



# OLR RESEARCH REPORT

September 2, 2011

2011-R-0298

## **NEW YORK TCEP (TRIS) LAW**

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You asked for information about the flame retardant chemical tris(2-chloroethyl)phosphate (TCEP), including what it is and how it affects the environment and human health. You also asked for a summary of New York's [new law](#) prohibiting the sale of certain child care products containing TCEP.

### **SUMMARY**

Chemical flame retardant use developed in response to an increase in fire safety regulations in the 1970's. TCEP is a human-made, phosphate-based chemical added to certain plastics, fabrics, and foams, to slow their capacity to ignite and burn.

TCEP can enter the environment through wastewater, manufacturing processes, and leaching from disposed materials containing the chemical, among other means. Studies have found TCEP persists in water and soil, but has low potential to build up within the tissues of organisms (i.e., bioaccumulate) and is a low- to moderate-toxicant to certain species. There is limited data regarding human health effects but adverse effects linked to TCEP in laboratory animal studies include carcinogenicity, reproductive toxicity, and neurotoxicity.

During the 2011 legislative session, New York became the first state to prohibit the sale or offer for sale of certain child care products containing TCEP. The ban begins December 1, 2013, and violators are subject to civil penalties.

This report cites information resources from a number of jurisdictions that have reviewed scientific studies on TCEP's effects. For the reader's convenience, we numbered and listed the studies in Attachment 1 and cite the reference number in the text.

## **TRIS(2-CHLOROETHYL)PHOSPHATE (TCEP)**

TCEP is part of a chemical class of fire retardants called "phosphate esters," and is produced by reacting phosphorus oxychloride (a chemical derived from white phosphorus) with an alcohol. It is added to many consumer products such as textiles, carpeting, furniture foams, and electronics, to reduce flammability.

TCEP is one of several types of phosphorus-based retardants referred to as "tris" chemicals ("tris" applies to chemical compounds with three parts of equal structure). Other forms of "tris" flame retardants include tris(1,3-dichloro-2-propyl)phosphate (TDCP or TDCPP), tris(1-chloro-2-propyl)phosphate (TCPP), and tris(2,3-dibromopropyl)phosphate (tris-BP), which have similar properties but different structures.

## **EFFECTS**

### ***Environmental***

TCEP does not naturally occur in the environment but can enter it through (1) wastewater, (2) manufacturing processes, and (3) leaching from disposed materials in landfills, among other means<sup>11</sup>. In soil and water, TCEP is mobile and persistent. The Minnesota Department of Health (MDH) considers TCEP a "chemical of emerging concern" because (1) it has been found in the environment and (2) there is evidence that humans are exposed to it<sup>11</sup>.

Reviewing available studies, Canada's Environment and Health agencies' (Environment Canada and Health Canada) Screening Assessment for TCEP concluded that it poses a low- to moderate- hazard to aquatic organisms, and the European Union's (EU) Risk Assessment Report for TCEP concluded it has a low- to moderate- toxicity to algae, aquatic invertebrates, and fish<sup>4,6</sup>. Both jurisdictions also determined that TCEP has low potential to bioaccumulate in the environment<sup>4,6</sup>.

Specifically, Canada concluded that TCEP “is not entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity or that constitute or may constitute a danger to the environment on which life depends”<sup>4</sup>. But the EU classifies TCEP as dangerous to the environment (Class N) and toxic to aquatic organisms (Class R51)<sup>6</sup>. The EU also classifies TCEP as “Class R53” because it may be able to cause long-term adverse effects in the aquatic environment<sup>6</sup>.

### ***Human Health***

MDH reports that TCEP has been detected in drinking water, runoff from agricultural fields treated with wastewater, and both surface and ground water<sup>11</sup>. The U.S. Department of Health and Human Services’ (DHHS) Agency for Toxic Substances and Disease Registry (ATSDR) advises that people can be exposed to TCEP by (1) consuming water and food containing TCEP, (2) inhaling TCEP dust or vapors from products treated with it, and (3) touching TCEP-treated products (by mouth or skin contact), particularly children<sup>1</sup>.

Although jurisdictions appear to agree that TCEP persists in the environment, little information is available on the health effects of people exposed to phosphate ester flame retardants, including TCEP<sup>1</sup>. Much of the information about TCEP’s health effects come from studies involving laboratory animals.

### ***Laboratory Studies***

Laboratory studies on animals exposed to TCEP linked the chemical to several adverse health effects, including carcinogenicity, reproductive toxicity, and neurotoxicity.

***Carcinogenic Effects.*** Laboratory studies cited by ATSDR found that (1) rats receiving oral doses of TCEP for two years developed kidney tumors and (2) mice fed with a diet containing the chemical for 18 months developed leukemia and kidney, liver, and stomach tumors<sup>1</sup>.

But according to ATSDR, there is not enough information to determine with certainty whether or not phosphate ester flame retardant chemicals, including TCEP, cause cancer in humans<sup>1</sup>. Additionally, the U.S. Environmental Protection Agency and DHHS have not classified TCEP’s carcinogenic potential, and the International Agency for Research on Cancer determined TCEP is not classifiable as to its human

carcinogenicity because there were (1) no available epidemiological data relevant to carcinogenicity and (2) limited evidence for its carcinogenicity in experimental animals<sup>1,7,8</sup>.

The EU's Risk Assessment Report for TCEP states there is clear evidence that TCEP is carcinogenic in two animal species (rats and mice), but the EU classifies it as a "category 3" carcinogen, meaning there is cause for concern for humans due to possible carcinogenic effects, but not enough information to satisfactorily assess its effect on humans<sup>6</sup>.

Other jurisdictions have categorized TCEP differently. In its screening of TCEP, Canada concluded that TCEP may pose a danger to human life or health because of its carcinogenic potential, and there may be a probability of harm at any exposure level<sup>4</sup>.

TCEP has also been added to states' lists of chemicals of high concern. California added TCEP to its "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity" (the Proposition 65 list) in 1992 because of cancer toxicity<sup>2</sup>. Among other things, Proposition 65 requires businesses to provide clear and reasonable warnings to consumers purchasing products containing these chemicals. TCEP is also included on (1) Maine's and Minnesota's lists of "Chemicals of High Concern," and (2) Washington's list of "Chemicals of High Concern to Children." Minnesota and Washington cite carcinogenicity and reproductive toxicity as possible effects of TCEP exposure, whereas Maine labels it only as a carcinogen<sup>9,10,13</sup>.

**Reproductive Toxicity.** Besides finding tumors and cancer in laboratory animal, studies have also linked TCEP to reproductive impairment in mice. In studies reviewed by the EU, Canada, and Minnesota, and cited by Washington, researchers found adverse reproductive effects, including (1) a decrease in the number and size of litters, and (2) adverse effects to male reproductive organs and sperm parameters<sup>4,6,12,13</sup>. The EU has identified TCEP as a "Substance of Very High Concern" because of reproductive toxicity<sup>3</sup>. It classifies TCEP as a "category 2, R60" reproductive toxicant, meaning it should be considered to impair human fertility because there is sufficient evidence to provide a strong presumption that human exposure may result in impaired fertility<sup>6</sup>. The presumption can be met by clear evidence from animal studies<sup>5</sup>.

**Neurotoxicity.** Laboratory studies with rats exposed to TCEP found adverse effects to their nervous systems including ataxia, convulsions, hyperactivity, impaired cognitive performance, and brain lesions<sup>3,6,12</sup>. However, delayed neurotoxicity studies on White Leghorn hens did not find such neurotoxic effects<sup>3,4,6</sup>.

## **NEW YORK LAW BANNING TCEP**

New York's TRIS-Free Children and Babies Act prohibits the sale or offering for sale of any product containing TRIS (TCEP) intended for use by a child under three years of age starting December 1, 2013 (N.Y. Envtl. Conserv. Law §§ 37-0701 – 37-0709 and 71-3703).

The ban applies to consumer products, such as baby products, toys, car seats, nursing pillows, crib mattresses, and strollers. Under the act, "TRIS" includes TCEP. The act does not apply to the sale or distribution of child care products that are (1) resold or offered for resale or (2) distributed by consumers for consumer use.

The act imposes a civil penalty of up to \$1,000 for each day a violation of the law continues, and a violator may be enjoined from continuing the violation. A second violation is punishable by a fine of up to \$2,500 for each day a violation continues.

The act (1) allows the Department of Environmental Conservation to promulgate rules and regulations and (2) provides the state with exclusive jurisdiction over TRIS matters regulated under the new law.

## **ATTACHMENT 1: REFERENCES**

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