

# CAUT Health and Safety Fact Sheet



## Exposure Limits – Acceptable vs Safe Fact Sheet

ISSUE 31

TLVs (Threshold Limit Values), TWAs (Time Weighted Averages), BEIs (Biological Exposure Indices), and OELs (Occupational Exposure Limits)<sup>1</sup> are mechanisms used to determine “accepted” exposures to hazardous substances for use in either regulations or guidelines.

The Ministry of Labour in Ontario<sup>2</sup> states that “Occupational Exposure Limits (OELs) restrict the amount and length of time a worker is exposed to airborne concentrations of hazardous biological or chemical agents.”

The restriction of exposure should be differentiated from safety from exposure. “Acceptable” levels of exposure are steadily being lowered as better research allows us to identify potential harm that may occur at previously acceptable levels of exposure. The best way to ensure a safe level of exposure is to reduce exposure to zero.

Troy Winters, Senior Health & Safety Officer at the Canadian Union Public Employees (CUPE) highlights that “Substances with OELs, like asbestos (TWA 0.1 f/cc) and diesel fuel (100 mg/m<sup>3</sup>) have been classified by the International Agency for Research on Cancer (IARC) as being carcinogenic to humans. When a substance is a proven cancer causing agent, there is no safe exposure limit for workers to these substances.” He is concerned that while TLV’s and OEL’s levels may eventually be lowered, any exposure is too high, and employers often rely on these numbers to guide health and safety. Troy stresses that “We must continually fight to reduce the amount of chemicals and dangerous substances that our members are exposed to.”

The Occupational Cancer Research Centre (OCRC) notes<sup>3</sup> that “Preventing occupational cancer at the source begins with reducing exposure to cancer-causing agents in the workplace. Occupational Exposure Limits (OELs) place maximum allowable limits on the concentration of a hazardous substance in the workplace air. In Canada, they are set by provincial and national authorities and are legally enforceable. ....The overall intent of OELs is to ensure that there are not harmful effects as a result of exposure to a particular hazard over a working lifetime.”

Workplace Joint Health & Safety Committees (JHSC) should ensure that all hazardous substances entering or currently in the workplace are assessed, and eliminated, substituted or use reduced. Those substances that must be used in the workplace have to have a valid Material Safety Data Sheet (MSDS). It is good practice to explore control measures to reduce exposure when the levels reach ½ the OEL or TLV. In fact, organizations such as the U.S. National Institute of Occupational Safety and Health (NIOSH) and the American

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Conference of Governmental Industrial Hygienists (ACGIH) refer to this as the “Action Level.”

## What are they?

TLVs are often cited by employers, ministry inspectors, joint health & safety committees, and others as definitive standards. However, the ACGIH resource document TLV®/BEI® Resources, state:

“TLVs® and BEIs® are not standards. They are guidelines designed for use by industrial hygienists in making decisions regarding safe levels of exposure to various chemical substances and physical agents found in the workplace. In using these guidelines, industrial hygienists are cautioned that the TLVs® and BEIs® are only one of multiple factors to be considered in evaluating specific workplace situations and conditions.”

The Ontario Workers Health & Safety Centre (WHSC) provides these simple definitions:

- Time Weighted Average Exposure Values (TWAEV): average airborne concentration to which a worker may be exposed in an 8 hour workday or 40 hour work week
- Ceiling Exposure Value (CEV): maximum airborne concentration to which a worker may be exposed at any time
- Short-Term Exposure Value (STEV): maximum airborne concentration to which a worker may be exposed for short periods of time

## ACGIH Definitions

The ACGIH is used as a standard reference for detailed definitions for exposure limit mechanisms:

**Threshold Limit Value—Time-Weighted Average (TLV-TWA).** The TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, for a working lifetime without adverse effect. Although calculating the average concentration for a workweek, rather than a workday, may be appropriate in some instances, ACGIH® does not offer guidance regarding such exposures.

**Threshold Limit Value—Short-Term Exposure Limit (TLV-STEL).** A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA. The TLV-STEL is the concentration to which it is believed that workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, 3) dose-rate-dependent toxic effects, or 4) narcosis of sufficient degree to increase the likelihood of accidental injury, impaired self-rescue, or materially reduced work efficiency. The TLV-STEL will not necessarily protect against these effects if the daily TLV-TWA is exceeded. The TLV-STEL usually supplements the TLV-TWA where there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature; however, the TLV-STEL may be a separate, independent exposure guideline. Exposures above the TLV-TWA up to the TLV-STEL should be less than 15 minutes, should occur less than four times per day, and there should be at least 60 minutes between successive exposures in this range. An averaging period other than 15 minutes may be recommended when this is warranted by observed biological effects

**Threshold Limit Value—Ceiling (TLV-C).** The concentration that should not be exceeded during any part of the working exposure. If instantaneous measurements are not available, sampling should be conducted for the minimum period of time sufficient to detect exposures at or above the ceiling value. ACGIH® believes that TLVs® based on physical irritation should be considered no less binding than those based on physical impairment. There is increasing evidence that physical irritation may initiate, promote, or accelerate adverse health effects through interaction with other chemical or biological agents or through other mechanisms.

## Purpose

OELs are an accepted standard tool that is enforceable under Canadian legislation, and should be used as a beginning point for controlling and lowering workplace exposures.

TLVs are developed using available studies of groups of workers and do not allow for the uniqueness of each worker, their workplace and the circumstances under which they may be exposed. For example, some individuals may be more susceptible because of allergies, co-exposure to other chemicals, or other factors. OELs are general only for airborne exposure, while many chemicals can pass through the skin, and are based on 8 hour days, while many people work extended hours or short-shifts. It is critical that JHSC's do detailed assessments that take the entire context of the workplace into consideration when using TLVs as a safety tool. They are one of many tools in the safety toolbox.

## Where can I find them?

OELs can be found in legislation, regulations and industry standards like the Canadian Standards Association (CSA)<sup>6</sup>. They can vary from country to country, despite internationally recognized standard values.

NIOSH in the United States is an excellent resource for accessing information on chemicals<sup>7</sup>.

CAREX Canada<sup>8</sup> is a national surveillance project that estimates the number of Canadians exposed to substances associated with cancer in workplace and community environments. These estimates provide significant support for targeting exposure reduction strategies and cancer prevention programs.

## How can I use them?

Workplace hazard assessments and inspections should be used to:

- identify hazardous substances in the workplace
- review substances against current legislative, regulatory or industry standards

- ensure work exposures are at or below required levels
- ensure emissions stay at or below recommended TLV levels
- develop a schedule for regular testing of emission levels

Levels higher than ½ the required levels should prompt an immediate investigation to determine the cause.

Appropriate steps should be taken to:

- safeguard workers from exposure
- contain emissions from spreading
- eliminate the cause
- return TLV levels to required or recommended levels, or lower
- develop an incident protocol that includes post-incident testing and emission clearing

Anthony Pizzino, Managing Director for the Occupational Health Clinics for Ontario Workers (OHCOW) notes that "Prevention is key to eliminating or reducing occupational exposure, and this includes the role that OELs play in prevention, even when exposures comply with the accepted limits."

OHCOW has assisted post-secondary institutions to deal with exposures to volatile organic compounds (VOCs), silica dust, mould, carbon monoxide, formaldehyde, noise, and indoor air quality problems, helping workers who have experienced illness or injury due to workplace exposures.

OHCOW's industrial hygienists can answer questions about interpreting exposure assessments, developing assessment strategies, assessing exposures, and developing control measures, and work directly with joint health safety committees, unions, employers, and individual workers.



## Training

JHSC members should have appropriate training to understand how OELs are created, their role in monitoring exposure, how they can be used to control workplace exposures, and reputable resources for assistance.

The Worker's Health & Safety Centre in Ontario, academic associations and other campus unions, provincial federations of labour and ministries of labour are excellent resources for training and advice on this issue. For more information, contact Laura Lozanski at [lozanski@caut.ca](mailto:lozanski@caut.ca).



## Resources

Canadian Centre for Occupational Health and Safety [www.ccohs.ca](http://www.ccohs.ca)

CAREX Canada [www.carexcanada.ca](http://www.carexcanada.ca)

Centre for Disease Control/NIOSH [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

Occupational Cancer Research Centre [www.occupationalcancer.ca](http://www.occupationalcancer.ca)

Occupational Health Clinics for Ontario Workers [www.ohcow.on.ca](http://www.ohcow.on.ca)

Provincial and Federal Ministries of Labour

Workers Health and Safety Centre [www.whsc.on.ca](http://www.whsc.on.ca)

## Notes

1 The term OEL will be used as the generic term in in this fact sheet unless otherwise indicated.

2 Ministry of Labour of Ontario [www.labour.gov.on.ca/english/hs/topics/oels.php](http://www.labour.gov.on.ca/english/hs/topics/oels.php)

3 Occupational Exposure Limits for Carcinogens in Ontario Workplaces: Opportunities to Prevent and Control Exposure, April 2012; Occupational Cancer Research Centre [www.occupationalcancer.ca](http://www.occupationalcancer.ca)

4 TLV®/BEI® Resources: ACGIH Guidelines for Industrial Hygienists [www.acgih.org/tlv/](http://www.acgih.org/tlv/)

5 Level I Toxic Substances Module Version 5.0, WHSC [www.whsc.on.ca](http://www.whsc.on.ca)

6 Canadian Standards Association [www.csa.ca](http://www.csa.ca)

7 NIOSH Pocket Guide to Chemical Hazards, September 2007, DHHS (NIOSH) Publication No. 2005-149 [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

8 CAREX Canada [www.carexcanada.ca](http://www.carexcanada.ca)