Study on the Disposal Method of Unexploded Riot Bomb

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Abstract—Based on the structure and mechanism of flash riot bomb widely equipped by PAP, the paper discusses the disposal methods, procedures and preventive measures. The unexploded reasons for flash riot bomb can be divided into three typical situations, one is human error, the other is firing mechanism failure, and the third is ignition tube failure. Corresponding disposal methods are re-throwing, provoking and bundling detonation, and the procedures are also refined. On this basis, effective preventive measures such as strengthening training and education, intensifying prior inspection and establishing a risk assessment mechanism were proposed. Through above research, it can effectively guide PAP to improve the ability to dispose unexploded bombs on the spot, which has important practical significance for ensuring actual combat training.

1. Introduction
Riot bombs are indispensable equipment for PAP to handle sudden incidents, counter-terrorism and maintain stability, and play an irreplaceable role in the implementation of various tasks [1-3]. With the advancement of actual combat training, there are more and more opportunities to use various riot bombs in the training process. Due to improper use methods or a small number of quality defects, the emergence of unexploded bombs had become a relatively common phenomenon. Because soldiers do not have a deep understanding of riot bombs, and have a sense of fear when disposing, the disposal of unexploded riot bombs had become a problem that plagued military training and equipment management. In order to guide PAP following the relevant spirit, this paper studied on the disposal field on the basis of the relevant learning materials and experience.

Riot bombs can be roughly divided into combustion type and explosive type according to the mode of action. When the combustion riot bombs occurred unexploded, the safety of whole was still relatively high, that is say the transform of burning to detonation does not occur generally. So general-purpose ammunition disposal methods can be adopted for the combustion riot bombs. Explosive riot bombs have a higher probability of exploding, but they are not as powerful as general-purpose ammunition in terms of power range and elimination complexity. Generally, it is not necessary to use professional units for disposal, but safe measures must be taken in oneself. The paper took a flash riot bomb as research object, analysed the unexploded reason, clarified the disposal methods and procedures, and proposes corresponding preventive measures. It can provide the grassroots theoretical basis and technical support for PAP to dispose of unexploded riot bomb on-site by relying on its own strength.
2. Theoretical part

2.1. Concept
In the paper, the unexploded bomb means that it should explode after being shot or thrown without exploding or incompletely exploding. Because the insurance mechanism has been partially or completely removed, it is very easy to explode under external force or electromagnetic effects.

2.2. Introduction to blast bomb

2.2.1. Structural Features. The flash riot bomb is made of all-plastic material and consists of three parts: body, flasher, and firing device, its appearance and structure are shown in Figure 1. It has the characteristics of light weight, strong flash, strong sound, safety and reliability [5], mainly used in anti-terrorism, anti-attack, anti-hijacking, capture, quelling riots, and high-risk intrusions.

Figure 1. Appearance and structure of flash riot bomb

2.2.2. Technical Features. The flash riot bomb belongs to non-lethal weapon that uses the dazzling strong light generated during the explosion to stimulate eyes of a living target and produce a huge sound, which makes the living target temporarily blind and dizzy. But it has no permanent hurt effect on the human body.

2.3. Security analysis
Because riot bombs usually release sound, light, smoke, fog, aerosols and other irritating substances by burning or exploding. Generally, they do not achieve combat effectiveness by hitting or damaging targets, the ability is limited to kill people and objects, so the accidental effect of riot bombs may cause less damage than conventional ammunition [6,7]. This technical feature determines the overall relative safety of the disposing process.

2.3.1. The characteristics of flash riot bombs determine that the damage to the human body is limited. Because Flash riot bomb adopts the granulating powder press-packing design and contains more functional agents, which makes it more powerful when exploring. Although it belongs explosive-type riot bomb, its effect on living targets is mainly reflected in strong flashes and strong sounds. Because of its plastic material, its fragments have limited damage to the target. According to the relevant technical specifications, a non-contact explosion of flash riot bomb within 1m from the human body will not cause fatal consequences; if it explodes within a distance of 1 to 6m, its fragments can only cause scratches to the bare skin; if the distance exceeds 6m, the hit probability is greatly reduced, there is basically no substantial damage to the human body, and the fragmentation damage can be ignored. By setting a safety distance, constructing a civil shelter and requiring the operator to wear a helmet and protective clothing, the safe can be ensured to the greatest extent.

2.3.2. The structural characteristics of flash riot bomb determine that it is safe in the unfired state. The unqualified products with defects such as "premature explosion" are mainly caused by the
insufficient delayed firing time of ignition tube, but firing and insurance institutions are qualified. Therefore, the bomb is very safe in the unfired state, and the operator does not need to bear additional risks when transporting, disassembling the outer packaging, exploding and disposing of it.

3. Analysis of unexploded conditions and disposal methods

3.1. Analysis of unexploded situation

From the actual situation, the reasons of unexploded riot bombs can be mainly divided into three typical situations

3.1.1. Situation I (Human errors). In situation I, safety pin was not pulled out to make firing mechanism locked, because the thrower is nervous or absent-minded. The situation usually appears in the recruits or the first thrower. Seen from the structure of flash riot bomb, safety pin is a key component of the firing mechanism and it must be pulled out before throwing, otherwise riot bomb will not work. Therefore, there is no disposal danger in this situation.

3.1.2. Situation II (firing mechanism failure). In situation II, safety pin has been pulled out, but safety handle did not fall off or firing pin flap was not turned in place, as shown in Figure 2. This situation is mainly caused by firing mechanism failure. It means that safety handle and firing pin flap usually had an interference fit, which causes the fuse handle to be stuck and cannot fall off, or the fuse handle has been fall off but firing pin flap was stuck and not in place. At this time, riot bomb was in a state of instability. Once it is subjected to vibration, firing pin flap is extremely easy to flip in place, and then cause firing.

3.1.3. Situation III (ignition tube failure). There are two reasons in situation III. The first is that firing pin flap has been turned over but failed to penetrate the metal skin of ignition tube, and fail to fire normally. The reason was analyzed that firing pin flap may encounter resistance during the turning process, which caused the strength of firing pin too week to penetrate ignition tube. Another possibility reason is that the mechanical strength of the metal skin is so high that firing pin was unable to penetrate, shallow pits on the surface is manifested as shown in Figure 3(a). In this time, the potential energy of firing pin had been exhausted and it was in close contact with ignition tube. Flash riot bomb was in a stable state, However, which cannot be confirmed visually due to the limited viewing angle.

The second is that ignition tube failed to fire normally so that internal charge unexploded. The front end of ignition tube was broken down, but the end does not ignite, as shown in Figure 3(b). The reason was analyzed that ignition tube had poor quality and major quality defects, which was misfire or extremely slow fire transmission speed (more than 3 seconds). At this time, the riot bomb is in an extremely unstable state, and there is still the possibility of explosion. However, due to the uncertainty of fire transmission time, in some cases an explosion occurred at the17st minute after throwing. Therefore, operator must be careful to disposal.
3.2. Analysis of disposal methods

Three situations above often occurred in daily training, and the corresponding on-site disposal methods were introduced below.

3.2.1. Rethrowing. The corresponding on-site disposal method of situation I was relatively simple. After careful observation and confirmation by the thrower, he picked up riot bomb and carefully checked for bomb body. If body had not been in damage, deformation and other abnormal conditions, it can be re-thrown in accordance with normal operating procedures. If the body was broken, leaked, or the insurance mechanism is deformed, it should be handed in in time, kept properly, and finally destroyed as a problem bomb.

3.2.2. Provocative firing. In situation II, safety handle or the firing pin flap is stuck and cannot be turned over. The corresponding on-site disposal method should apply appropriate external force to force it to detach or turn over. Generally, a special EOD rod for riot bombs can be used for provocation operations, as shown in Figure 4(a) [8]. In an emergency, a wooden stick of more than 2 meters can also be used to strike. This disposal method will eventually cause a firing and complete the EOD. At last, once the safety handle was observed to turn over or ignition tube was heard firing, the operator should quickly evacuate to a safe distance.

3.2.3. Bundle detonation. Since the state of ignition tube cannot be observed in the third case, it must be detonated. First, by replacing the operating end of the EOD rod for riot bombs, the operator can put a normal riot bomb into the operating end, and then pull out safety pin. Second, the operator used external force to slowly approach the unexploded riot bomb, made the two riot bombs together by special tools, such as shown in Figure 4(b). Third, after the two riot bombs were bound, the operator pressed the release button to make the two bombs drop into a dug pitted previously, when unexploded riot bomb was detonated through normal bombs.
3.3. Analysis of disposal process

3.3.1. Institutional settings
1. Command team. It was composed of on-site commanders, liaison officers, etc., who were responsible for on-site command and dispatch.
2. Operation team. It was composed of trained officers and soldiers, who were responsible for site setting, digging, operation, and site cleaning.
3. Guard team. It was composed of service cadres and security soldiers, who were responsible for the security and defence duties of EOD operation area.
4. Service team. It was composed of medical, fire-fighting and mobile standby personnel, who were responsible for medical rescue, firefighting and temporary or emergency handling.

3.3.2. Operation Process
1. Organize the venue. Set up a work site in accordance with the requirements of EOD operations.
2. Prepare equipment. According to the unexploded situation, prepare to protect materials and equipment.
3. Determine the location and status. Observe the status of unexploded ordnance, ask the parties concerned, approve the type and quantity, and do a good job of registration and identification.
4. Detonation. The leader of operation team checks the preparations, reports to the on-site commander, and implements manual detonation after approval.
5. Inventory. After the operation is completed, the site shall be thoroughly cleaned up to prevent the leakage of residual parts and explosives, which may cause accidents.

3.3.3. Implementation steps
1. Observe and ask carefully. The main purpose is to find out the number of unexploded bombs and the reasons for unexploded, distinguish the types and the degree of danger, and register while checking and classifying, and determine the correct disposal method.
2. Plan and draft carefully. It is mainly based on the number and types of unexploded bombs to study and formulate a disposal implementation plan, clarify the scope and disposal method, and determine the time, tasks, procedures, requirements and safety measures.
3. Preparation of personnel, venue and material. The main task is to select outstanding officers and soldiers to participate in disposal, clarify responsibilities, and do a good job in education and training. The posterior task is to pre-select and set up venues, raise and inspect security materials and equipment.
4. Strict organization and scientific implementation. It is necessary to strengthen the organization and leadership, abide by the operating procedures, and implement the technological process. At the same time, key tasks such as guard duty guarantee also should be strictly organized.
4. Preventive measures

4.1. Strengthen education and training

In practice, most offender did not fully participate in the preliminary training, and not have enough understanding of the basic performance of riot bombs, such as structure, ignition principle, and safe landing height. Under the pressure of dignified atmosphere in the live ammunition throwing scene, the fear caused excessive tension; At the same time, effective neuromuscular memory was not formed because they did not master the key throwing skills and practiced little throwing movement. Therefore, all participation in the preliminary training is an important measure.

Before organizing throwing, offices must seriously organize soldiers to learn the mechanism, mechanism of action, and operation methods of riot bombs. The methods of education must be flexible and diverse, focusing on effects. Especially for recruits or first-time throwers, appropriate observation can be increased to relieve tension and fear. In addition, practice should be done step by step, that is to say, recruits should first use the riot bomb with less dangerous to practice, and then use the explosive riot bomb. Generally, the throwing process is not required to be neat and uniform, but in the form of individual moves. In addition, it is necessary to formulate corresponding safety plans to prevent accidents.

4.2. Intensify pre-inspection

Like general-purpose ammunition, riot bombs follow a certain production law, and the rate of inferior products is inevitable. Generally speaking, the rate of serious defects such as misfire shall not be higher than 2%. For the treatment of such unqualified products, on the one hand, manufacturers must increase product inspection efforts, and try to pick out defective products as much as possible in advance to prevent them from flowing to the army. On the other hand, organizers or offices should pay attention to inspection before actual practice, such as organizing small-scale trial launches in advance, so as to discover possible problems with the batch. In addition, organizer should educate users not to remove the outer packaging of riot bombs during the carrying process in order to protect the structure. Before using, the operator should carefully check the firing mechanism and kill mechanical failure in advance.

4.3. Establish a risk assessment mechanism

The use of riot bombs is a systematic project. Organizers or offices should establish a risk assessment mechanism. By adopting a top-down deployment, bottom-up assessment step by step, a comprehensive analysis and evaluation was conducted and closely focus on personnel training level, personnel psychological quality, and daily management level, quality monitoring system and other aspects. It can predict the possible unexploded bomb category, probability, hazard, etc, determine the risk level, and formulate preventive measures.

5. Conclusion

Under the new situation of intensive combat-oriented military training, the task of disposing unexploded riot bombs for PAP has become more and more onerous. Because of its strong professionalism and extremely dangerous, it has become a difficult problem that cannot be ignored. The paper analyzed the unexploded reason, proposed the disposal methods and procedures, and proposed preventive measures based on the actual situation of PAP. Specific operations and suggestions were also put forward to avoid danger.

1. In view of the structural characteristics and mode of action of riot bombs, the reasons for three typical unexploded cases are distinguished as human errors, firing mechanism failure and ignition tube failure. The corresponding on-site disposal methods are re-throwing, provocation firing and bundle detonation.
2. Starting from the three aspects of institutional setting, operation process and operation steps, specific specifications for the on-site disposal were put forward, which provides a theoretical reference for the formulation of relevant regulations and systems.

3. The preventive measures were discussed and drawn that education and training should be strengthened, pre-inspection should be strengthened, and risk assessment mechanism should be established.

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