complete evaluation, suggesting it came from the range could be a false assumption. Just as an example, how old was the facility? Did it contain lead-based paint? Did the property and training grounds have a former use that included deposition of lead compounds? etc. Unless this was thoroughly evaluated, the conclusion that it must have come from the range is invalid.</p>	<p>HHE, and the rooms were investigated thoroughly for other sources of lead according to one of the authors of this report.</p>
	9	Case Reports, Case 4	<p>Delete "ammunition substitution." Reason: See comment for Page 8, Paragraph 1 about the redundancy of using lead free ammunition AND adopting lead management practices.</p>	<p>We Agree again, but those were the recommendations provided by NIOSH. NIOSH provides a range of recommendations fully anticipating that not all can or will be implemented.</p>
	10	Case Reports, Case 5	<p>Paragraph 1. Just a question/comment on placement of the microphone. Where was the microphone located</p>	<p>The microphones used were omni-directional and measurement were either made at the ear of shooters (for personal</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	10	Conclusions	<p>when the testing was done? The sound energy wave from firing activities is directional. The measurements are only valid if taken at the ear of firing range employees.</p> <p>Paragraph 3. "...increased risk for inhalation and (delete "skin," and replace with "ingestion") lead exposure hazards..." also later in the paragraph "...identifying (delete "skin," replace with "ingestions") exposures.</p> <p>Reason: Clarifies the potential exposure risks. See earlier comments.</p>	<p>exposures) or on a tripod placed at the level of the ear of a shooter between lanes (for area exposures and hearing protection evaluations).</p> <p>Again, lead can be absorbed by the skin, not just inhaled or ingested. No changes made.</p>
	10	Conclusions	<p>Paragraph 4. These points need to be highlighted, put in bold letters, and should really be emphasized in the introduction. This is the heart of what should be done to prevent lead exposures at indoor firing ranges.</p> <p>Paragraph 5. "...by using proper sound measuring instruments (insert "and microphone location") and the importance of..."</p> <p>Reason: See comments for Page 10, Paragraph 1.</p>	<p>We must follow a specific format in the Alert and highlighting or bolding sentences are not an option. We do emphasize these options in the introduction.</p> <p>We added the words "and techniques" instead since microphones location and selection are part of the techniques used to make proper measurements.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	11	Ammunition Substitution	<p>Add the following sentence: ‘Further, mixing spent lead bullets with metals from non-lead alternatives may render the material unfit for recycling and therefore require costly and otherwise unnecessary disposal of the spent ammunition as a hazardous waste.’</p> <p>Paragraph 1. “... while some jacketed bullets present no airborne lead hazard (delete “the US EPA still considers lead from expended bullets to be toxic;” replace with “at the firing line, impact with the bullet trap may generate lead dust at the trap. This lead dust may present a source of lead exposure”) to people conducting range maintenance...” Also, delete the “[EPA 2005]” reference at the end of the sentence.</p> <p>Reason: Clarifies the message, and eliminates a mis-quote of the 2005 EPA document.</p>	<p>Added as suggested.</p>
	12	Ammunition Substitution	<p>First bullet point. The first sentence is exactly reversed. It should read: “Use jacketed lead bullets (as opposed to dip-coated copper plating) to minimize...”</p>	<p>Modified as suggested.</p>
	12	Ammunition Substitution	<p>Reason: Clarifies the message, and eliminates a mis-quote of the 2005 EPA document.</p>	<p>Replaced as suggested.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	13	Ammunition Substitution	Reason: Jackets are the thicker material. Paragraph 1. Delete "...where the projectile has a fluted copper jacket combined with a cast zinc alloy core."	Deleted as suggested.
	13	Ammunition Substitution	Reason: Most frangible ammunition is a sintered material. It's likely that any bullet with a jacket would not qualify as "frangible" because the jacket would constitute a single mass of metal that would be less likely to fragment on impact. First bullet point. "...operators who depend on using (delete "ammunition," replace with "lead") substitutes..." Reason: Clarifying the message. It's not substituting the ammunition, it's substituting the material used to make the ammunition.	Replaced as suggested.
			"...ensure that (add "firing ranges and") firearms previously used with lead ammunition are (add "appropriately") cleaned (delete "thoroughly," replace with "and evaluated") before being used with the new type of ammunition.	Replaced as suggested.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	13	Ammunition Substitution	<p>Reason: Mixing different metals may create recycling problems, so an appropriate cleaning prior to implementation is advisable. Also, the equipment must be evaluated to ensure safety and compatibility with the new type of ammunition.</p> <p>Second bullet point. Delete</p> <p>Reason: Proper and thorough training requires live ammunition. We are asking men and women in uniform to step into harms way. We have a responsibility not to cut corners in their training for the sake of convenience.</p>	<p>This is a suggestion by one of our other reviewers in law enforcement. They have used such systems in their operations. This is just an option, not necessarily a replacement. No deletion made.</p>
	13	Engineering Controls, Lead	<p>Paragraph 6 (First bullet point under "Lead") Delete "This is called parallel air flow."</p> <p>Reason: Wordsmithing. The way it's worded, it sounds like reverse airflow back to the firing line is called 'parallel air flow,' which is not correct.</p>	<p>Deleted as suggested.</p>
	13	Engineering Controls, Lead	<p>Paragraph 7 (Second bullet point under "Lead") (delete "A minimum distance of 15</p>	<p>Deleted as suggested. This is in agreement with Reviewer #2.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	15	Filter System Maintenance Recommendations	<p>feet is needed from the wall to the firing line. Some experts consider diffusers to be least desirable since they produce jets of air that can produce" replace with "Diffusers that produce jets of air can create") turbulence at the firing line.</p> <p>Reason: Different diffuser systems have different distance requirements. The distance is dependant on many variables and is specific to the building and the system. In general, the more directed the air (ie: "jets of air") are more likely to create turbulence unless there is an appropriate distance between the diffuser and the firing line.</p>	<p>Added as suggested.</p>
			<p>Paragraph 5 (second bullet point under "Filter System Maintenance Recommendations:") "Loaded filters will (insert "likely") contain lead (delete "contain gun powder, making the waste toxic and potentially explosive. Dirty;" replace with "in sufficient quantity to classify the used filter as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). A Toxicity Characteristics Leaching Procedure (TCLP) test will</p>	

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>determine whether the filter is a regulated hazardous waste under the RCRA regulation. If the filter does not meet the criteria of a hazardous waste, it can be disposed of as normal solid waste. However, if the filter does have sufficient lead to be considered a hazardous waste there are two options: first is to recycled or reuse the filter, in which case it is NOT considered a waste (RCRA recycling exemption 40 CFR 261.4(a)(13)) and there are no hazardous waste handling procedures required. If the filter is not recycled, and it fails the TCLP, then it must be disposed of properly and according to Federal, State and local regulations.”</p> <p>Reason: filters are not shown to contain gun powder, and even if they did, gun powder is NOT an explosive. Refer to the Sporting Arms and Ammunition Manufacturers' Institute, Inc. (SAAMI) DVD “Sporting Ammunition and the Firefighter” for more information. Also, the proposed new text accurately reports on the RCRA recycling exemption.</p>	

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	16	Engineering Controls, Noise	<p>Second bullet point (towards the end) "Observation room windows should be (insert "located behind the firing line and") designed to (delete "withstand bullet impacts and to") maximize sound reduction. The glass should be laminated (delete "and certified as bullet impact resistant"). If double panes of glass (delete "can be," replace with "are") used, then the glass that is in the firing range should be (delete "bullet impact resistant and") of a different thickness than the interior pane to increase noise reduction."</p> <p>Reason: The bullets go the other direction and a requirement for bullet proof glass behind the firing line is excessive.</p>	<p>This is an important requirement for some law enforcement agencies. No changes made except to replace "can be" to "are"</p>
	17	Work practice and administrative controls, Preventing the potential for lead exposure by ingestion and by avoidance of skin contamination...	<p>First bullet point under "Preventing the potential for lead exposure..." Delete "or adjacent areas."</p> <p>Reason: redundant and unduly restrictive.</p> <p>Second bullet point Is there justification for a lead exposure from handling spent cases? If not, delete.</p>	<p>Delete as suggested.</p> <p>Lead residues on the spent cases.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			<p>Third bullet point Same question as second bullet point.</p>	<p>Lead residues on the spent cases.</p>
	18	<p>Work practice and administrative controls, Preventing take-home lead exposure</p>	<p>Paragraph 2 (First bullet point) (delete "Shooters and") workers should shower, whenever possible, and change clothes at firing range facilities after (delete "shooting or") performing maintenance or cleaning activities at the range." Reason: Refer to previous comments about the scope of the issue and this Alert not including the shooting sports participant.</p>	<p>The shooters here are specifically meant to include those law enforcement officers that are not necessarily "workers" or "employees" of the range. No changes made.</p>
	18	<p>Work practice and administrative controls</p>	<p>Paragraph 6 "... limiting the length of time (delete "shooters," replace with "employees are on") the firing range..." Reason: Administrative controls are only relevant to employees.</p>	<p>We added the words "and employees" to emphasize that this recommendation should cover everyone who uses the firing range occupationally.</p>
	18	<p>Personal Protective Equipment</p>	<p>(First bullet point under "Personal Protective Equipment") "For (delete "shooters," replace with employees") requiring improved communication..." Reason: Refer to previous comments on the scope.</p>	<p>This is specific requirement of some law enforcement shooters who are not necessarily employees of the firing range. No changes made.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Author's Response
	18	Personal Protective Equipment	<p>“...protective outer clothing (which may be disposable). (Insert “If respirators are part of the lead management plan,”) firing range operators must develop...”</p> <p>Reason: There is no requirement for the use of respirators unless the air level exceeds the PEL.</p>	<p>Inserted as requested.</p>
	19	Employer and worker education, Exposure monitoring	<p>Last paragraph (First bullet point under “Exposure Monitoring”) “...linking results to worker records (insert “while complying with HPPA”) should be clearly outlined.”</p> <p>Reason: HPPA creates strict rules that must be followed—and severe penalties for mishandling confidentiality of healthcare records.</p>	<p>Worker records here is not implying their medical records, but working records since we are discussing exposure monitoring.</p>
	20	Employer and worker education, Worker health monitoring	<p>Second column (First bullet point under “Worker Health Monitoring”) “The OSAH general industry lead standard contains provisions for the medical monitoring of workers exposed to lead (29 CFR 1910.1025 (d)). NIOSH supports using these provisions for firing range workers (delete the rest of the bullet point unless it summarizes the OSHA general lead standard as it applies to firing ranges).”</p>	<p>The AOEC is a significant recommendation that has been requested by several other reviewers. This is a NIOSH guidance document and has no bearing on current regulations.</p>

NIOSH Alert: Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges, NIOSH Docket Number NIOSH-128.
<http://www.cdc.gov/niosh/review/public/128/> Comments due June 30, 2008

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
			Reason: Again, this discussion may be worthwhile, but this is not the place. The guidance must be consistent with the current regulations.	

Reviewer 16

June 30, 2008

NIOSH Docket Office
Robert A. Taft Laboratories
4676 Columbia Parkway, Mailstop C-34
Cincinnati, Ohio 45226

NIOSH Docket Number 128

SUBJECT: Comments on the Draft Document: "Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges"

To Whom It May Concern:

Thank you for the opportunity to comment. The Occupational Lead Poisoning Prevention Program (OLPPP) of the California Department of Public Health is submitting the following comments on the draft document entitled "Preventing Occupational Exposures to Lead and Noise at Indoor Firing Ranges," prepared by the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention (CDC).

This education and outreach document contains important information about health and safety issues related to owning, operating, working at, and patronizing both indoor and outdoor firing ranges. In April 2006, OLPPP staff submitted comments on an earlier draft of this document and we are pleased to see that many of our comments have been incorporated into this latest draft. Our comments on this latest draft are organized into: A) general comments and B) specific comments on the text of the document. If you have any question about our comments, please contact Michael J. DiBartolomeis, PhD, DABT, Chief, OLPPP, at (510) 620-5757 or mdibarto@cdph.ca.gov.

A) General Comments

1. The draft document refers to the 2007 summary of recent scientific literature on exposures to and health effects of lead prepared by the Association of Occupational and Environmental Clinics (AOEC). In addition to this information, we highly recommend

that NIOSH also summarize the findings published by Kosnett M. et al., "Recommendations for Medical Management of Adult Lead Exposure," *Environmental Health Perspect.*, 115(3):463-471, 2007 (<http://www.ehponline.org/members/2006/9784/9784.html>). OLPPP prefers the EHP article because we believe its guidance is more health protective for some exposures and vulnerable populations. We provide some suggested language to add to the document in our specific comments below.

2. NIOSH should recommend switching to lead-free ammunition (bullet and primer) in the one-page recommendations to the employer/operator. At the very least, ranges should permit only fully jacketed ammunition to minimize lead exposures on the range. In our specific comments on the text, we suggest some added language for the recommendations for employers and firing range operators in the draft document.
3. The document would be improved by including a description of and providing information on newer designed backstops and traps. Some of the newer backstops (shredded rubber tires encased in a net) can help reduce lead bullet fragmentation, lower noise levels, and reduce hazardous waste clean-up for the workers. For example, "Super Trap" (http://www.supertap.com/ST_Products.htm) is one of the better known products available. OLPPP does not endorse any specific product; we only include this link for reference.

B) Specific Comments on the Text of the Document

In the following comments, OLPPP has copied portions of text from the original draft document and suggested changes to the text. Additions are shown as underlined text in red print and deletions are shown with a single strike through.

(The following excerpt is from the Worker 'one-pager' at the front of the NIOSH document.)

Workers should take the following steps to protect themselves from exposure to hazardous lead concentrations and noise levels at indoor firing ranges:

4. Know and report symptoms.

- Common symptoms of lead poisoning in adults include nausea, diarrhea, vomiting, poor appetite, weight loss, anemia, excess lethargy or hyperactivity, headaches, abdominal pain, and kidney problems.
- If you suspect you may have been exposed to lead, even if you have no symptoms, ask about having a blood lead level test done.
- Exposure to high levels of noise can lead to hearing loss, tinnitus (ringing in the ear), stress, anxiety, high blood pressure, gastro-intestinal problems, and chronic fatigue.
- Report any of these symptoms to your employer or range operator.

- Seek medical attention when appropriate.

(The following excerpts are from the Employer 'one-pager' at the front of the NIOSH document.)

Employers and firing range operators should take the following steps to protect their workers and shooters from exposure to hazardous lead concentrations and noise levels at indoor firing ranges:

1. Provide workers and shooters with information about hazards and appropriate training to prevent hazardous exposures.

- Provide general information and specific hazard warnings through workplace postings and targeted training programs.
- State the precautions and hygiene practices required of the firing range workers and shooters.
- Train workers and shooters on the actions and means available to eliminate or limit potential exposures.
- Inform workers and shooters about symptoms that may indicate a health problem. Also inform workers that elevated lead levels can occur without overt symptoms and that a blood lead level test should be done if there is concern about an exposure to lead.
- Inform workers and shooters that levels of lead once thought safe are now known to be harmful. Advise that blood lead levels be kept below 10 micrograms of lead per deciliter ($\mu\text{g}/\text{dL}$) of blood.
- Inform pregnant workers and shooters, or those considering pregnancy, about the possible adverse health effects to the fetus as well as the increased chance of miscarriage at blood lead levels $> 5 \mu\text{g}/\text{dL}$.

4. Provide workers with health and medical monitoring.

- Provide workers with initial and periodic medical monitoring as required by the OSHA lead standard (29 CFR 1910.25(d)).
- Best medical management practices, from organizations such as the Association of Occupational and Environmental Clinics or those provided in the journal *Environmental Health Perspectives* (March 2007)¹ should be considered recommended for all lead-exposed adults (workers and shooters).
- Provide workers with audiometric evaluations as required by OSHA noise standard (29 CFR 1910.95(d)(e)(g)(h)).

5. Allow only lead-free bullets and primers or fully jacketed ammunition with lead-free primers on the firing range.

1. Michael Kosnett, Richard Wedeen, Stephen Rothenberg, Karen Hipkins, Barbara Materna, Brian Schwartz, Howard Hu, Alan Woolf. Recommendations for Medical Management of Adult Lead Exposure. *Environmental Health Perspect*, 115(3):463-471, 2007. <http://www.ehponline.org/members/2006/9784/9784.html>

(The following excerpt is from page 1 of the NIOSH document.)

BACKGROUND

The Bureau of Justice Statistics estimates that 105,000 Federal law enforcement officers and more than 1 million State and local police officers are employed in the United States [DOJ 2004]. These officers are required to train regularly in the accurate and proficient use of firearms. Indoor firing ranges have gained wide appeal among law enforcement agencies because they offer protection from inclement weather conditions and can be operated around the clock under controlled environmental conditions. The National Shooting Sports Foundation estimates that there are 17 million active target shooters in the United States. Of those, 13.8 million are rifle shooters and 10.7 million participate in handgun target shooting [NSSF 2006]. NIOSH estimates that 16,000 to 18,000 firing ranges operate in the United States. Most are small operations and are often family-run. Many are operated without the benefit of sufficient environmental and occupational health controls in place to effectively protect the health of shooters and firing range personnel from the adverse effects of exposure to lead, noise, and other contaminants. The hazards from exposure to lead (both airborne, ingestion, and skin), noise, and other contaminants at indoor firing ranges have been widely investigated [Valway et al. 1989; Novotny et al. 1987; Price 1989]. Some of these investigations have documented elevated blood lead levels and hearing loss—particularly among employees and instructors.

During the last 2 decades, NIOSH has performed numerous Health Hazard Evaluations (HHEs) of indoor firing ranges and documented the hazards of exposure to lead and noise among firing range operators, workers, and shooters. In 1975, NIOSH published a technical document titled *Lead Exposure and Design Considerations for Indoor Firing Ranges* to provide recommendations for reducing or eliminating hazards associated with indoor firing ranges [NIOSH 1975]. This Alert highlights the issues inherent in operating such facilities and addresses advances in exposure assessment methods, control technologies, and new regulations and exposure guidelines.

(The following excerpt is from page 2 of the NIOSH document.)

CURRENT REGULATIONS, RECOMMENDATIONS, AND OTHER GUIDELINES

The primary sources of exposure standards and guidelines for the U.S. workplace are the Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs) (29 CFR* 1910) and the NIOSH recommended exposure limits (RELs) [NIOSH

1992a]. Most employers are mandated to follow the OSHA standards; however, employers are encouraged to follow the most protective criteria. This is especially true for the OSHA lead standards which are based on medical information on lead that was available in the 1970's.

OSHA Regulations

(Note: The OSHA lead standards are based on medical information that was available in the 1970's. While once thought to be protective, it is now known that the adverse health effects of lead occur at much lower levels. Current recommendations are that adult blood lead levels be kept below 10 $\mu\text{g}/\text{dL}$ and that pregnant women or women considering pregnancy not have a blood lead level above 5 $\mu\text{g}/\text{dL}$.)

The Federal OSHA General Industry Lead Standard (29 CFR 1910.1025) establishes specific airborne lead exposure levels for employees working in areas where airborne lead is present. Lead exposure is determined through air sampling that measures the concentration of lead in the air (the number of micrograms of lead present in a cubic meter of air). The standard creates two levels of exposure, the action level (AL) and the PEL. The action level for airborne lead exposure is 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of air as an 8-hour time-weighted average (TWA). If it is determined that airborne lead concentrations exceed the action level for more than 30 days per year, an employer must provide a medical surveillance program to the worker consisting of biological monitoring and medical examinations and consultations. Should a worker's average blood lead level (BLL) meet or exceed 50 micrograms of lead per deciliter ($\mu\text{g}/\text{dL}$) of blood, the employer is required to temporarily remove the worker from the work area. The OSHA standard does provide for economic protection for such medically removed workers. Medically removed workers cannot return to jobs involving lead exposure until their BLLs are below 40 $\mu\text{g}/\text{dL}$. Benefits must be provided during the period of temporary medical removal—i.e., the employee continues to receive the same earnings, seniority, and other rights and benefits he or she would have had if they had not been removed. The OSHA PEL for airborne exposure to lead is 50 $\mu\text{g}/\text{m}^3$ as an 8-hour TWA. The PEL is reduced for shifts greater than 8 hours using the formula:

maximum PEL in $\mu\text{g}/\text{m}^3 = 400 / \text{hours worked per day}$

If airborne lead levels exceed the PEL for more than 30 days per year, then an employer is required to implement additional monitoring and management activities.

Currently, 24 States and 2 territories administer and enforce their own occupational safety and health programs. A list of these "State Plan States" can be obtained by contacting the appropriate authority in the State where the firing range is operated or through the OSHA Web site at www.osha.gov. It is important to note that State Plans must be at least as protective as the Federal OSHA standards.

*Code of Federal Regulations. See CFR in references.

(The following excerpt is from page 3 of the NIOSH document.)

NIOSH Recommendations

The NIOSH REL for airborne lead is 50 $\mu\text{g}/\text{m}^3$ as an 8-hr TWA; airborne concentrations should be maintained so that a worker's BLL remains below 60 μg lead/100 g of whole blood [NIOSH 1992a].

In addition to inhalation exposures, lead from contaminated surfaces and from firearms discharge can be transferred to people's skin, especially the hands. Lead-contaminated hands can contribute to ingestion while handling food, beverages, and other items that contact the mouth. Skin exposures often result from hidden hazards that are not anticipated or recognized, and hence are inadequately controlled. Controlling lead-contaminated surfaces (and skin contamination) is highly dependent on anticipation and identification of lead contamination on surfaces; strict attention and adherence to personal hygiene practices; and appropriate administrative controls (e.g., hazard communication). To avoid ingesting lead, it is necessary to recognize that surfaces in the range are likely to be highly contaminated with lead and to clean them regularly. Currently, there are no Federal occupational exposure limits for lead contamination of surfaces. However, NIOSH researchers have investigated surface and skin contamination from lead in a variety of occupational settings and developed two analytical methods for identifying lead contamination. NIOSH Method 9100 is a surface-wipe collection method...

(The following excerpt is from page 6 of the NIOSH document.)

Other Guidelines and Best Management Practices

Association of Occupational and Environmental Clinics

The Association of Occupational and Environmental Clinics (AOEC) has reviewed current literature concerning lead exposure and health effects [AOEC 2007]. The AOEC has determined that the evidence provided by current health effects studies calls for an

update of guidance for professionals involved with medical assessment and treatment of lead-exposed workers. Among other provisions in their guidance, the AOEC has determined that current evidence supports the need for: 1) qualitative assessment of the need for inclusion in a medical surveillance program for lead workers in addition to inclusion in a medical surveillance program based on documentation of exposure to airborne lead at a concentration above the OSHA action level; 2) increased frequency of BLL testing; 3) removal from exposure to lead for workers with BLL of 30 $\mu\text{g}/\text{dL}$ or more; and 4) education of workers concerning occupational exposure to lead and provision of necessary personal protective equipment and administrative measures to prevent both occupational and take-home exposure to lead.

Environmental Health Perspectives Mini-Monograph

The March 2007 edition of Environmental Health Perspectives included a Mini-Monograph on adult lead exposure. Recommendations in this document include the following: 1) medical surveillance for all lead-exposed workers should include quarterly BLL testing for individuals with blood lead concentrations between 10 and 19 $\mu\text{g}/\text{dL}$, and semiannual testing when sustained blood lead concentrations are $< 10 \mu\text{g}/\text{dL}$; 2) pregnant women avoid occupational or avocational lead exposure that would result in sustained BLL above 20 $\mu\text{g}/\text{dL}$; and 3) removal from exposure to lead for workers with BLL of 30 $\mu\text{g}/\text{dL}$ or more or if a worker has a hazards as well as ongoing access to health counseling regarding lead-related health risks to prevent both occupational and take-home exposure to lead.

Filter System Maintenance Recommendations:

(The following excerpt is from page 15 of the NIOSH document.)

Filter change-out should be performed by personnel trained in the removal and disposal of dirty filters and in lead safety. They should use appropriate personal protective equipment and environmental precautions.

RECOMMENDATIONS

(The following excerpt is from page 18 of the NIOSH document.)

Employer and worker education

- Inform workers about symptoms that may indicate a health problem. Also inform workers that elevated lead levels can occur without overt symptoms and that a blood lead level test should be done if there is concern about an exposure to lead. Common symptoms of lead poisoning in adults include nausea, diarrhea, vomiting, poor appetite, weight loss, anemia, excess lethargy or hyperactivity, headaches, abdominal pain, and kidney problems. Exposure to high noise levels can cause hearing problems, stress, poor concentration, insomnia, nervousness, anxiety, and depression. It can also cause accelerated heartbeat, high blood pressure, gastro-intestinal problems and chronic fatigue. Employers should advise employees to report these symptoms to their supervisors and physicians.
- Inform pregnant workers and shooters about the possible adverse health effects to the fetus from exposure to lead and noise. A fetus can be poisoned in utero. Studies show that fetal blood contains approximately 80% of the blood lead concentration of the mother. Pregnant workers and shooters, or those considering pregnancy, also need to know about the increased chance of miscarriage at blood lead levels $> 5 \mu\text{g/dL}$. Evidence also suggests that exposure to peak sound pressure levels above 155 dBC can cause hearing loss in the fetus beyond the fifth month of pregnancy. The evidence of whether the particular noise exposure associated with firing ranges is harmful to the developing fetus and warrants removal of the pregnant woman from exposure is ambiguous. This issue is further complicated because female workers may be exposed to lead and noise even before they know they are pregnant. Firing ranges might wish to establish guidelines for pregnant workers exposed to lead and noise.

Worker exposure and medical health monitoring

(The following excerpt is from page 20 of the NIOSH document.)

Worker health monitoring

Blood lead levels are currently the best indicator of personal lead exposure. Workers potentially exposed to lead should therefore be monitored for the presence of lead in blood ~~and the effects of lead on the blood forming system~~. This assessment is necessary to ensure that engineering controls, personal hygiene practices, and PPE are preventing lead exposure.

- The OSHA general industry lead standard contains provisions for the medical monitoring of workers exposed to lead (29 CFR 1910.25(d)). NIOSH supports using these provisions for firing range workers but acknowledges that current understanding of health risks associated with lead exposure may require updated/additional provisions for medical surveillance. Recommendations from the March 2007 edition of Environmental Health Perspectives' Mini-Monograph on adult lead

exposure and from the Association of Occupational and Environmental Clinics (AOEC) ~~recommends that a medical surveillance program contain~~ include the following elements:

- Informing workers and shooters that levels of lead once thought safe are now known to be harmful. Advise that blood lead levels be kept below 10 micrograms of lead per deciliter ($\mu\text{g}/\text{dL}$) of blood.
- Informing pregnant workers and shooters, or those considering pregnancy, about the possible adverse health effects to the fetus as well as the increased chance of miscarriage at blood lead levels $> 5 \mu\text{g}/\text{dL}$.
- Workers should be included in a medical surveillance program whenever they are handling or distributing materials with a significant lead content that could potentially cause exposure through inhalation or ingestion.
- New employees and those newly assigned to lead work should have a pre-placement lead medical examination and a BLL test, followed by periodic BLL monitoring, blood pressure testing, and health status review.
- Monthly BLL testing is recommended for the first three months of employment in order to assess the adequacy of exposure control measures.
- Testing frequency can be reduced to every six months as long as BLLs remain below $10 \mu\text{g}/\text{dL}$, or quarterly for individuals with blood lead concentrations between 10 and $19 \mu\text{g}/\text{dL}$.
- Any increase in BLLs of $5 \mu\text{g}/\text{dL}$ or greater should trigger a re-examination of control measures.
- Workers with BLLs of $30 \mu\text{g}/\text{dL}$ or more, or ones with a sustained BLL above $20 \mu\text{g}/\text{dL}$, should be removed from lead exposure.
- All lead-exposed workers should receive, annually, educational materials and prevention information about the health effects of exposure to lead from a clinician and the employer; and they should be provided necessary protections including protective clothing, clean eating areas, and hygiene measures such as wash facilities and/or showers to prevent both ingestion and take-home exposures.

(The following excerpt is from page 21 of the NIOSH document.)

The OSHA noise exposure standard (29 CFR 1910.95(d)(e)(g)(h)) requires the employer to establish a monitoring program and ~~maintain~~ provide audiometric testing to all employees whose exposures equal or exceed an 8-hour TWA of 85 dBA under the action level monitoring criteria.

REFERENCES

(The following excerpt is from page 22 of the NIOSH document.)

...
 Kardous CA, Willson RD, Hayden CS, Szlapa P, Murphy WJ, Reeves ER [2003]. Noise exposure assessment and abatement strategies at an indoor firing range. *Appl Occup Environ Hyg* 18(8):629–636.

Kosnett M, Wedeen R, Rothenberg S, Hopkins K, Materna B, Schwartz B, Hu H, Wolf A. Recommendations for Medical Management of Adult Lead Exposure. *Environmental Health Perspect*, 115(3):463-471, 2007.
<http://www.ehponline.org/members/2006/9784/9784.html>

Lalande NM, Hetu R, Lambert J [1986]. Is occupational noise exposure during pregnancy a risk factor of damage to the auditory system of the fetus? *Am J Ind Med* 10(4):427–435.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
Michael J. DiBartolomeis, PhD, DABT, Chief, Occupational Lead Poisoning Prevention Program California Department of Public Health (510) 620-5757 mdibartolo@cdph.ca.gov		General Comments	The draft document refers to the 2007 summary of recent scientific literature on exposures to and health effects of lead prepared by the Association of Occupational and Environmental Clinics (AOEC). In addition to this information, we highly recommend that NIOSH also summarize the findings published by Kosnett M. et al., "Recommendations for Medical Management of Adult Lead Exposure," <i>Environmental Health Perspect</i> , 115(3):463-471, 2007 (http://www.ehponline.org/members/	We agree.

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
		General Comments	<p>2006/9784/9784.html). OLP prefers the EHP article because we believe its guidance is more health protective for some exposures and vulnerable populations. We provide some suggested language to add to the document in our specific comments below.</p>	<p>This is an unduly restrictive recommendation that may not be a workable solution for many range operators and employers.</p>
		General Comments	<p>NIOSH should recommend switching to lead-free ammunition (bullet and primer) in the one-page recommendations to the employer/operator. At the very least, ranges should permit only fully jacketed ammunition to minimize lead exposures on the range. In our specific comments on the text, we suggest some added language for the recommendations for employers and firing range operators in the draft document.</p>	
		General Comments	<p>The document would be improved by including a description of and providing information on newer designed backstops and traps. Some of the newer backstops (shredded rubber tires encased in a net) can help reduce lead bullet fragmentation, lower noise levels, and reduce hazardous waste clean-up for the workers. For example,</p>	<p>Discussion on backstop included on pages 16/17.</p>

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
	iii	4. Know and report symptoms	<p>“Super Trap” (http://www.superttrap.com/ST_Products.htm) is one of the better known products available. OLPPP does not endorse any specific product; we only include this link for reference.</p> <p>Add another bullet:</p> <p>If you suspect you may have been exposed to lead, even if you have no symptoms, ask about having a blood lead level test done.</p>	<p>Added as suggested.</p>
	iv	1. Provide workers and shooters with information about hazards...	<p>Add the following sentence to the 4th bullet:</p> <p>Also inform workers that elevated lead levels can occur without overt symptoms and that a blood lead level test should be done if there is concern about an exposure to lead.</p> <p>Add this bullet:</p> <p>Inform workers and shooters that levels of lead once thought safe are now known to be harmful. Advise that blood lead levels be kept below 10 micrograms of lead per deciliter (µg/dL) of blood.</p>	<p>We believe this bullet is unnecessarily alarming and might be counter-productive to range operators and employers as they try to comply with current regulations and the recommendations of this Alert. We do provide this recommendation in the worker health monitoring section.</p> <p>The first portion of the bullet was</p>
	iv	1. Provide workers and shooters with information about hazards...	<p>Inform pregnant workers and</p>	

Reviewer (organization and contact information)	Page	Section Subject-Title	Comment	Authors' Response
		and shooters with information about hazards...	shooters, or those considering pregnancy, about the possible adverse health effects to the fetus as well as the increased chance of miscarriage at blood lead levels > 5 µg/dL.	modified as suggested. The portion about the miscarriage is highlighted in the worker health monitoring section.
	v	4. Provide workers with health and medical monitoring	Best medical management practices, from organizations such as the Association of Occupational and Environmental Clinics or those provided in the journal <i>Environmental Health Perspectives</i> (March 2007) ¹ should be considered recommended for all lead-exposed adults (workers and shooters).	Modified as suggested.
	v	4. Provide workers with health and medical monitoring	5. Allow only lead-free bullets and primers or fully jacketed ammunition with lead-free primers on the firing range.	This recommendation is unduly restrictive and will present many challenges to firing range operators. We do provide recommendations on lead-free bullets but allow the firing range operators or employers the choice to make a decision based on their specific training or shooting requirements. Bullet not added.
	1	Background	airborne, ingestion, and skin),	Modified as suggested.
	4	Current Regulations, Recommendations,	Add the following statement to the first paragraph:	We have added the following statement:

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		and other guidelines	This is especially true for the OSHA lead standards which are based on medical information on lead that was available in the 1970's.	"However, since current standards and regulations are based on outdated medical information, employers are encouraged to follow the most protective criteria."
	4	OSHA Regulations	Add the following note to the beginning of the OSHA Regulations section: (Note: The OSHA lead standards are based on medical information that was available in the 1970's. While once thought to be protective, it is now known that the adverse health effects of lead occur at much lower levels. Current recommendations are that adult blood lead levels be kept below 10 µg/dL and that pregnant women or women considering pregnancy not have a blood lead level above 5 µg/dL.)	Again, this is unnecessary in light of the addition in the paragraph above as suggested by this reviewer.
	5	NIOSH Recommendations	Skin exposures often result from hidden hazards that are not anticipated or recognized, and hence are inadequately controlled. Controlling lead contaminated surfaces (and skin contamination) is highly dependent on anticipation and identification of lead contamination on surfaces; strict attention and ad-	We believe it is important to retain the original portion to convey the message about skin hazards that may not be readily anticipated or recognized. No changes made to this section.

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			<p>herence to personal hygiene practices; and appropriate administrative controls (e.g., hazard communication). To avoid ingesting lead, it is necessary to recognize that surfaces in the range are likely to be highly contaminated with lead and to clean them regularly.</p>	
	6	<p>Other Guidelines and Best Management Practices</p>	<p><u><i>Environmental Health Perspectives Mini-Monograph</i></u></p> <p>The March 2007 edition of Environmental Health Perspectives included a Mini-Monograph on adult lead exposure. Recommendations in this document include the following: 1) medical surveillance for all lead-exposed workers should include quarterly BLL testing for individuals with blood lead concentrations between 10 and 19 $\mu\text{g}/\text{dL}$, and semiannual testing when sustained blood lead concentrations are < 10 $\mu\text{g}/\text{dL}$; 2) pregnant women avoid occupational or avocational lead exposure that would result in blood lead concentrations > 5 $\mu\text{g}/\text{dL}$; 3) removal from exposure to lead for workers with BLL of 30 $\mu\text{g}/\text{dL}$ or more or if a worker has a sustained BLL above 20 $\mu\text{g}/\text{dL}$; and 4) annual</p>	<p>Added as suggested.</p>

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	15	Filter System Maintenance Recommendations	<p>education of lead workers concerning occupational exposure to, and control of, lead hazards as well as ongoing access to health counseling regarding lead-related health risks to prevent both occupational and take-home exposure to lead.</p> <p>Filter change-out should be performed by personnel trained in the removal and disposal of dirty filters and in lead safety. They should use appropriate personal protective equipment and environmental precautions.</p>	<p>Added as suggested.</p>
	19	Employer and worker education	<p>Inform workers about symptoms that may indicate a health problem. Also inform workers that elevated lead levels can occur without overt symptoms and that a blood lead level test should be done if there is concern about an exposure to lead.</p>	<p>Modified to include the comment about overt symptoms.</p>
	19	Employer and worker education	<p>Inform pregnant workers and shooters about the possible adverse health effects to the fetus from exposure to lead and noise. A fetus can be poisoned in utero. Studies show that fetal blood contains approximately 80% of the blood lead concentration of the mother. <u>Pregnant workers and shooters, or those considering pregnancy, also</u></p>	<p>Modified as suggested.</p>

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	20	Worker health monitoring	<p>need to know about the increased chance of miscarriage at blood lead levels > 5 µg/dL.</p>	<p>Removed as suggested.</p>
	20	Worker health monitoring	<p>Blood lead levels are currently the best indicator of personal lead exposure. Workers potentially exposed to lead should therefore be monitored for the presence of lead in blood and the effects of lead on the blood-forming system.</p>	<p>Replaced as suggested.</p>
	20	Worker health monitoring	<p>updated/additional provisions for medical surveillance. Recommendations from the March 2007 edition of Environmental Health Perspectives' Mini-Monograph on adult lead exposure and from the Association of Occupational and Environmental Clinics (AOEC) recommends that a medical surveillance program contain include the following elements:</p> <p>Informing workers and shooters that levels of lead once thought safe are now known to be harmful. Advise that blood lead levels be kept below 10 micrograms of lead per deciliter (µg/dL) of blood.</p> <p>Informing pregnant workers and shooters, or those considering</p>	

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			<p><u>pregnancy, about the possible adverse health effects to the fetus as well as the increased chance of miscarriage at blood lead levels > 5 $\mu\text{g}/\text{dL}$.</u></p> <p>Testing frequency can be reduced to every six months as long as BLLs remain below 10 $\mu\text{g}/\text{dL}$, or quarterly for individuals with blood lead concentrations between 10 and 19 $\mu\text{g}/\text{dL}$.</p> <p>Any increase in BLLs of 5 $\mu\text{g}/\text{dL}$ or greater should trigger a re-examination of control measures.</p> <p>Workers with BLLs of 30 $\mu\text{g}/\text{dL}$ or more, or ones with a sustained BLL above 20 $\mu\text{g}/\text{dL}$, should be removed from lead exposure.</p> <p>All lead-exposed workers should receive, annually, educational materials and prevention information about the health effects of exposure to lead from a clinician and the employer, and they should be provided necessary protections including protective clothing, clean eating areas, and hygiene measures such as</p>	

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	20	Worker health monitoring	wash facilities and/or showers to prevent both ingestion and take-home exposures. The OSHA noise exposure standard (29 CFR 1910.95(d)(e)(g)(h)) requires the employer to establish a monitoring program and maintain provide audiometric testing to all employees whose exposures equal or exceed an 8-hour TWA of 85 dBA under the action level monitoring criteria.	Modified as suggested.

Reviewer 17

Name
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Comments

In regard to range ventilation systems, recirculation systems can provide a means of heat recovery (heating and cooling) in extreme climates. We have designed systems for the military and others clients that utilize total particulate meters within the downstream side of the supply duct (after the multi-stage HEPA filtration) to indicate when particulate levels exceed certain limits. You can't be sure the particulate is lead but you can make that assumption to play it safe. Another safety measure that we incorporate and find very economical is to monitor and shut down the range ventilation system when the pressure drops across any of the 2-3 stages of filtration is too low (each stage monitored independently). For example, a 99.997% HEPA filter with a pressure drop below 0.10 inches of water column is an indication that one or more filters are missing. I can't tell you the number of ranges we see where the filters on a recirculation system have been removed or have fallen out due to the age of the filtration equipment. The blow-by is also significant where the total particulate meter or lack of pressure drop across the filter would sense this situation. Carbon Monoxide are recirculation systems is also something we monitor and alarm in real time. It also can be very dangerous (acute time frame) with rapid fire on large calibers... Please feel free to contact me with any questions. We have been in this business since 1996 and have designed and installed a significant number of indoor shooting range ventilation systems on fixed and mobile facilities. We work closely with Randy Jackson.

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<p>Michael Bott Range Ventilation Design, Inc. 17 Regent Lincolnshire, IL 60069 Mike.Bott@RVDinc.com</p>		<p>General comments</p>	<p>In regard to range ventilation systems, recirculation systems can provide a means of heat recovery (heating and cooling) in extreme climates. We have designed systems for the military and others clients that utilize total particulate meters within the downstream side of the supply duct (after the multi-stage HEPA filtration) to indicate when particulate levels exceed certain limits. You can't be sure the particulate is lead but you can make that assumption to play it safe. Another safety measure that we incorporate and find very economical is to monitor and shut down the range ventilation system when the pressure drops across any of the 2-3 stages of filtration is too low (each stage monitored independently). For example, a 99.997% HEPA filter with a pressure drop below 0.10 inches of water column is an indication that one or more filters are missing. I can't tell you the number of ranges we see where the filters on a recirculation system have been removed or have fallen out due to the age of the filtration equipment. The blow-by is also significant where the</p>	<p>We agree with the general consensus of the comments here but we have no specific changes made to the Alert as a result of these comments.</p>

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			<p>total particulate meter or lack of pressure drop across the filter would sense this situation. Carbon Monoxide are recirculation systems is also something we monitor and alarm in real time. It also can be very dangerous (acute time frame) with rapid fire on large calibers... Please feel free to contact me with any questions. We have been in this business since 1996 and have designed and installed a significant number of indoor shooting range ventilation systems on fixed and mobile facilities. We work closely with Randy Jackson.</p>	