CHEMICAL IRRITANTS

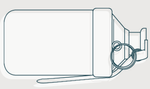
Chemical irritants (CIs), commonly known as tear gas and pepper spray, are used for crowd-control purposes by law enforcement worldwide. While CIs are often thought of as causing minimal, transient harm, the findings of a systematic review of medical literature carried out by Physicians for Human Rights identify troubling levels of morbidity and even instances of death caused by these weapons. CIs are inherently indiscriminate and therefore the risk of exposing bystanders and individuals other than the intended targets, including vulnerable people, is high.

HISTORY

The most common CIs are **Agent CS**, **Agent OC** and its synthetic form, **PAVA**. Agent CS was developed in the **1920s** in the **United States** and introduced as a military weapon. It became a frequently used weapon in the second half of the 20th century and was famously deployed by the U.S. military in the **Vietnam War**. Agent OC was also developed by the United States and originally used as a deterrent against wild animals (and by the U.S. Postal Service against dogs). Agent OC became a law enforcement weapon in the late 1980s. CIs are banned for use in warfare but are permitted for law enforcement purposes by the **Chemical Weapons Convention (1993)**.

HOW THEY WORK

CIS ARE POTENT SENSORY IRRITANTS THAT CAUSE PAIN AND INFLAMMATION VIA MULTIPLE MECHANISMS.



AGENT OC AND PAVA

These agents work on pain and temperature receptors (**TRPV1**) to cause sensations of burning and severe pain. Since **OC is an oil,** even small concentrations of it can penetrate skin and enter mucous membranes, causing severe and prolonged (**20–90 minutes**) discomfort.

AGENT CS

When CS comes into contact with water, sweat or oil on a person's skin or mucous membranes, it dissolves and becomes a **painful acidic liquid.** The moisture in the respiratory tract and mucous membranes like the mouth, eyes and nose is one reason these organs tend to have increased sensitivity to the compound. Heat and humidity in the atmosphere can also amplify the effects of CS. Agent CS is also an **alkylating agent** with the power to react with different chemicals in the body's metabolic system, potentially causing tissue injury via inactivation of enzymes.

COMMON AGENTS

AGENT CS (2-CHLOROBENZALMALONONITRILE) is a solid white powder that is mixed with a solvent and then aerosolized, heated or exploded to be dispersed into the air. The effects of CS may be temporary at low concentrations, but higher concentrations are known to cause permanent injury and death.

AGENT OC/PEPPER SPRAY (OLEORESIN CAPSICUM) is the active chemical in cayenne peppers that makes them spicy and is available in different concentrations as an oil in a solvent and **PAVA (pelargonic acid vanillylamide or capsaicin II)** is its highly potent synthetic form.

DEPLOYMENT MECHANISM

GRENADE OR 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

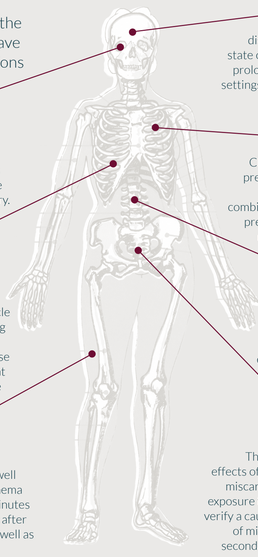
Aerosolized streams of irritants can be sprayed at distances of 2.4–3.6 metres in one- to two-second bursts, allowing for potentially higher doses of the chemical agent to directly strike targeted people or groups.

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 thin-coated spherical projectile (similar to paint inside a paintball).

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**.



PSYCHOLOGICAL

The physical symptoms of CIs 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.

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. Vision can become blurry. These injuries may lead to corneal burns, abrasions, lacerations and blindness.

CARDIOVASCULAR

CIs can cause increases in heart rate and blood pressure. Preexisting heart conditions may pose a risk of injury to vulnerable individuals. The combined effects of increased heart rate and blood pressure, and hypoxia from respiratory distress, may result in heart attack and possibly death.

RESPIRATORY SYSTEM

CIs cause inflammation of the airways and pain. Coughing, difficulty breathing and bronchorrhea are common. The smooth muscle of the respiratory tract may contract, resulting in airway closure and difficulty breathing. Individuals with preexisting 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.

ORAL & 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. Excessive vomiting and the toxicity of the agent can cause blood vessel ruptures and persistent pain.

SKIN

CIs cause a 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.

EFFECTS ON PREGNANCY & THE FETUS

There are some case reports to suggest adverse effects of CIs on the fetus. Animal models indicate that miscarriages and fetal abnormalities can occur after exposure to CIs. There is insufficient population data to verify a causal link in humans, but there are case reports of miscarriage and teratogenic effects on the fetus secondary to exposure to high concentrations of CIs.

TRAUMA

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

FINDINGS ON INJURIES FROM A LITERATURE REVIEW & RESEARCH

A systematic review conducted by Physicians for Human Rights of medical literature on CIs over the past **25 years** identifies **5,131** people who suffered injuries and **9,261** documented injuries (many people had multiple injuries).

INJURY SEVERITY

Two people died and **70 people** (**1.3%**) suffered permanent disabilities. The majority of people who were injured fully recovered from their injuries (**5,059** individuals or **98.6%**). Some **8.7%** of the injuries were severe and required professional medical management, while **17%** were moderate and **74.2%** were minor.

INJURIES FROM CANISTERS

231 canister injuries were reported, of which **63** (**27%**) were severe. There were **73** traumatic injuries to the head and neck, including at least **six** people who lost vision in an eye; **45** injuries to the chest, abdomen, back and genitalia; **95** upper or lower extremity injuries (including at least three people requiring amputations and **16** with severe functional loss of a limb).

VARIABLES THAT CAN EXACERBATE INJURIES

✕ Using CIs in **crowded spaces or busy areas**, which can impact unintended targets and bystanders.

✕ Using CIs over **prolonged periods**.

✕ Firing CIs into closed spaces or spaces with **limited exit opportunities.**

✕ **Using CIs with other crowd-control weapons**, such as projectiles or water cannons.

POLICY RECOMMENDATIONS

CIs, WHEN DEPLOYED USING CANISTERS OR GRENADES, ARE INDISCRIMINATE BY NATURE. CAUTION SHOULD BE USED DURING DEPLOYMENT TO STOP THE EFFECT FROM SPREADING TO UNINTENDED TARGETS AND BYSTANDERS.

- ✔ Firing multiple canisters in the same spot or firing repeatedly must be avoided, as this produces higher concentrations of CIs, which can cause serious injury or even death.
- ✔ Contextual factors must 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, uninvolved populations in the vicinity.
- ✔ 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 avoided, as its effects have not been properly studied.
- ✔ Firing gas canisters or grenades directly into a crowd or towards individuals must be prohibited.

For more information, see Physicians for Human Rights and INCLO, *"Lethal in Disguise: The Health Consequences of Crowd-Control Weapons,"* (March, 2016).

PHR Physicians for Human Rights

INCLO INTERNATIONAL NETWORK OF CIVIL LIBERTIES ORGANIZATIONS