
**Shooting Range Design & Safety Evaluation
of the
Team Crucible
Training Complex
Spotsylvania, Virginia**

16 April 2018

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1 Background and Scope of Work

Team Crucible wishes to construct and operate a shooting range facility in Spotsylvania County, Virginia. Kramer One, Inc. was retained by Team Crucible to evaluate their proposal to construct and operate this shooting range facility.

Kramer One, Inc. is an architecture and planning firm nationally recognized for shooting range design. The firm is located in Scottsdale, Arizona, and has designed shooting ranges in thirty states, including Virginia.

The Team Crucible Training Complex was not designed by Kramer One, Inc. Our role is limited to the review of the shooting range safety systems for this proposed facility and make recommendations where appropriate. Team Crucible has incorporated all of the additional engineering and administrative controls we requested.

Prior to writing this report, we reviewed the following documents.

- Drawings 1-6 by W W Webb & Associates, PLLC, revision dated March 15, 2018
- Generalized Development Plan – Narrative – Rezoning & Special Use Permit Applications
- Letter to Leon Hughes, dated March 22, 2018
- Voluntary Proffer Statement

2 Shooting Range Safety Standards

The industry standard recommendations for the design and operation of facilities like the Team Crucible Training Complex come from the National Rifle Association (NRA) and the National Shooting Sports Foundation (NSSF). The primary document is the NRA Range Source Book. The latest edition is dated 2012. We have used the 2012 NRA Range Source Book for reference in preparing this report.

The primary bullet containment concept of the shooting range industry, as promulgated by NRA, is all bullets fired on the firing ranges should not leave the property owned or controlled by the shooting range facility.¹ The methods to controlling the bullets fired may include engineering controls, administrative controls, or a combination of administrative and engineering controls. From a practical standpoint, both engineering controls and administrative controls are necessary. The best engineering controls can be defeated by a lack of administrative controls. No engineering controls would be equally undesirable.

We understand military standards, to include Surface Danger Zones (SDZ), has been suggested as the applicable standard for the Team Crucible Training Complex. We disagree. The United States Armed Services publishes standards for various weapons facilities, including small arms² firing ranges. These standards have specific applicability to facilities operated by various branches of the United States Armed Services, but have no applicability to other firearms facilities, such as private, public, law enforcement and security firing ranges. The Team Crucible Training Complex is not operated by any branch of the United States Armed Services, nor does it exclusively use ammunition for which SDZs are published.

In the next two chapters of this report we will discuss engineering controls and administrative controls.

¹ Exception: Bullets being removed for recycling or disposal.

² “Small arms” is defined as firearms that may be both carried and discharged by one person. Pistol, rifles and shotguns are all examples of small arms.

3 Engineering Controls

The engineering controls shown on the Team Crucible Training Complex documents include earth backstops with ricochet catchers, and side berms. Additionally, the types of targets and their locations are restricted. Details of these engineering control may be found in the following sections of this chapter.

Backstops

Backstops are the primary device intended to stop bullets fired on shooting ranges.

The NRA Range Source Book recommends earth backstops be constructed with a minimum height of 20 feet, a minimum slope on the shooting face of 1.5:1 (1.5 units horizontal to 1 unit vertical), and the material in the shooting face have no rocks greater than $\frac{3}{4}$ inch in diameter to a minimum depth of 24 inches.³ The Team Crucible Training Complex will be designed to meet these standards.

Berms/Walls

Side berms or walls may be used to separate shooting ranges from one another. They may also be used as an engineering control for added protection of areas adjacent to a shooting range.

The NRA Range Source Book's recommendation for side berms is similar to their recommendation for earth backstops, except the minimum height is reduced to 8 feet.

The NRA Range Source Book describes an option to side berms where the material is an impenetrable vertical wall or barrier, rather than sloped earth. The minimum height recommendation remains 8 feet.

The Team Crucible Training Complex will have perimeter side berms much greater than 8 feet for sound control reasons. Internal walls will be a minimum of 10 feet high, exceeding the NRA recommendation of 8 feet. All side berms and walls will exceed the minimum standards identified in the NRA Range Source Book.

Ricochet Catchers

When ricochet catchers are constructed, the NRA Range Source Book recommends constructing a barrier embedded into the earth backstop and extending outward at least 6 feet.

³ The NRA Range Source Book is inconsistent regarding maximum rock size. Both $\frac{3}{4}$ inch and 1 $\frac{1}{2}$ inch are stated. This report uses the more restrictive size.

The NRA Range Source Book does not adequately address under what conditions a ricochet catcher should be utilized. However, in our professional opinion the Team Crucible Training Complex could experience backstop deflected bullets leaving their property without ricochet catchers be constructed on all of the earth backstops. Team Crucible has agreed to construct these devices. Be aware that the addition of ricochet catchers exceeds the minimum standards identified in the NRA Range Source Book.

Targets

When steel targets are used, the NRA Range Source Book recommends the minimum distance from shooter to target be 10 yards (30 feet) to prevent bullet splatter from injuring shooters. Paper and cardboard targets have no such recommendation, as the bullets travel through the targets into the backstop. However, the NRA Range Source Book also recommends shooters not shoot closer than 10 yards (30 feet) from the earth backstop they are shooting into. For paper and cardboard targets, the targets should be placed to prevent the distance from the shooter to the earth backstop from being less than 10 yards. The Team Crucible Training Complex will use steel targets, as well as paper and cardboard targets. Administrative controls will be in place to maintain appropriate distances.

The use of backward falling steel plate targets can result in deflected bullets leaving an outdoor shooting range property. Team Crucible will not be using this these types of steel targets.

Ground Surfaces

To control ground deflected bullets, the shooting range industry recommends locating targets such that bullets do not strike the ground surface, rather the bullets strike the impact area of the backstop. The Team Crucible Training Complex will be designed and operated to meet this standard.

4 Administrative Controls

Range safety is not a function of design alone. Often when incidents of bullet escapement have occurred, they are the result of a properly designed and maintained shooting range being utilized improperly. The solution is supervision of the shooting activities.

Shooting range supervision can be accomplished by active or passive means. An example of passive means of shooting range supervision would be posting shooting range rules on the shooting range. An example of active means of shooting range supervision would be the presence of a range safety officer.

An industry accepted method, and one of the most common methods, of controlling direct fire bullets is through active administrative controls. Administrative controls could include educating the range users about safe gun handling rules and enforcing those rules through shooting range supervision by range safety officers.

Safe gun handling rules include, but are not limited to:

1. Keep firearm muzzles pointed in a safe direction. The safe direction on a shooting range is toward the impact area of the backstop.
2. Keep fingers off the trigger until the firearm sights are aligned with the target.

For a firearm to be discharged over the earth backstop, both of these fundamental rules would need to be simultaneously violated. Teaching the safe gun handling rules makes the shooters aware of their responsibility and the consequences of violating the rules. On a supervised shooting range, range safety officers police the shooting activities to enforce the safe gun handling rules.

The Team Crucible Training Complex is an actively supervised shooting facility. No firearms training will be conducted without qualified range safety officers being present and in charge during all firing activities. This meets the highest level of care for the shooting range industry. Team Crucible has an existing record of operating a supervised outdoor shooting range facility, and without a single incident of bullet escapement being alleged at that facility. This indicates an understanding of proper education and enforcement by Team Crucible staff.

5 Conclusion

The Team Crucible Training Complex as proposed would meet current industry standards for shooting range safety. The commercial shooting range industry has an exemplary safety record and Team Crucible has had no reported incidents of bullet escapement on their existing facility, which has been in operation for nineteen years.

The industry standards for this type of facility are as published by the National Rifle Association and the National Shooting Sports Foundation. Specific engineering and administrative controls proposed for the Team Crucible Training Complex meet or exceed those industry standards.

Maintaining safety for shooting range users and the surrounding neighborhood involves a combination of appropriate design and construction, attention to maintenance, and proper operation. The Team Crucible approach to these factors appears to be consistent with a facility being operated at a high level of care. All shooting operations are conducted under the supervision of qualified range safety officers. All shooting range users will be educated about safe gun handling rules and those rules will be enforced by the range safety officers. Engineering controls meet or exceed the recommendations of the industry.



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