

## Chemical Exposure Limits: How Much Is Too Much?

### SAFE SCIENCE: BE PROTECTED

By Dr. Ken Roy\*

#### Introduction:

Exposure for employees and students to chemicals in the air, water, food, etc., may be hazardous to their health. Science teachers need to be ever vigilant on this issue relative to short and long-term exposure ramifications. Is there a safe limit? How much is too much? OSHA standards require these kinds of questions to be considered and addressed by the employer and employees.

#### PELS: OSHA'S Legal Limits!

PEL or Permissible Exposure Limit is the legal standard established by OSHA for exposure to a selected group of hazardous chemicals. PELs are usually expressed as a short-term exposure limit (STEL), a time-weighted average (TWA) or a ceiling exposure limit. There are approximately over 500 hazardous chemicals that had PELs established in 1971. These were based on research conducted in primarily in the 1950's and 1960's. Current research indicates that these levels are outdated and don't sufficiently protect employees.

#### NIOSH Exposure Limits

NIOSH (National Institute for Occupational Safety and Health) has the statutory responsibility for recommending exposure levels which would protect employees. In this way, they have established recommended exposure limits or RELs on a select group of hazardous chemicals. Like the PEL, this can be expressed in a time-weighted average (TWA) or as a ceiling limit. This level establishes the highest allowable airborne concentration for exposure to employees without health injury.

A more serious classification is the Immediately Dangerous to Life and Health or IDLH classification. This amount of

exposure set the limit in terms of maximum concentration where an employee can escape within 30 minutes without any irreversible health effects.

#### ACGIH Exposure Limits

A third group of exposure limit classifications has been created by the ACGIH (American Conference of Governmental Industrial Hygienists). Threshold Limit Value or TLV is used to express the airborne concentration of a chemical substance to which most workers can be exposed during a normal work schedule without adverse health effects. However, some in-

dividuals may be hyper susceptible to selected substances because of genetic factors, habits, medication, age or other factors.

Therefore, in these cases, such employees may have adverse health effects from chemical concentrations at or below the TLVs.

TLVs have been established based on industrial experience, experimentation and/or animal studies. These level values were developed for interpretation and application in industrial hygiene practice. They serve as guideposts to control potential workplace health hazards. They were not developed as a legal standard. TLVs are expressed in three ways:

**TLV-TWA:** This is a time-weighted average concentration for an 8-hr workday or 40-hr workweek. Most employees may be repeatedly exposed, day after day, without adverse health effects.

**TLV-STEL:** This is the short-term exposure limit or maximum concentration for a continuous exposure period of 15 min-

utes. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should occur at a frequency no higher than four times per day with at least 60 minutes between successive exposures.

Most employees can be exposed within the guidelines for the TLV-STEL short period of time without concern for irritation, chronic or irreversible tissue damage or other concerns.

**TLV-CEILING (TLV-C) LIMIT:** This is the concentration which is never to be exceeded at any time.

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Two Evils: Always  
look for the less or  
least chemically  
hazardous material  
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work.**

For TLVs for gases and vapors are usually noted in parts per million of the substance in air by volume. The equation for converting TLVs in mg/m<sup>3</sup> to ppm is: TLV in ppm = (TLV in mg/m<sup>3</sup>) (24.45)/gram molecular weight of the substance

The ACGIH levels are more stringent than OSHA PEL standards. It is also of interest to note that the ACGIH also has established Biological Exposure Indices (BEI's).

#### Confusion In Legality!

ACGIH TLVs and NIOSH RELs are recommendations for exposure limits on hazardous chemicals. OSHA's PELs are the only legal limits set into law. Unfortunately, there is some confusion as a result of court cases and other legal maneuvering. OSHA currently enforces Transitional Limits but is seeking Final Rule Limits. A 1992 11th Circuit Court of Appeals forced OSHA to vacate newly proposed limits and return to the original 1971 limits. Some states have adopted

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Final Rule Limits and employers should secure information from the appropriate state agency. Also, employers can establish their own limits if they are more stringent than state or federal limits.

OSHA lists current PELs in the 29 CFR 1910, Subpart Z.

## IV. Issues for the science teacher?

The science teacher must consider several issues relative to use and exposure of hazardous chemicals in their school laboratories.

*1. Long Term Exposure:* Relatively low or high levels of exposure over the long term can have negative health ramifications. Teachers need to be vigilant in addressing protective actions such as having appropriate ventilation in the lab, referring to MSDS information and using personal protective equipment.

*When Unsure - Request the Test:* OSHA standards provide the right of the employee to be tested if exposure levels to hazardous chemicals are in question. When unsure, request that your employer have the worksite tested by a licensed industrial hygienist.

*Pregnancy:* Both female employees and students may be pregnant. Consult the MSDS for information and cautions

relative to reproductive toxins, harm to the fetus, and other relevant concerns.

Opt for Less of the Two Evils: Always look for the less or least chemically hazardous material in doing laboratory work.

## RESOURCES:

American Conference of Governmental Industrial Hygienists, Inc. HYPERLINK <<http://www.acgih.org/>> <<http://www.acgih.org>>

Canadian Center for Occupational Health and Safety HYPERLINK <<http://www.ccohs.ca/>> <<http://www.ccohs.ca>>

National Institute for Occupational Safety and Health HYPERLINK <<http://www.cdc.gov/niosh/homepage.html>> <<http://www.cdc.gov/niosh/homepage.html>>

Occupational Safety and Health Administration HYPERLINK <<http://www.osha.gov/>> <<http://www.osha.gov>>

LIVE LONG AND PROSPER SAFELY!

Dr. Ken Roy\*

K-12 Director of Science & Safety  
& Authorized OSHA Instructor  
c/o Glastonbury Public Schools  
Glastonbury, CT 06033-3099  
Fax 860-652-7275

Email: Royk@glastonburyus.org

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