**Determination of range of fire & its related phenomena**

1. Muzzle Patterns

When a firearm is pressed against a human target and fired, the muzzle of the firearm leaves an imprint on the target. It indicates contact wound which often are seen in suicide cases. The whole GSR enters into the target. No burning, tattooing or blackening phenomena can be seen around the entrance hole. They tear the skin in star or stellate shape wounds.

1. Scorching

It caused by the flame or hot gases. It is a sure sign that a firearm has been discharged from a close range as they can travel only a few centimeters range in cases of pistols and revolvers and not more than 1 meter in cases of rifles and muskets. It depends on the length of the barrel. It is also known as singeing, burning or charring.

1. Blackening

It is caused by smoke deposit due to burning of powder charge. It is limited to a small range. The intensity is maximum in case of gun powders, less in semi-smoke and least in smokeless powders. It is black in gun powders and greyish black in smokeless powders. The blackening range is three times the burning range.

1. Tattooing

Tattooing is caused by embedding of semi-burnt and un-burnt powder particles into the surface of the target. It is also called as peppering of powders. These particles are slightly heavier than smoke particles. Therefore, they retain motion to longer intervals causing its distance of about one and a half times the blackening range. The age and quality of powders have predominant effect on the range and intensity of tattooing.

1. Powder Residues

The amount of powder residues left at the target is dependent upon the range. The maximum powder range in handguns is about one meter. It is often used in cases of alleged suicides.

1. Metal Particles

They are produced by lead fouling and scraping of the projectiles and form part of the ejected charge. They being heavier, travel longer distances than the powder or smoke particles range. They are detected by X-rays or chemical tests.

1. Wad Distribution

They enter the target up to about three meters. If they are not obstructed, they scatter from five meters to about ten meters or more. If the distance between the wads and victim is known, the range of fire can be identified. Factors affecting its movement include weather, velocity, and direction of wind.

1. Pallet Patterns

The distance covered by pellets fired from a shot gun is proportional to the distance between the muzzle of the firearm and the target. Greater the range, greater is the area covered. The spread is affected by the length of barrel, choking, and condition of the ammunition.