Recent Developments of an Updated Methodology for Deriving Immediately Dangerous to Life or Health (IDLH) Values: Science Methods and Comparison to Other Acute Limit Values

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Abstract

What is an IDLH value?

IDLH values derive from the National Institute of Occupational Safety and Health (NIOSH): • Have an important history in defining work practice requirements with potential entry into high exposure environments, and • Are used as 30-min maximum airborne concentrations above which only a highly reliable breathing apparatus providing maximum worker protection is permitted.

Proposed IDLH derivation method

• IDLH values are based on health effects considerations determined through a critical assessment of the toxicology and human health effects data conceptually similar to that used in other risk assessment applications. • The updated protocol is based on a weight-of-evidence (WOE) approach that applies a scientific judgment for the critical evaluation of the quality and consistency of the scientific data, and includes: • Critical review of human and animal toxicity data to identify potential relevant studies and characterize the various lines of evidence that can support the derivation of the IDLH value; • Determination of a chemical’s mode of action (MOA) or description of how a chemical exerts its toxic effects; • Application of duration adjustments (time scaling) to determine 30-minute equivalent exposure concentrations and conduct of other dosimetric adjustments as needed; • Selection and application of an UF to the IDLH value from the various analytical or exposure scenario data (e.g., age, body mass, gender, MOA, species, duration, environment, etc.), • Development of the final recommendation for the IDLH value; • The revised methodology is likely to generate significant improvements in the interpretation and robust application of the IDLH values.

Science Issue: Uncertainty Factor (UF)

Application of duration adjustments (time scaling) to determine 30-minute equivalent exposure concentrations and conduct of other dosimetric adjustments as needed; • Selection and application of an UF to the IDLH value from the various analytical or exposure scenario data (e.g., age, body mass, gender, MOA, species, duration, environment, etc.), • Development of the final recommendation for the IDLH value; • The revised methodology is likely to generate significant improvements in the interpretation and robust application of the IDLH values.

Conclusions

• The revised methodology is likely to generate significant improvements in the interpretation and robust application of the IDLH values. • IDLH values play an important role as credible peer-reviewed values as part of the IE tool box of acute exposure limits. • These science enhancements and communication of the role of the IDLH values relative to other values is important due to the increasing role of the IH in addressing diverse occupational, emergency, and environmental exposure scenarios.

Acknowledgment and Disclaimer

The findings and conclusions in this presentation have not been formally disseminated by NIOSH and should not be construed to represent any agency determination or policy.

Acute Exposure Guidelines

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<tr>
<th>Application</th>
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Typical Composite UF

For acute studies of other durations – ten times longer

**WOE defined**

• The weight of evidence approach refers to the critical examination of all the available data from diverse lines of evidence supported by a scientific interpretation based on the collective body of data including its relevance, quality, and reported results.
• WOE approach is more integrative, and is used to develop the IDLH value benchmark, consideration of other limits, and the various lines of evidence instead of using a strict data hierarchy.

Science Issues: Selection of Acute Limit Values

**Science Issue: Safety Hazard**

NIOSH recognizes that in some cases a health-based IDLH value may not account for all workplace hazards, (i.e., safety concerns), those situations include but are not limited to:
• Airborne concentration causes oxygen deprivation (oxygen concentration < 19.5%), which represents a life-threatening condition (e.g., argon gas, carbon dioxide, and nitrogen).
• Particulate matter concentration significantly reduces visibility preventing escape from the hazardous environment.
• Airborne concentration represents an explosion hazard (greater than 10% of the lower explosive limit (LEL), e.g., acetone, ethyl acetate, and n-pentane).
• Health based IDLH values is greater than the time-weighted average (TWA) occupational exposure limit (OEL) multiplied by the Uncertainty Factor (UF).
• The revised methodology is likely to generate significant improvements in the interpretation and robust application of the IDLH values.

Conclusions

• The revised methodology is likely to generate significant improvements in the interpretation and robust application of the IDLH values.
• IDLH values play an important role as credible peer-reviewed values as part of the IE tool box of acute exposure limits.
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