

Pepper spray in the indoor environment and in the vicinity of food products and preparation surfaces

 ncceh.ca/documents/field-inquiry/pepper-spray-indoor-environment-and-vicinity-food-products

- [Chemical Agents](#)
- [Contaminants and Hazards](#)
- [Food](#)
- [Indoor Air](#)

[Print](#)

Jump to

Jump to

Pepper spray is discharged during an attempted robbery of a jewellery store in a large urban mall. The robbery site is located next to the mall's food court. For several days, mall patrons continue to report uncomfortable symptoms (e.g., burning sensation in their eyes and throat) when they enter the food court. Public Health Inspectors (PHIs) are asked to respond to concerns about contamination in the food court.

[What is pepper spray?](#)

[What is pepper spray composed of?](#)

[What are the human health effects of pepper spray?](#)

[How does pepper spray cause health effects?](#)

[How should human exposure to pepper spray be managed?](#)

[How should pepper spray discharge in an indoor environment be managed?](#)

[How should pepper spray discharge in the vicinity of food products and preparation surfaces be managed?](#)

[What protection is recommended for personnel managing a pepper spray discharge?](#)

[Where can I learn more?](#)

[Acknowledgements](#)

[References](#)

What is pepper spray?

Oleoresin capsicum (OC) spray, also known as pepper spray, is used in bear and dog repellents, personal defense sprays and by law enforcement.¹ Pepper spray causes irritation and inflammation, and produces a range of signs and symptoms affecting the eyes, mouth, throat, lungs, and skin. In Canada, pepper spray is classified as a prohibited weapon.²

What is pepper spray composed of?

Pepper spray contains OC which is an oily resin derived from chili peppers.¹ OC contains capsaicinoids, including the major pungent component capsaicin.^{1,3,15,16} Capsaicinoids are responsible for pepper's "hot" spicy taste. The intensity of OC formulations and their toxicological effects depends on the amount of capsaicinoids (capsaicin) in the product.³

In addition to OC, pepper spray contains a carrier solvent such as rubbing alcohol or a hydrocarbon.¹

What are the human health effects of pepper spray?

Exposure to OC can cause symptoms due to contact with skin, eyes, mucous membranes, or as a result of inhalation or ingestion. The onset of symptoms is almost immediate. The severity of symptoms depend on concentration, duration of exposure, and proximity to the spray discharge.¹

Eyes: Stinging, burning, tearing and redness, temporary blindness, with reports of corneal abrasion in 8% of exposed cases.

Skin: Tingling, burning pain, redness, and occasional blistering.

Respiratory, inhalation: Burning sensation in the nose and throat, coughing and sneezing. Possibly wheeze and shortness of breath. Laryngospasm and bronchospasm may also occur, with associated stridor and secondary anxiety. Rarely, this may progress to severe respiratory compromise; cyanosis, apnea and respiratory arrest have occasionally been reported.¹⁵

People with asthma may have worsening of symptoms.¹

Ingestion: Burning or stinging sensation in the mouth, nausea and vomiting. (Note that nausea may also occur after acute inhalation exposure to OC).

Other systemic effects may include disorientation, panic, and loss of control of motor activity.⁴

For the majority of individuals, the irritant effect of pepper spray lasts for approximately 30 minutes.^{4,17} However, a range of reaction severity has been reported.

How does pepper spray cause health effects?

OC may cause local irritant effects as well as neurogenic inflammation.¹⁵ Capsaicin is thought to act on peripheral sensory nerves. It can induce the release of peptide compounds contained in nerve terminals, including the neurotransmitter substance P. Substance P causes vasodilatation, leakage of plasma from capillaries, and the sensation of pain. This effect, called neurogenic inflammation, may occur in vascular beds, endocrine glands and

smooth muscle. In the airways, the depletion of substance P results in the activation of mast cells which then release histamine. This causes bronchoconstriction, with possible tightness of the chest, dilatation of local blood vessels, and mucus formation.

Note that long-lasting exposure to capsaicin can cause desensitization.^{3,4} Pepper spray causes burning and pain in exposed areas initially, but after some time the skin becomes insensitive to pain and temperature; reduced sensitivity may last for several days.⁴

How should human exposure to pepper spray be managed?

A person who has been exposed to pepper spray should be immediately removed from the contaminated environment to a well-ventilated area (e.g., outside in the fresh air). Clothing should be removed and placed in a sealed plastic bag.^{1,17} Exposed individuals must not touch their face or rub their eyes.¹⁷

Eyes should be flushed for at least 20 minutes with copious amounts of cool water.¹⁵ Contact lenses should be removed as quickly as possible, and soft lenses should be discarded since they will likely retain enough contaminant to preclude re-use.

Many sources suggest that skin should be washed with non-oil or cold cream based soap and copious amounts of cool water, ensuring that folds, crevices, creases and groin are cleaned. Burns should be treated in the same way as any other chemical burn. Topical steroids may be used for dermatitis and erythema if they are severe.

If respiratory symptoms do not resolve, humidified oxygen may provide relief of symptoms, but occasionally, inhaled beta-2 agonists or aminophylline may be required to treat for bronchospasm.

How should pepper spray discharge in an indoor environment be managed?

Indoor environments provide particular challenges, as ventilation is naturally less than in outdoor environments. Once discharged, pepper spray may be dispersed throughout an indoor environment. Individuals who are in the environment at the time of discharge might be affected, as might others who enter the environment after discharge. Generally, area decontamination consists of opening doors and windows in order to ventilate the enclosed area.³ Numerous variables will influence the time that ventilation is required, including the amount of ventilation to the area and the degree of contamination.

How should pepper spray discharge in the vicinity of food products and preparation surfaces be managed?

Surfaces and products in the vicinity of pepper spray discharge may become contaminated. In the case reported here, discharge occurred near food and food preparation surfaces. No guidelines have been identified pertaining to the decontamination of food products and contact surfaces. What follows are general principles:

- Since OC is an oily resin, washing surfaces with water and a light detergent (not an oil-based cleaner) is advisable.
- Foods that are not protected from airborne contamination should be discarded.
- For fruits and vegetables with a peel, or foods that are in packages, no information has been found that describes how these foods can be effectively decontaminated. It is difficult to ensure that all residual contaminant is effectively removed by washing. Further, the degree of contamination may vary depending on distance of the food from discharge, area ventilation, etc. Therefore, in the absence of evidence that complete decontamination has been achieved, it is advisable to discard food-stuffs that are contaminated by pepper spray discharge, even if covered.

Pepper spray is reportedly biodegradable,¹⁹ however no literature has been found that identifies the amount of time it takes to biodegrade, and whether this varies by types of surfaces.

What protection is recommended for personnel managing a pepper spray discharge?

Personnel who clean environments contaminated with pepper spray, or assist affected individuals, should be provided with appropriate equipment and supplies that protect mucous membranes and skin from contamination. This should include gloves, goggles, clothing protection, and a respirator with a chemical/mechanical type filter system that can remove particles, gas, and vapor.⁵

Where can I learn more?

The British Columbia Drug and Poison Information Centre (BC-DPIC) has a fact sheet on pepper spray, available at: <http://dpic.org/faq/pepper-spray-and-chili-peppers>

Open Questions

1. How long does it take OC to biodegrade? How long does OC remain on surfaces, and does duration vary by types of surfaces?
2. Does washing of fruits and vegetables with a peel, and packaged foods, provide adequate decontamination, or should all exposed items be discarded?
3. How should ventilation systems be decontaminated after pepper spray discharge?

Acknowledgements

We would like to thank Tom Kosatsky and Sion Shyng for their valuable input and review of this document.

References

1. British Columbia Drug and Poison Information Centre (BC-DPIC). [Pepper spray and chili peppers](#).
2. Canada Border Services Agency. [Importing a firearm or weapon into Canada](#).

3. Archuleta MM. Oleoresin Capsicum Toxicology Evaluation and Hazard Review. 1995. Printed by Sandia National Laboratories for the United States Department of Energy.
4. Busker RW, van Helden HPM. Toxicologic Evaluation of Pepper Spray as a Possible Weapon for the Dutch Police Force: Risk Assessment and Efficacy. *American Journal of Forensic Medicine & Pathology* 1998; 19(4): 309-16.
5. Miller DS. Review of Oleoresin Capsicum (Pepper) Sprays for Self Defense Against Captive Wildlife. *Zoo Biology* 2001; 20(5): 389-98.
6. Vesaluoma M, Müller L, Gallar J, Lambiase A, Moilanen J, Hack T, Belmonte C, Tervo T. Effects of Oleoresin Capsicum Pepper Spray on Human Corneal Morphology and Sensitivity. *Investigative Ophthalmology and Visual Science* 2004; 41: 2138-2147.
7. Cichewicz RH, Thorpe PA. The antimicrobial properties of chile peppers (*Capsicum* species) and their uses in Mayan medicine. *Journal of Ethnopharmacology* 1996; 52: 61-70.
8. Centers for Disease Control and Prevention (CDC). [Fact sheet: facts about riot control agents interim document](#).
9. Brown L, Takeuchi D, Challoner K. Corneal abrasions associated with pepper spray exposure. *American Journal of Emergency Medicine* 2000;18:271-2.
10. Smith J, Greaves I. The use of chemical incapacitant sprays: a review. *The Journal of Trauma: Injury, Infection, and Critical Care* 2002; 52(3): 595-600.
11. Sciencelab.com Inc. [Material Safety Data Sheet \(MSDS\): Oleoresin capsicum](#).
12. Claman FL, Patterson DL. Personal aerosol protection devices: caring for victims of exposure. *Nurse Practitioner* 1995; 20: 11.
13. Fitch JP, Raber E, Imbro DR. Technology Challenges in Responding to Biological or Chemical Attacks in the Civilian Sector. *Science* 2003; 302 (5649): 1350 – 1354.
14. Raber E, Hirabayashi JM, Mancieri SP, Jin AL, Folks KJ, Carlsen TM, Estacio P. Chemical and Biological Agent Incident Response and Decision Process for Civilian and Public Sector Facilities. *Risk Analysis* 2002; 22(2).
15. Greenberg MI (editor-in-chief), Hamilton RJ, Phillips SD, McCluskey GJ (eds.). 2003. *Occupational, industrial and environmental toxicology*, 2nd ed: Mosby.
16. Olajos EJ, Stopford W. *Riot control agents: issues in toxicology, safety and health*. 2004. New York: CRC Press.
17. Carron PN, Yersin B. Management of the effects of exposure to tear gas. *BMJ* 2009; 338.
18. University of California Police Department. B-Safe Bulletin. Mace & pepper spray.
19. US Department of Justice, National Institute of Justice. [Oleoresin Capsicum: Pepper Spray as a Force Alternative](#). 1994.

August 2010