2.2.2 Shotgun Ranges

In contrast to rifle/pistol ranges, shot at shotgun ranges (trap, skeet, and sporting clays) is widely distributed. When a shotgun target is hit by a well-centered shot, only a relatively few of the several hundred pellets in the shot string actually strike the target. These may be deformed or deflected and fall to the ground nearby. Most of the pellets in the load, however, continue beyond where the target was hit.

The full extent of the total shot fall zone at a trap or skeet field or sporting clays stations must be known before effective lead management practices can be implemented. Careful examination of the ground for the presence of shot around the theoretical shot fall zone perimeter (indicated by the size and shape of the theoretical shot fall zones in Figures 2-8, 2-9, and 2-10) should be performed to determine the extent of the actual shot fall zones. In general, actual shot fall zones should not be considered to be any smaller than those illustrated in the figures unless unusual topography exists. If shots are fired on a downhill slope, the actual shot fall zones could be considerably larger than indicated in the figures.

Figure 2-8. Theoretical shot fall zone and area of maximum shot fall at trap fields. Typical layout of multiple trap fields at top; modified layout to minimize total shot fall zone at bottom (NSSF 1997).
Distribution of Shot at Trap Ranges

The positions of the shooters and the angles at which trap targets are thrown result in a funnel-shaped theoretical shot fall zone as illustrated in Figure 2-8. Depending on the load, the angle at which the shot was fired, wind, and other factors, typical lead trap loads can reach about 770 feet from the shooter, although most shot tends to fall roughly 375–600 feet from the shooter. (Note: The maximum range of shot is highly variable and is directly related to elevation above sea level.) Figure 2-8 illustrates the theoretical shot fall zone and the area of maximum shot fall at a trap field. Note the overlap of the shot fall zones from adjacent fields, resulting in areas with increased amounts of lead. The theoretical shot fall zone of a single trap field covers approximately 4 acres, and about 1½ acres are added with each additional overlapping field (assuming the trap houses are spaced 100 feet apart). The top of Figure 2-8 illustrates a typical layout for multiple trap fields. The lower portion of Figure 2-8 illustrates a slightly different layout to maximize the overlap of the shot fall zones, which confines the lead to a smaller area and results in easier recovery and less potential environmental disturbance. If shooting games other than regulation trap are shot on a trap field, the shot fall zone and area of maximum shot fall tend to expand to the sides, depending on the angles at which targets are thrown and shots fired. At a maximum, they resemble the shape described below for skeet fields, with an outer perimeter about 770 feet from the shooters.

Distribution of Shot at Skeet Ranges

At skeet ranges, the positions of the shooters and the angles at which targets are thrown result in a fan-shaped theoretical shot fall zone. Depending on the load, the angle at which the shot was fired, wind, and other factors, typical lead skeet loads can reach about 680 feet from the shooter, although most shot typically tends to fall roughly 375–600 feet from the shooter. The theoretical shot fall zone and the area of maximum shot fall at a skeet field are illustrated at the top of Figure 2-9. The lower part of Figure 2-9 shows the shot fall zone and area of maximum shot fall from several adjacent skeet fields. The theoretical shot fall zone of a single skeet field is approximately 14 acres, and about 2 acres is added with each additional overlapping field. Even if shooting games other than regulation skeet are shot on a skeet field, the shot fall zone and area of maximum shot fall are typically no larger than those described above for standard skeet.

Figure 2-9. Theoretical shot fall zone and area of maximum shot fall at skeet fields. Single field shown at top; multiple adjacent fields shown at bottom (NSSF 1997).
The shot fall zone at a single combination trap and skeet field is very similar to that at a single skeet field, except that the “funnel” of trap shot fall extends about 90 feet beyond the perimeter of the skeet shot fall zone due to the greater range of typical trap loads. The areas of maximum shot fall overlap, producing an area of maximum lead in the center of the fan. Where there are several adjacent combination trap and skeet fields, multiple shot fall zones and areas of maximum shot fall overlap.

**Distribution of Shot at Sporting Clays Courses**

The defining feature of sporting clays courses is the complete flexibility in target angles and shooting directions. Because there is no standard layout, it is impossible to illustrate a standard shot fall zone or area of maximum shot fall for a sporting clays course. Figure 2-10 illustrates a typical configuration of a sporting clays course. As you can see, the shot fall zones do not overlap, and shot distribution is widespread. Figure 2-11 illustrates an idealized layout for a 10-station sporting clays course which provides overlapping shot fall areas and makes shot deposition more manageable. The boxes around the perimeter represent the shooting stations, and the colored lines represent the direction of shot from each station. The oval represents the overlapping shot fall area for each shooting station. This illustration makes it clear that sporting clays courses can distribute shot widely or provide overlapping shot fall areas depending on the characteristics of the course area. The theoretical shot fall zones could extend 770 feet from the firing positions, depending on the loads and angles at which they are fired.

![Figure 2-10. A sporting clays course configuration with six shooting stations and multiple fall zones.](image-url)
2.3 Shooting Off Property

For ranges where shooting activities impact properties not owned or controlled by the range, there is potential human health concern if current or future use of that property increases potential exposure. Off-property lead shot deposition could be resolved through remediation or property acquisition for incorporation into the existing range. It could also be controlled by using shot curtains as can be seen later in Section 3.13.

2.4 Cartridges and Clay Targets and Litter

In addition to spent lead shot, other components, such as cartridge cases, wads, and clay targets, are produced and need to be considered (Figure 2-12).

![Figure 2-11. Layout for a sporting clays course with a single shot fall zone.](image)

**Cartridge Cases and Wads**

Spent cartridge cases and wads are unsightly litter and contain metals and other residue that can contribute to contamination issues at a range.

**Clay Targets**

Clay targets are typically made of about 70% limestone bound with 30% pitch, bitumen, or other organic material. The binding material, particularly if derived from tar or pitch, may contain a complex mix of PAHs, some of which are regarded as toxic. The PAH content varies considerably, with bitumen binding containing the lowest levels. The use of clay targets with low
or zero PAH levels is likely to increase in the future. In addition to low-PAH traditional clay targets, new materials are being developed in both America and Europe, including true clay material. These are claimed to have no hazardous components and to break down rapidly in the environment. Fragments of clay targets are not known to cause problems for wildlife. Farmers sometimes express concern over their livestock, but no current information indicates any problems. Uncontrolled accumulations of clay fragments may become an aesthetic problem or interfere with other land uses.

2.5 Shooting Sound

Sounds of shooting and other activities from a range are inevitable. They create one of the most common issues for both proposed and existing ranges with respect to range neighbors. What to one person is a sound of no great consequence may be an unacceptable noise to another. The perception of sound is both a psychological and physical process, and how people respond to it depends on many factors, including its nature, the time of day, and whether they like its cause. A community’s reaction to the sounds of shooting can be influenced by its attitude to the range itself. Range managers need to develop and maintain good community relations with all in the neighborhood (see Section 3).

The sound at the muzzle of a shotgun firing a typical clay shooting cartridge reaches some 140–150 decibels [dB(A), A = weighted scale to approximate human hearing for steady state noise]. For comparison, normal speech is around 50–60 dB(A), and clapping hands up to around 80 dB(A). For many people sound levels above 140 dB(A) become painful. A relevant feature of sound is that with increasing distance its level rapidly declines. At 1 km from a range, for example, the sound level can be 60–70 dB(A).

The main sources of sound on rifle/pistol ranges are muzzle blast, supersonic bullet flight, and, least importantly, bullet impact. Muzzle blast is caused by rapidly expanding gas from the burning propellant powder as it leaves the barrel. The sound level of a large-caliber rifle bullet traveling at 700–1000 m/sec (supersonic) is much lower than the muzzle blast, but, because it is typically in a much higher frequency band (some 1–4 kHz, compared with the broad spectrum of the muzzle blast), it is often perceived to be a more unpleasant sound. This ballistic sound does decline more quickly, however, with distance from the bullet path. Sound from bullet impacts varies; it is generally lowest in sand traps or earth berms and highest in metallic bullet traps. The extent to which the sounds from rifle/pistol ranges are perceived as unwanted noise by people outside depends much on the type of range itself.

2.6 Dust

Dust from bullets impacting berms and from lead recovery/recycling operations often contains lead. Lead recovery may be a large generator of dust at shotgun and rifle/pistol ranges. Lead can also enter the air from

- a release of lead due to the heat of burning powder acting on bullet base with exposed lead,
- friction between the barrel and an unjacketed bullet, and
- burning lead compounds used in primer mixtures.