

# Crowd-Control Weapons and Social Protest in the United States

PHR Primer – June 2020

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## Introduction

Physicians for Human Rights (PHR) has studied the overuse and misuse of crowd-control weapons (CCWs), which include a range of weapons typically used by law enforcement in a wide range of countries and contexts to discourage and disperse public protests. While these weapons are often referred to as “non-lethal” or “less than lethal,” our research and investigations have shown that CCWs often cause severe injury and even death. The following information on commonly used CCWs draws from several sources, including PHR’s report [“Lethal in Disguise: The Health Consequences of Crowd-Control Weapons.”](#)

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## Tear Gas and Pepper Spray

In response to recent protests against racism and police brutality, law enforcement officers across the United States have deployed tear gas and pepper spray to disperse crowds. In Louisville, Kentucky, a [reporter](#) was hit by a pepper ball while on live television delivered by an officer who appeared to be aiming right at her. In New York City, a police officer stood before a [young man](#) with his hands up, pulled down his mask, and shot pepper spray directly into his face. In Washington, DC, the Trump administration instructed U.S. Park Police to use pepper balls and other CCWs against peaceful protesters. Contrary to Attorney General William Barr’s [assertion](#), pepper spray is classified as a chemical by the [U.S. Centers for Disease Control and Prevention](#) and [Department of Justice](#).

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## Overview

Tear gas and pepper spray are common terms for a variety of chemical compounds intended to produce sensory irritation. The most commonly used chemicals include CS gas and its successors, as well as pepper (oleoresin capsicum (OC), a highly concentrated and weaponized form of chili peppers, and its synthetic version, PAVA). While different compounds, they cause similar symptoms: pain to the eye, eyelid spasm, and a burning sensation to the skin. They also cause respiratory distress as well as disorientation and agitation. They are typically deployed either as a spray or via a canister/grenade. More recently, tear gas canisters have been fired as projectiles to target individuals. Chemical irritants (CIs) are inherently indiscriminate and the risk of exposing bystanders and individuals, including vulnerable people, who are not intended targets, is high.



A 40mm CS gas canister used during the 2020 George Floyd Protests in Portland, Oregon.

While these weapons are often referred to as “non-lethal” or “less than lethal,” they often cause severe injury and even death.

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## Tear Gas and Pepper Spray *continued*

### How they work

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These agents work on pain and temperature receptors to cause sensations of burning and severe pain. Since pepper spray is an oil, even small concentrations of it can penetrate skin and enter mucous membranes, causing severe and prolonged discomfort.

### Device Types

**Grenade and canister:** This method of deployment produces a cloud of chemicals, usually within 60 seconds. It is indiscriminate by nature and can spread to unintended targets and bystanders. Gas canisters are sometimes deliberately misused as projectile weapons fired directly at protesters at close range.

**Spray:** Aerosolized streams of irritants can be sprayed at distances of 2.4-3.6 meters (approx. 8 to 12 feet) in one- to two-second bursts, allowing for potentially higher doses of the chemical agent to directly strike targeted people or groups.

**Other systems:** CIs can also be dissolved in water to be used in water cannons or fire hoses or contained as a powder inside a spherical projectile (similar to paint inside a paintball).

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### Health Effects

CIs can cause injuries to many different body systems, depending on the exposure times, concentrations, the ability of the exposed person to leave the area, and prior medical conditions or vulnerabilities.

**Eyes:** Irritation of the conjunctiva and cornea produces tearing, uncontrollable eyelid spasms, redness, and pain. The severe spasms can cause the lids to close tightly and produce temporary blindness. Severe injuries may include corneal burns, abrasions, lacerations, and blindness.

**Respiratory system:** CIs cause inflammation of the airways and pain. Coughing, difficulty breathing, and sputum production are common. Individuals with pre-existing respiratory disease may be more sensitive to these agents, even at low concentrations. Exposure may precipitate attacks of respiratory distress resulting in hypoxia, respiratory arrest, and death.

**Skin:** CIs cause a severe burning sensation to the skin as well as redness, itching, or allergic reactions. Erythema (redness of the skin) usually begins several minutes after contact and can last for minutes or days after the injury. Blistering and burns of the skin as well as allergic skin reactions may also occur.

**Psychological:** The physical symptoms of CI exposure often result in disorientation and agitation, which can lead to a state of fear, anxiety, and panic. In some instances of prolonged and repeated exposure to CIs in protest settings, symptoms of post-traumatic stress disorder have been documented.

**Cardiovascular:** CIs can cause increases in heart rate and blood pressure. Preexisting heart conditions, in combination with those physiological responses and the low oxygen from the impact on the lungs, may result in heart attack and possibly death.

**Oral and gastrointestinal mucosa:** Irritation of the nose produces a burning sensation, inflammation, rhinorrhea, and sneezing. In the mouth and gastrointestinal tract, exposure to CIs can cause pain, excessive salivation, and nausea and vomiting.

## Chemical irritants are inherently indiscriminate and the risk of exposing bystanders and individuals who are not intended targets is high.

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### Tear Gas and Pepper Spray *continued*

#### Health Effects *continued*

**Trauma:** Direct impact by the canisters and grenades carrying tear gas can cause significant blunt trauma and death. Particularly dangerous are injuries to the head and neck. Bruises, abrasions, and lacerations are common, and, at closer range, bone fractures and serious internal injuries are possible.

A systematic review of medical literature documenting the health effects of chemical irritants identified 5,131 people in 11 countries who suffered injuries worldwide; two of these people died and 58 suffered permanent disabilities. Out of 9,261 documented injuries, 865 (8.7 percent) were severe and required professional medical management, while 1,582 (17 percent) were moderate and 6,878 (74.3 percent) were minor. The canisters caused traumatic injuries to the head, neck, and torso, as well as neurovascular injuries to the extremities. Eye injuries from the canister all led to permanent vision loss, most often from globe rupture. Children, the elderly, and those with chronic respiratory health conditions were at a higher risk of injury.

Chemical irritants are an indiscriminate weapon by design, especially when delivered by firing a grenade or a canister, so it is difficult, if not impossible, to limit the exposure to individuals or small groups without affecting bystanders.

In addition, the diagnosis and treatment of chemical irritant exposure is complicated because of the combination of different chemicals and the lack of transparency about the agents used. The chemical agent known as CS and its successors can linger on surfaces and in neighborhoods, causing symptoms hours and even days after their first use. Tear gas is frequently misused in crowd-control settings. Disproportionate firing of canisters, targeting individuals, or firing from close range or in enclosed spaces or areas where people cannot leave can dramatically worsen injuries and even cause death.

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#### Recommendations

- Firing gas canisters or grenades directly into a crowd or towards individuals should be prohibited.
- Firing grenades or canisters containing CIs into closed spaces or open spaces where there is no safe egress should be prohibited.
- Mixing more than one chemical agent or dissolving the agent into the liquid used in water cannons should be prohibited.
- Firing multiple canisters in the same spot or firing repeatedly should be avoided, as this can cause serious injury or even death.
- Caution should be used during deployment to stop the effect from spreading to unintended targets and bystanders.
- Contextual factors should always be considered before making a decision to deploy indiscriminate CIs: geographical nature of the deployment site, wind patterns and temperature, or the existence of hospitals, schools, or dense uninjured populations in the vicinity.

# At close range, kinetic impact projectiles can strike with high force that can be lethal.

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## Kinetic Impact Projectiles

Law enforcement officers responding to recent protests against racism and police violence have fired kinetic impact projectiles (KIPs) into crowds, causing a range of injuries. In Minneapolis, [Linda Tirado](#), a freelance photographer, was hit by a rubber bullet to her face, causing loss of vision in her left eye. An 18-year-old [man](#) in Sacramento was shot in the face and hospitalized for a broken jaw. A [community organizer](#) in San Jose who was trying to deescalate tensions between police and peaceful protesters got shot in the groin, leaving him with a ruptured testicle and possibility sterility. A [grandmother](#) in La Mesa was shot by a bean bag round between her eyes and ended up in intensive care. An [actor](#) reported being hit seven times at close range and having to get stitches. A [woman](#) in Minneapolis who was providing first aid in a medic tent during a demonstration described being shot at while trying to provide medical care to an injured man. A [journalist](#) in Long Beach got hit in the throat and posted photos of his injury.

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## Overview

Rubber bullets and other KIPs include a range of projectiles used in crowd-control settings that are made from combinations of rubber; plastic; PVC; wood; hard foam; wax; and even in some cases various metals, including lead and steel. Some bullets are designed to be fired as a single missile, while others are fired as a group of pellets (“shot”). The projectile’s force depends on a number of factors, including its size and speed. In addition, the shape of the projectile, its ability to break apart, the number of projectiles fired at once, and the direction in which they are fired can all impact how the projectile functions.

KIPs are inherently inaccurate when fired from afar and therefore can cause unintended injuries to bystanders and strike vulnerable body parts. At close range, they can strike with high force that can be lethal when they target the head or other vulnerable areas of the body. Our research suggests that KIPs are not an appropriate weapon to be used for crowd management and specifically for dispersal purposes.

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## How they work

KIPs work by transferring kinetic energy from a weapon into a person. KIPs are purportedly designed to inflict pain and incapacitate an individual without penetrating the body. In theory, the larger shape and slower speed of KIPs should limit their ability to penetrate the skin or cause deep blunt trauma injury. However, due to their irregular shape and slower speed, KIPs are often inaccurate and therefore can strike vulnerable body parts or unintended targets.



Police officers hold back demonstrators protesting the G8/G20 summits in 2010 in Canada. Photo: Scott Olson/Getty Images.

## Some types of KIPs have the same ability to penetrate the skin as conventional live ammunition and can be just as lethal.

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### Kinetic Impact Projectiles *continued*

#### Device Types

**Rubber and plastic bullets** are solid, spherical, or cylindrical projectiles of variable sizes fired as single shots or in groups of multiple projectiles. Pellets can be made of rubber, plastic, PVC, or a composite that includes metal.

**Bean bag rounds**, also known as **flexible batons**, are synthetic cloth bags filled with small metal pellets that are fit into a cartridge and expand as they travel to create a broader surface area of impact.

**Sponge rounds** is a term for projectiles that limit penetration of the projectile into the skin by having a tip or nose that is slightly softer. These include foam rounds with a hard foam nose or attenuated energy projectiles with a hollow nose.

**Pellet rounds** are cartridges filled with small lead, steel, or plastic/rubber pellets that disperse when fired. In the United States, terms such as “stingerballs” or “combined tactical systems” refer to these cluster munitions.

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### Health Effects

KIPs can cause blunt or penetrative trauma. Penetrative injuries are those that pierce the skin or soft tissue. Blunt injuries are those that cause internal damage without breaking the skin barrier. All projectiles can cause these injuries based on the force and location of

**Eyes:** Direct trauma to the eye from KIPs causes permanent blindness in that eye to the vast majority of survivors, due to rupture of the globe (eyeball) as well as trauma to nearby structures. KIPs can also penetrate through the eye socket and enter the brain, causing brain injury.

**Cardiorespiratory System:** KIPs can cause bruising of the lungs or heart, and penetration into the chest may cause serious, possibly fatal, injuries.

**Musculoskeletal System:** Injuries to the muscles and bones may cause bruises and fractures. Deeper injuries can cause permanent damage to the neurovascular structures, leading to amputations or compartment syndrome.

**Brain:** Blunt trauma to the brain can cause concussions and bruising inside the brain as well as different types of bleeding in the brain (intracranial hemorrhage) and skull fractures. KIPs have also been known to penetrate the skull or enter the brain tissue, causing hemorrhage and permanent brain damage.

**Head and Neck:** The delicate structures of the face and neck are particularly vulnerable to traumatic injury. The bones of the face and skull, the spinal cord, and the blood vessels in the neck are all close to the skin surface.

**Abdominal:** Blunt injuries can cause bleeding in the solid organs, such as the liver, oleoresin capsicum kidney, and spleen. Penetrative injuries can also cause bleeding, perforations, and urogenital injuries.

**Skin and Soft Tissue:** KIPs can cause bruising and contusions of the skin and soft tissue, as well as superficial and deep lacerations, some of which may cause muscle or nerve damage as well as bleeding.

## KIPs should never be fired at close range and should never be targeted at the head or other vital areas of the body.

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### Kinetic Impact Projectiles *continued*

#### Health Effects *continued*

The findings of a systematic review of medical literature indicate that KIPs cause serious injury, disability, and death. Our study identified 1,925 people with injuries from KIPs; 53 of these died from their injuries and 294 suffered permanent disabilities. Of all people with injuries, 70 percent were considered severe (i.e. required professional medical treatment).

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#### Recommendations

- Indiscriminate KIPs that fire multiple projectiles, such as shotgun pellets and other types of ammunition, should be prohibited in the context of protest.
- KIPs should never be fired at close range and should never be targeted at the head or other vital areas of the body, where impact typically causes serious injury and, in many instances, death.
- The data demonstrates that severe injuries are more likely when KIPs are fired at close range; some types of KIPs have the same ability to penetrate the skin as conventional live ammunition and can be just as lethal. When launched or fired from afar, these weapons are inaccurate and strike vulnerable body parts, as well as cause unintended injuries to bystanders. Therefore, there are significant doubts that these weapons can be used in a manner that is simultaneously safe and effective.

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### Flash-bangs (Stun Grenades)

In Seattle, a [young woman](#) went into cardiac arrest after being hit in the chest with a blast ball fired by law enforcement officers at a recent protest; she only survived because street medics performed CPR. Also in Seattle, a [television reporter](#) was hit while on the air with a flash-bang, which singed her jacket. In Washington, DC, the Trump administration's [attack on peaceful protesters](#) in front of the White House also involved flash-bangs.

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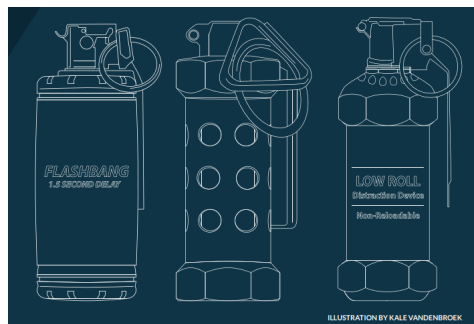
#### Overview

Disorientation devices, also known as concussion grenades, flash-bangs, stun grenades, or blast balls, are weapons that create a loud explosion and/or a very bright flash of light. Originally developed as a military weapon, the use of disorientation devices in crowd-control settings has increased significantly over the past several years. While their stated objective is to cause disorientation and a sense of panic, the potential for injuries caused by the pressure of the blast or by shrapnel from the fragmentation of the grenade is disproportionately high, and could even lead to death. Therefore, these weapons have no place in effective crowd

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#### How they work

Disorientation devices are usually constructed like a conventional grenade, with explosive powder that ignites when struck by a fuse. The grenade is thrown and explodes after a roughly 1.5-second delay. The exploding magnesium-based pyrotechnic chemicals cause a very bright flash and a loud sound (160-180 decibels), which can cause temporary blindness, temporary loss of hearing, and loss of balance, as well as a sense of panic. Parts of the device can burst and travel as shrapnel.



Source: Lethal in Disguise. PHR-INCLC report, 2016.

# Acoustic weapons use hundreds of modern transducers to create highly concentrated and amplified sound.

## Flash-bangs (Stun Grenades) *continued*

Case reports, news media, and even police reports have identified the risks associated with disorientation weapons. Many of the reported injuries involve severe burns resulting from the weapons being fired at close range, in enclosed spaces, or in dense crowds.

### Health Effects

**Primary blast injury:** This results from pressure shock waves from the blast. These can cause internal injuries, especially of delicate membranes like the eardrum.

**Secondary blast injury:** The explosion and fragmentation of objects can cause blunt and penetrating trauma.

**Tertiary blast injury:** The displacement of air can push people into solid objects, causing blunt and penetrating trauma.

**Quaternary blast injury:** Other parts of the explosion can cause miscellaneous injuries such as burns, respiratory injuries, crush injuries, and psychological trauma. In addition, crush injuries may result from the panic and chaos caused by large moving crowds that have suddenly become disoriented.

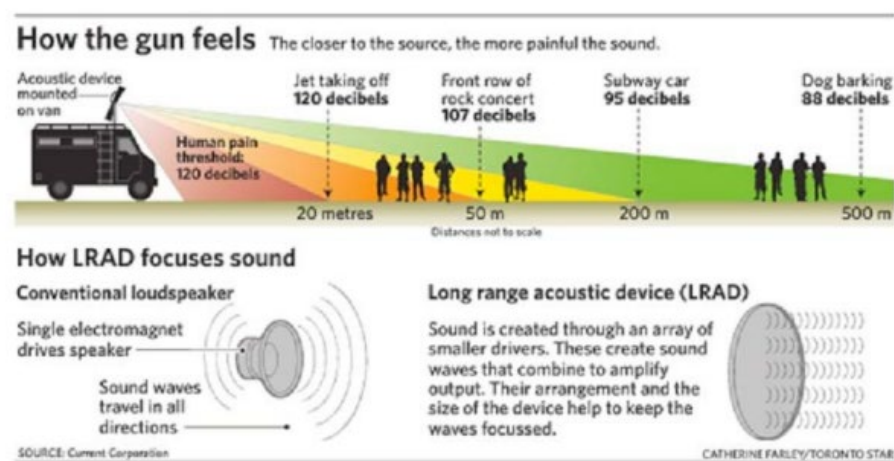
A *ProPublica* report in 2015 documented more than 50 cases of death and serious injury from law enforcement use of stun grenades since 2000 in the United States alone.

### Recommendations

- Prohibit the firing of stun grenades directly into crowds or towards individuals.
- Significantly tighten quality control and regulation of disorientation devices.

## Acoustic Weapons

In recent weeks, police have reportedly used long range acoustic devices against protesters in Austin, Charleston, Chicago, Colorado Springs, Columbus, Fort Lauderdale, New York City, Phoenix, Portland, and San Jose.



# The baton has a greater risk of lethality than tear gas.

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## Acoustic Weapons *continued*

### Overview

Acoustic weapons, also known as long-range acoustic devices and sound cannons, are devices that deliver very loud sounds over long distances. This technology is used for crowd-control purposes by emitting loud and painful levels of noise that may lead to significant harm to the ears, potentially causing hearing loss. Serious questions remain about the safety and efficacy of acoustic weapons in crowd-control contexts.

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### How they work

Acoustic weapons function by emitting loud, painful, and even dangerous levels of noise. They use hundreds of modern transducers to create highly concentrated and amplified sound. This fairly narrow beam can focus on specific targeted areas. The sound is designed to be controlled by police officers who can alter the frequency, level, quality, and duration of the alarm. Abuse or lack of operator knowledge about the health effects can exacerbate injury.

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### Device types

The **LRAD (Long Range Acoustic Device)** brand: The LRAD has a range of 8,900 meters (9,730 yards) for intelligible speech and a maximum output of 12 decibels at one meter (3.3 feet). It can cause pain at 20 meters (22 yards) and permanent hearing loss at close range (five meters [5.5 yards] or less).

**"The Mosquito"**: A high-pitched sound weapon that is audible and painful to younger people, while leaving older people (30s and older) unaffected.

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### Health Effects

There is little medical literature on the effects of acoustic weapons on people. There are cases reported between 1990 and 2015 of hearing loss and prolonged ear pain or ringing, but adequate scientific research is not yet available to develop consensus on specific health effects. However, it is clear from reports about actual use that the weapons can be indiscriminate, causing harm or pain to protesters, bystanders, and even law enforcement officers themselves.

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### Recommendations

- Based on initial case reports, there are serious concerns about the high potential of acoustic weapons to cause serious and permanent injury, particularly if they are utilized more frequently. The use of acoustic weapons in protests should be suspended at least until such concerns are addressed.

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## Batons and Shields

There have been numerous cases of law enforcement officers using batons and shields against demonstrators.

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### Overview

A baton or truncheon is a roughly cylindrical club made of wood, rubber, plastic, or metal. A shield is a piece of equipment, usually made of strong plastic or other hard synthetic material, carried in front of one's chest as a protection device. Some ballistic shields are designed to stop or deflect bullets fired or other items thrown at their carrier. Shields typically are long enough to cover an average-sized man from the top of the head to the knees.

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### How they work

As with any hard object, batons and shields if used to strike another person can cause severe blunt injuries leading to bone fractures, serious internal bleeding, and head concussions. The baton in particular has a greater risk of lethality than tear gas.



# The state has a duty to protect those exercising their right to peaceful assembly from any type of violence, including violence from law enforcement agents and other protesters.

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## International Human Rights Law on CCWs

The Universal Declaration of Human Rights (1948) and the International Covenant on Civil and Political Rights (1966) protect the right to freedom of assembly, including the right to hold public or private meetings, marches, processions, demonstrations, and sit-ins.

The state has a duty to protect those exercising their right to peaceful assembly from any type of violence, including violence from law enforcement agents and other protesters. As long as the purpose of the assembly is peaceful, incidental violence does not discharge the state from this obligation to protect.

International legal principles, including the UN Basic Principles on the Use of Force and Firearms (1990), require law enforcement agencies to adopt rules and regulations for the use of force within the following parameters:

- The use of force must be minimized, targeted, proportional, and directed at de-escalating violence.
- The use of “less than lethal” incapacitating weapons must be carefully controlled.
- The deployment of “less than lethal” incapacitating weapons must occur in a manner that minimizes the risk of endangering uninvolved persons.
- Restraint must be shown in all use of force by law enforcement agents, with a view to minimizing injury and loss of life.
- Any use of force against a public assembly should be followed by a proper reporting and accountability process to determine whether it was lawful, necessary, and proportionate.

In addition, the state has an obligation to ensure that assistance and medical aid are rendered to any injured or affected persons at the earliest possible moment.

International human rights principles have been violated if the use of “less than lethal” incapacitating weapons is not adequately regulated, or if the weapons are used in an indiscriminate manner. Since CIs are inherently indiscriminate, the legality of their use is questionable and should be severely restricted.

The Chemical Weapons Convention (1993) prohibits the use of all “riot control agents,” including tear gas and pepper spray, as methods of warfare. The UN Human Rights Guidance on Less-Lethal Weapons in Law Enforcement (2020) outlines the legal framework for the use of each type of crowd-control weapon. National and local laws and regulations are limited and often not publicly available.

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## Overall Recommendations

- The use of CCWs in assemblies should be an absolute last resort when dealing with genuine and imminent threats to the safety of those present, and only after all other means have been exhausted.
- Even in the context of protests, where there are people who either engage in or incite others to engage in acts of violence and which require police intervention, the explicit goal of intervention should be to de-escalate the situation, and promote and protect the safety and the rights of those present – protesters, journalists, medical personnel, monitors, and bystanders.
- If CCWs are deployed, their use should always be necessary and proportionate to the threat faced and to the legitimate aim pursued. Any use should be targeted and should never be indiscriminate.

The use of CCWs in assemblies should be an absolute last resort when dealing with genuine and imminent threats to the safety of those present, and only after all other means have been exhausted.

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## Overall Recommendations *continued*

- Law enforcement should ensure that proper medical assistance is available to provide aid promptly when CCWs are deployed. Law enforcement should never interfere with or obstruct emergency medical response. Transparency to the public, health care providers, and first responders is critical to assure appropriate treatment of injuries and other health consequences.
  - Law enforcement officials should record and report any use of CCWs, including specific models of CCWs deployed, the distances from the targeted individuals/bystanders and duration of deployment, the number of each type of CCW used, and documented or reported injuries caused by CCWs. Their reporting must demonstrate that the use of CCWs was proportionate, necessary, and legal.
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## Looking Forward

The American Academy of Ophthalmology, the leading U.S. medical organization representing eye doctors, in a [statement](#) issued on June 3, called on law enforcement officials to “immediately end the use of rubber bullets and similar projectiles to control or disperse crowds of protesters.” The American Thoracic Society, an organization representing lung disease and critical care specialists, issued a [call](#) on June 11 for a moratorium on the use of tear gas, pepper spray, and other chemical agents against demonstrators.

Efforts are now underway to restrict or ban the use of specific crowd-control weapons against protesters in [Austin](#), [Berkeley](#), [Boston](#), [Denver](#), [the District of Columbia](#), [Louisville](#), [New Orleans](#), [Pittsburgh](#), [Portland](#), [Salt Lake City](#), [San Francisco](#), [San Jose](#), [Seattle](#), and elsewhere. There are also [county](#), [state](#), and [national](#) efforts.

New attention to the dangers of crowd-control weapons in the United States presents an opportunity for lasting change.

Additional Resources: The information in this document comes from the following sources: [Health impacts of chemical irritants used for crowd control: a systematic review of the injuries and deaths caused by tear gas and pepper spray](#); [Death, Injury and Disability From Kinetic Impact Projectiles in Crowd-Control Settings: A Systematic Review](#); [No Safe Space: Health Consequences of Tear Gas Exposure Among Palestine Refugees](#); [PHR & INCLO Crowd Control Weapons Factsheets](#).



Physicians for  
Human Rights

**For more than 30 years, Physicians for Human Rights (PHR) has used science and the uniquely credible voices of medical professionals to document and call attention to severe human rights violations around the world. PHR, which shared in the 1997 Nobel Peace Prize for its work to end the scourge of landmines, uses its investigations and expertise to advocate for persecuted health workers and facilities under attack, prevent torture, document mass atrocities, and hold those who violate human rights accountable.**