



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
PUBLIC HEALTH SERVICE  
CENTER FOR DISEASE CONTROL  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45226

HAZARD EVALUATION AND TECHNICAL ASSISTANCE REPORT  
TA 80-34

U.S. DISTRICT COURT  
DISTRICT OF COLUMBIA  
INDOOR FIRING RANGE  
WASHINGTON, D.C.

May 1980

I. SUMMARY

In January 1980, the National Institute for Occupational Safety and Health (NIOSH) provided technical assistance to the General Services Administration in evaluating the ventilation and design of an indoor firing range. The concern was potential exposure to inorganic lead among U.S. Marshalls who would be qualifying with firing weapons at the indoor firing range located in the District Court House, Washington, D.C.

Since the firing range has been closed down since June 1978, no environmental or medical testing for lead exposure could be performed. However, NIOSH measured ventilation at all air supply and exhaust vents, used smoke tubes to determine air flow, evaluated room pressure, and compared the current firing range design with NIOSH's recommended design considerations for indoor firing ranges.<sup>1</sup>

NIOSH has determined that the ventilation system at this indoor firing range is inadequate and that there may be a health hazard of lead exposure to the range officer and to U.S. Marshalls qualifying with firing weapons. Recommendations on improving ventilation design and assuring safe and healthful working conditions are contained on page 4 of this report.

II. INTRODUCTION

In December 1979, NIOSH received a request from a safety officer with the General Services Administration, Washington, D.C., to provide technical assistance in evaluating an indoor firing range. The request was generated from U.S. Marshalls needing a place to qualify with their handguns. The firing range was closed down in June 1978, because it did not conform to the design criteria recommended by NIOSH (1), and presented a possible health hazard to employees from lead exposure. Since U.S. Marshalls must qualify annually with fire arms, and indoor firing ranges are scarce in Washington, D.C., GSA asked NIOSH to provide recommendations to make this firing range operational once again.

### III. DESCRIPTION OF FACILITY

This indoor firing range is located in the basement of the District Court House, 3rd and Constitution NW, Washington, D.C. Prior to its closing in June 1978, 100 to 150 U.S. Marshalls qualified annually. The handguns used for qualifying were the .38 and .357 caliber revolvers, a 9-millimeter semiautomatic handgun, and a 12-gauge shotgun. It takes approximately 45 minutes to 1 hour to qualify. There are two range officers assigned to this firing range, each is exposed approximately 4 hours per day.

The range is approximately 108 feet long, 12 feet wide, and 9 feet high. There are three firing booths equipped with automatic target setters and a steel wedge-shaped bullet trap. A sand pit below the bullet trap collects the spent lead wadcutter slugs.

### IV. METHODS

Environmental and biological samples for lead were not taken since the firing range was closed down. However, ventilation measurements were made, air flow patterns were determined, and overall range design was evaluated.

All supply and exhaust grills were measured with a hot-wire anemometer for air flow in feet per minute. The grills were also measured for size so that the volume of air introduced and discharged from the firing range could be computed. Smoke tubes were used to characterize air flow and to determine room pressure (positive or negative). The range design, such as work station of the range officer, shooting stations, firing line, ventilation, soundproofing, and housekeeping, was compared to the NIOSH recommended design considerations for indoor firing ranges.

### V. EVALUATION CRITERIA

The current U.S. Department of Labor (OSHA) Federal standard for occupational exposure to inorganic lead is 0.05 milligrams per cubic meter of air ( $\text{mg}/\text{M}^3$ ) for an 8-hour time-weighted average daily exposure. Federal agencies are required to follow the OSHA standard under Presidential Executive Order 12196 (February 9, 1980).

The physiological effects of prolonged absorption of lead or its inorganic compounds from inhalation or ingestion of fume or dust can result in severe gastrointestinal disturbances and anemia. Symptoms are weakness, weight loss, lassitude, insomnia, and hypertension. Later findings include anemia, pallor, a 'lead line' on the gums, and decreased hand grip strength. Exposure over an extended period of time may cause "wrist drop," which is caused by the toxic effects of lead upon the radial nerve. The kidneys can also be damaged after long periods of lead exposure, with kidney dysfunction and progressive azotemia (increased urea in the blood) (2). Health information related to lead suggests that blood lead levels in workers should be below 40 micrograms of lead per deciliter of whole blood ( $\text{ug}/\text{dl}$ ).

VI. RESULTS

A schematic of the firing range and ventilation rates is in Appendix I of this report. The ventilation system supplies approximately 1300 cubic feet of air per minute (cfm) and exhausts 3700 cfm. Air is introduced to the range through 12 ceiling diffusers which are placed at various points along the firing line. Air is exhausted through three ceiling diffusers located above each shooting station.

Smoke tube testing showed the range to be under negative pressure with respect to the rest of the building (negative pressure is desirable). Smoke tube measurements at the shooting stations showed efficient exhaust straight up, but measurements further down range showed the air to be stagnant. The direction of air flow was not supplied in a uniform flow from the back of the shooting stations to the bullet trap.

Air supplied above the range officer's console was direct, with little dispersion. The lack of a proper grill diffuser makes this area drafty, inefficient for removing airborne lead, and an undesirable work station.

VII. DISCUSSION/CONCLUSIONS

Although no environmental or biological lead samples were taken from employees working or qualifying in the firing range, GSA determined the firing range to be a potential health hazard based upon poor ventilation design. Thus, it was a prudent decision to close the range until improvements were made.

In general, the overall design of the District Court House firing range needs improvement. However, with some modifications it could be made operational again. The first design modification should be in the ventilation system. Air flow should be laminar, flowing from the back wall of the firing range toward the bullet trap. The present system of exhausting contaminated air above the shooting stations is not very effective, especially in removing lead-laden air down range. The range officer is then at risk since he maintains this area and cleans the sand pit of bullet debris. Previous studies by NIOSH have indicated that range officers are occasionally exposed to higher concentrations of lead when compared to range shooters (3,4).

Recent telephone communications with a U.S. Marshall working at the District Court House indicated that the ventilation system would be improved and a water trap installed at the bullet trap to capture spent bullets. The sand pit will be removed.

VIII. RECOMMENDATIONS

The District Court House officials should continue with their plans to install new ventilation systems within the range. A performance criteria should be written into the purchase contract whereby the new ventilation system will exhaust lead to levels below 0.05 mg/M<sup>3</sup>. Also, workers in the firing range are urged to follow good work practices as discussed in the NIOSH publication 76-130, "Lead Exposure and Design Considerations for Indoor Firing Ranges."

Additional recommendations specific to this firing range are:

1. Diffusers should be installed over the range officer's console to make air movement more effective and less drafty.
2. Air exhaust above the shooting stations may be left on if environmental measurements show this exhaust to be effective in reducing firing range lead concentrations below 0.05 mg/M<sup>3</sup>.
3. To minimize noise created by gunfire, all reflecting walls should be covered with high efficiency sound absorbing material. Bullet trap noise can be reduced by applying an epoxy resin to the back side of the trap plates.

IX. REFERENCES

1. Anania, T.L. and Seta, J.A.: Lead Exposure and Design Considerations for Indoor Firing Ranges. HEW Publication No. (NIOSH) 76-130. December 1975.
2. Occupational Diseases--A Guide to Their Recognition. HEW Publication No. (NIOSH) 77-181.
3. Anania, T.L., and Seta, J.A.: Hazard Evaluation and Technical Assistance Report NIOSH No. 76-53, 1976.
4. Kronoveter, K.J.: Hazard Evaluation and Technical Assistance Report NIOSH No. 78-22, 1978.

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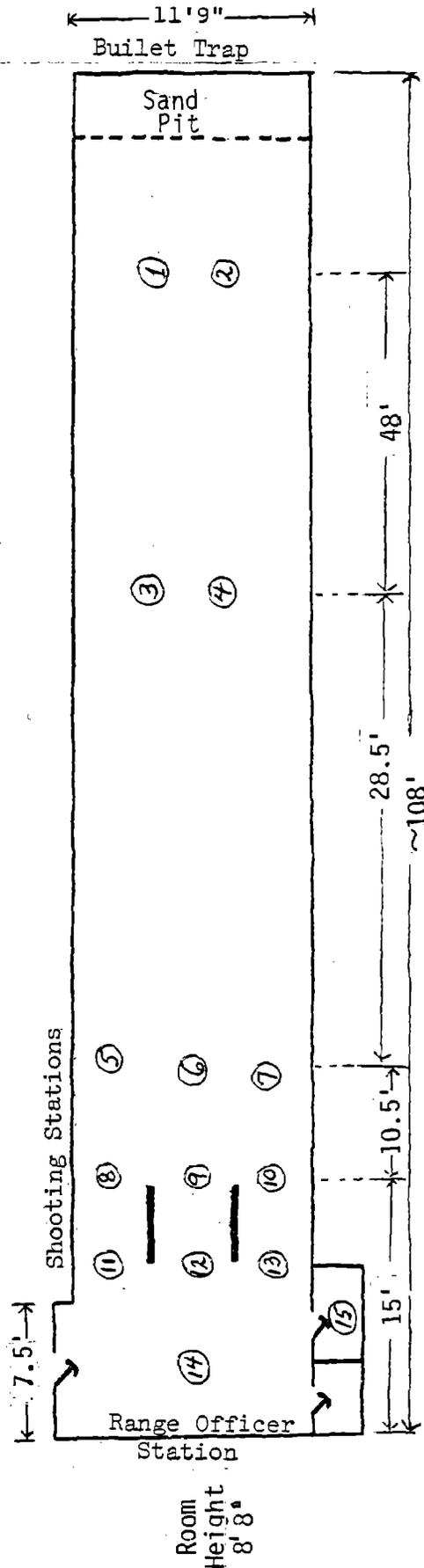
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5. Mr. Frank Sisson, General Services Administration
6. Mr. Samuel Brathweight, U.S. Marshall Office

APPENDIX I

Results of Air Velocity Measurements  
 District Court House Firing Range  
 Washington, D.C.



Legend: (X) represents ceiling vents and their location

\*Drawing not to scale.

Key (X)

Air Supply Vents

No.	$\bar{X}$ fpm*	Vent Size (inches)		cfm**
		Length	Width	
1	440	7½	x 5½	126
2	450	7½	x 5½	130
3	520	7½	x 5½	151
4	505	7½	xx 5½	146
5	340	9½	x 5½	123
6	265	9½	x 5½	96
7	50	9½	x 5½	18
11	20	11½	x 11½	18
12	15	11½	x 11½	14
13	25	11½	x 11½	23
14	180	11½	x 7½	108
15	325	12	x 12	325
TOTAL				<u>1300</u>

Air Exhaust Vents

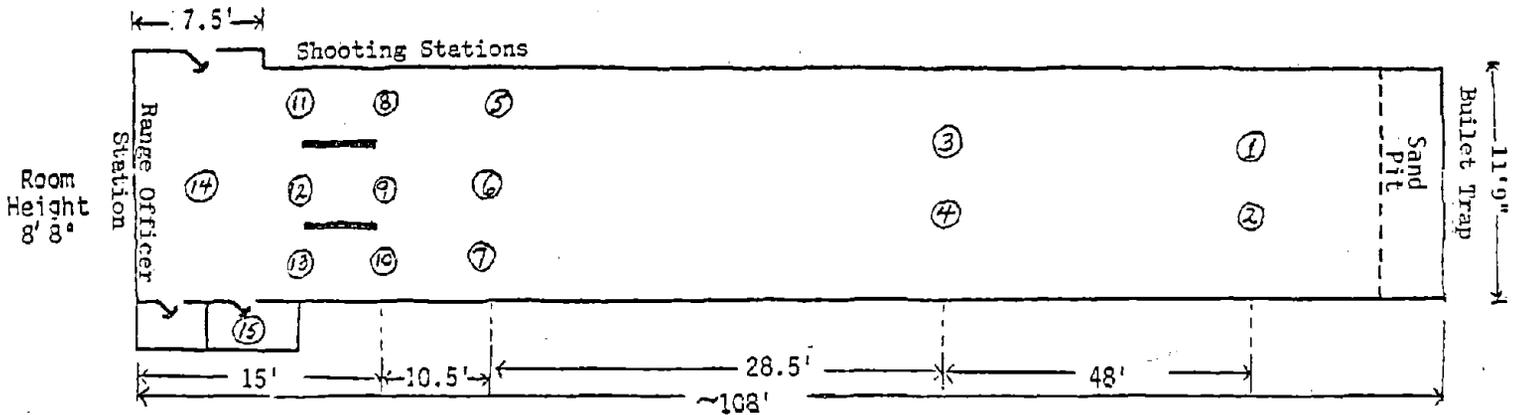
No.	$\bar{X}$ fpm	Vent Size (inches)		cfm
		Length	Width	
8	475	19	x 11¼	705
9	475	19	x 11¼	705
10	1550	19	x 11¼	2300
TOTAL				<u>3700</u>

\* fpm = feet per minute

\*\* cfm = cubic feet per minute

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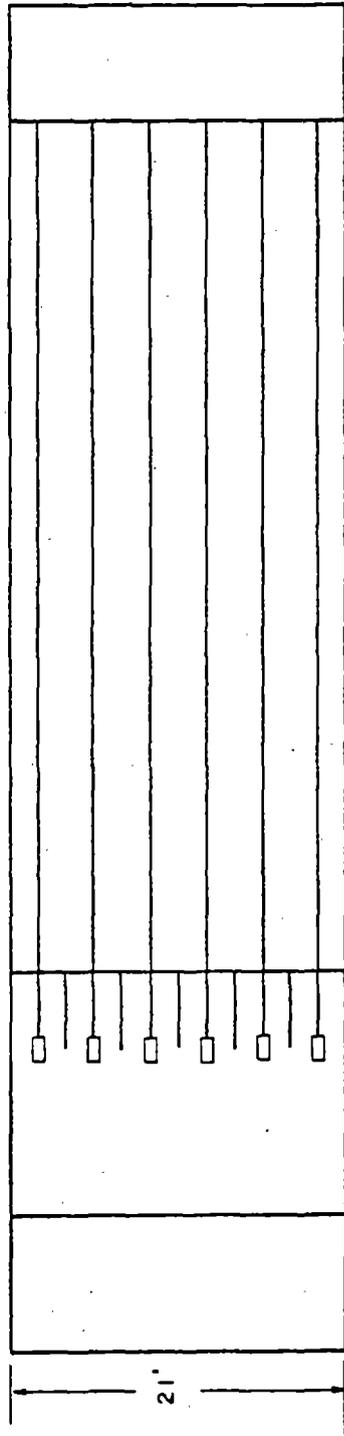
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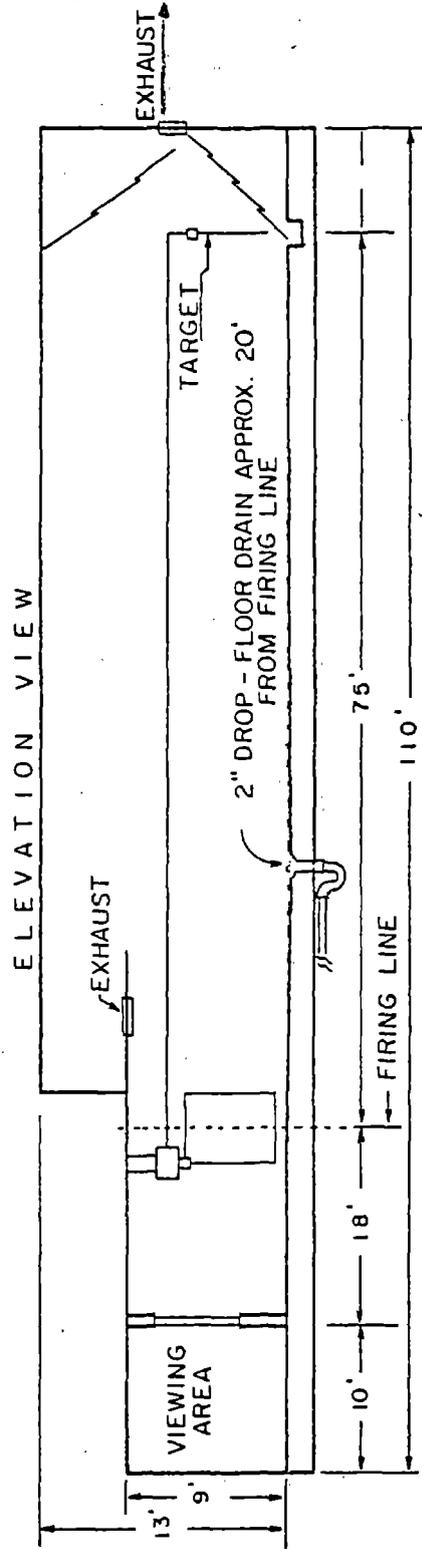
\* fpm = feet per minute  
 \*\* cfm = cubic feet per minute

APPENDIX II

(Example Only)



PLAN FOR INDOOR FIRING RANGE



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