SCHO

Sociedad Colombiana de
Higienistas Ocupacionales

JORNADA DE ACTUALIZACION DE TLVs & BEIs

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Sociedad Colombiana de Higienistas Ocupacionales

1 TLVs

2 Metodologia de Adopcion

3 NIC-C + NIE-C2018

4 NIC+NIE 2019

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Sociedad Colombiana de Higienistas Ocupacionales

1 TLVs

Esenciales

- ACGIH® es una asociación sin animo de lucro dedicada a promover la higiene y la salud ocupacional y ambiental mediante el desarrollo de programas educativos y la expansión del conocimiento científico en higiene y la salud ocupacional y ambiental.

- ACGIH® logra este propósito mediante:
  - La implementacion y uso de procesos para garantizar la toma de decisiones científicas independientes,
  - El fomento de la colaboración multidisciplinaria para el desarrollo de la higiene y la salud ocupacional.
  - El fortalecimiento de redes de cooperación con asociaciones cientificas y organizaciones profesionales aliadas.

Esenciales

- Asociacion Cientifica Multidisciplinaria.
  - Higienistas Ocupacionales
  - Toxicologos
  - Epidemiologos
  - Medicos del Trabajo
- Neutral en las posiciones publicas
- No ofrece programas de acreditación profesional o certificación de competencias
- Miembros Fundadores corresponden a especialistas de salud e higiene ocupacional de entidades del gobierno e instituciones académicas

Funciones

- Comité de Seguridad y Salud Agrícola
- Comité de instrumentos de muestreo de aire
- Comité de Bioaerosoles
- Comité de índices de exposición biológica
- Comité de Comunicación, Educación y Difusión.
- Comité de Ventilación Industrial
- Comité internacional
- Comité Conjunto de Educación Ética en Higiene Industrial (JIHEEC)
- Comité de interacción conjunta
- Comité de Nominaciones
- Comité de Pequeñas Empresas
- Comite de Valores límite umbral para sustancias químicas
- Comite de Valores límite umbral para agentes físicos
- Comite de Valores límite umbral para agentes Biologicos

Overview

- 1938 - se conforma en Washington la National Conference of Governmental Industrial Hygienists (NCGIH) 76 miembros de 26 estados
- 1941 - Nombramiento del Comité TLV para Contaminates Quimicos
- 1943 – Se plubica la primera version de los TLVs para Contaminantes Quimicos (148).
- 1946 - Cambia el nombre a ACGIH
- 1954 - Se publica los agentes con Noticias de Intencion de Cambio.
- 1955 – Se inicia el desarrollo de la documentación para cada TLV.
- 1962 – Se publica la primera edición de la documentación.
- 1968 - Nombramiento del Comité TLV para Agentes Físicos (2).
- 1980 – Actualizacion de directrices y procedimientos de los comités (1987, 1989, 1992, 1994, 1998, 2001)
- 1983 – Nombramiento del Comite BEI
- 1986 – Primera Edicion del *Applied Occupational and Environmental Hygiene*
- 2000 – Revision de estatutos y políticas de conflicto de intereses para permitir privilegios de votación ampliados.

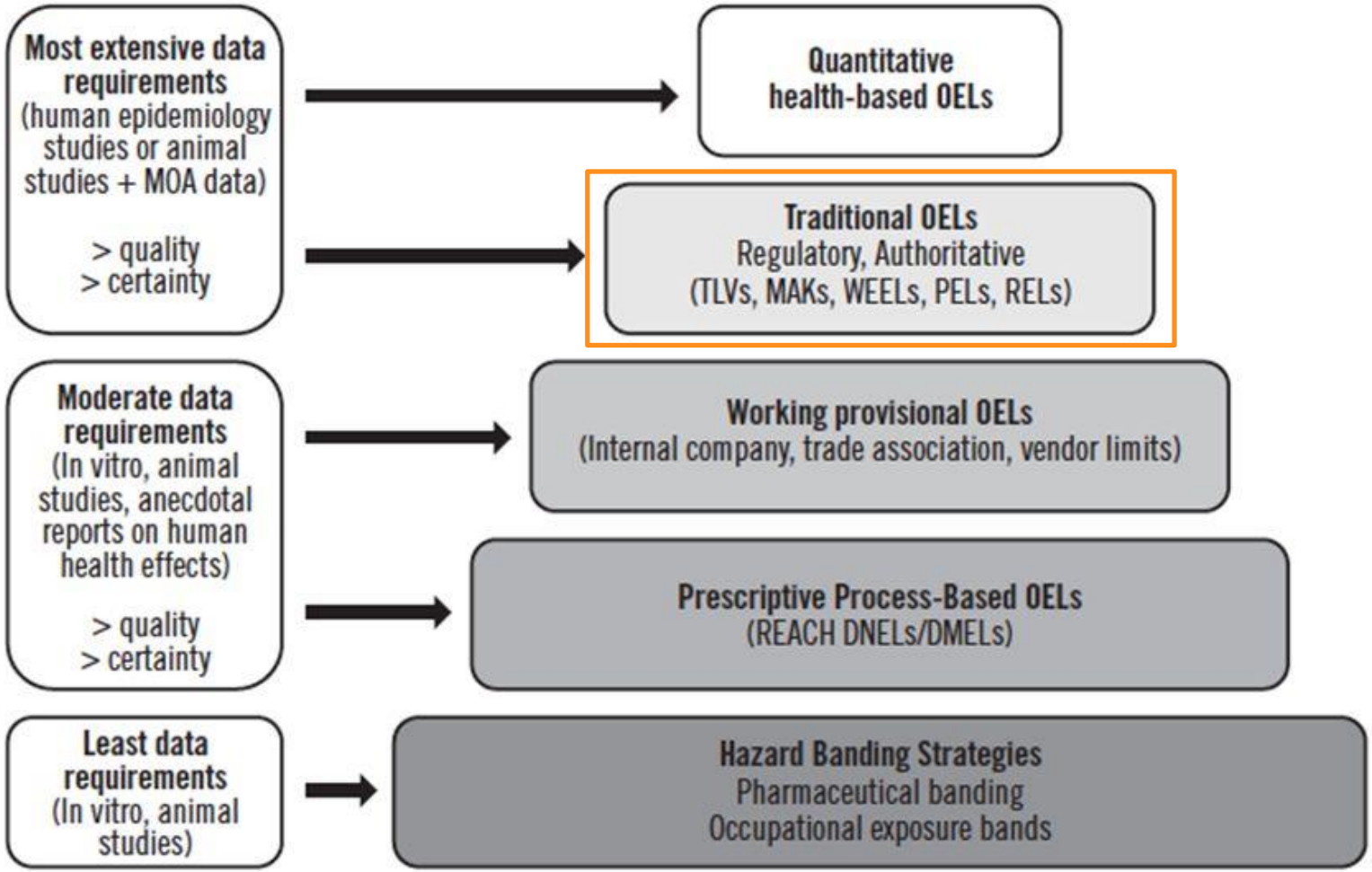

Figure 5–4. A hierarchy of risk-based occupational exposure benchmarks.

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Occupational and Environmental Health®

Concentración a la que pueden estar expuestos casi todos los trabajadores repetidamente día tras día, sin efectos adversos. Individuos hiper sensitivos e hiper susceptibles pueden aun ser afectados. Un pequeño porcentaje de individuos puede experimentar agravación de condiciones preexistentes.

TLV TWA

Media ponderada a 8 Horas

TLV STEL

Máxima Exposición 15 Minutos 4 Veces al día inter exposición 1h

TLV STEL-C

Instantánea/Techo

HYDROGEN SULFIDE

CAS number: 7783-06-4

Synonyms: Hydrosulfuric acid; Stink damp; Sulfur hydride; Sulfureted hydrogen

Molecular formula: H_2S

TLV–TWA, 10 ppm (14 mg/m^3)
TLV–STEL, 15 ppm (21 mg/m^3)

Summary

A TLV–TWA of 10 ppm (14 mg/m^3) and TLV–STEL of 15 ppm (21 mg/m^3) are recommended for occupational exposure to hydrogen sulfide. These values are intended to minimize the potential for eye and respiratory tract irritation, symptoms of fatigue, headache, and dizziness, and central nervous system effects, the most important being paralysis of the respiratory center and sudden death. The offensive odor of hydrogen sulfide is unreliable as a warning signal for hazardous exposure concentrations due to the rapid onset of olfactory fatigue. The recommended TLV–STEL is intended to provide an additional measure for a safe exposure limit. Sufficient data were not available to recommend Skin, SEN, or carcinogenicity notations.

Chemical and Physical Properties

Hydrogen sulfide is a colorless, flammable gas with an offensive odor suggesting rotten eggs. An odor threshold of 0.008 ppm has been reported.[1] Chemical and physical properties include:[2]

- Molecular weight: 34.08
- Specific gravity: 1.192 (air = 1.0)
- Freezing point: –85.49°C
- Boiling point: –60.33°C
- Explosive limits: lower, 4.3%; upper, 45.5% by volume in air
- Autoignition temperature: 260°C
- Solubility: at 20°C, 1 gram hydrogen sulfide will dissolve in 242 ml of water, in 94.3 ml of absolute alcohol, and in 48.5 ml of ether
- Conversion factors at 25°C and 760 torr: 1 ppm = 1.39 mg/m^3; 1 mg/m^3 = 0.719 ppm

Major Uses

Hydrogen sulfide has been widely employed as a reagent in analytical chemistry and is used in the manufacture of heavy water. It is a source of elemental sulfur. The majority of occupational exposures to hydrogen sulfide, however, have resulted from its occurrence in petroleum, natural gas, soil, sewer gas, and natural springs and as a by-product of chemical reactions, such as may take place in the viscose rayon and certain leather tanning processes.

Animal Studies

Acute

In high concentrations (1000 to 3000 ppm) hydrogen sulfide was lethal to dogs. At 3000 ppm, respiration ceased after a few breaths; death occurred within 15 to 20 minutes at 1000 ppm.[3] Lund and Wieland[4] exposed monkeys at 500 ppm for durations of 22 to 35 minutes. Each of three monkeys lost consciousness abruptly in about 15 minutes; microscopic examination revealed that the brain, particularly the motor cells of the cerebellum, was the principal target organ of inhaled hydrogen sulfide.[4] This conclusion was based on the evidence of extensive necrosis of the parietal and occipital cortex of the brain; a reduced number of Purkinje cells in the cerebellular cortex; isolated accumulation of glial cells in otherwise normal basal ganglia; and normal heart, liver, kidneys, and adrenals.

Subchronic

Subchronic (90-day) inhalation studies of hydrogen sulfide at concentrations of 0, 10.1, 30.5, and 80 ppm have been carried out in Sprague–Dawley and Fischer 344 rats and B6C3F1 mice.[5–7] The experimental design included clinical hematologic, urinary and serum chemistry parameters, and detailed necropsy and microscopic examinations. In addition, detailed neurologic and ophthalmologic studies were conducted. There was a significant decrease in body weight in all animals exposed at 80 ppm and a depression in brain weight versus that of controls in the Fischer 344 rats exposed at 80 ppm. The only tissue pathology found was inflammation of the mucosa in the anterior segments of the nose. All other endpoints examined were similar to the values recorded in the control group.

Genotoxicity Studies

Gocke et al.[8] reported that hydrogen sulfide was a weak mutagen in *Salmonella typhimurium* TA

Resumen

- Valores de exposición en el aire para el entorno laboral.
- Valores basados en la salud. No se considera la viabilidad técnica, económica y analítica.
- No está destinado a la adopción legal; Los TLV no son estándares de consensuados.
- Valores orientativos a aplicar por personas formadas en higiene ocupacional.
- El concepto de “umbral”.
- Establecido para proteger a "casi todos" los trabajadores.
- No es apropiado para su uso como índice de toxicidad relativa.

Quimicos

TLV Bases– Efecto Critico	Porcentaje
Irritacion	30.4
Sistema Nervioso	12.0
Sistema Respiratorio	8.8
Higado	8.7
Sangre	6.4
Riñon	4.7
Piel	3.8
Cancer	3.7
Sensibilizacion	2.8
Otros Efectos	18.7

TLV-TWA
630

TLV-STEL/C
178

BEIs
54

Fisicos

- Acustica
  - Infrasonido y Sonido de Baja Frecuencia
  - Sonido Audible
  - Ultrasonido
- Campos Electromagneticos 0-300 GHz
  - Radiacion Electromagnetica
  - Campos Electrostaticos
  - Campos Magneticos de Subradiofrecuencia
  - Campos Electrostaticos de Subradiofrecuencia
  - Radiofrecuencia & microondas
- Radiacion Optica
  - Luz Visible y Radiacion de Infrarojo Cercano
  - Radiacion ultravioleta
  - Laseres
- Radiacion Ionizante
- Ergonomia
  - Actividad Manual
  - Carga
  - Vibracion Mano Brazo
  - Vibracion Cuerpor Entero.
- Estres Termico
  - Estres por Frio
  - Estres por Calor

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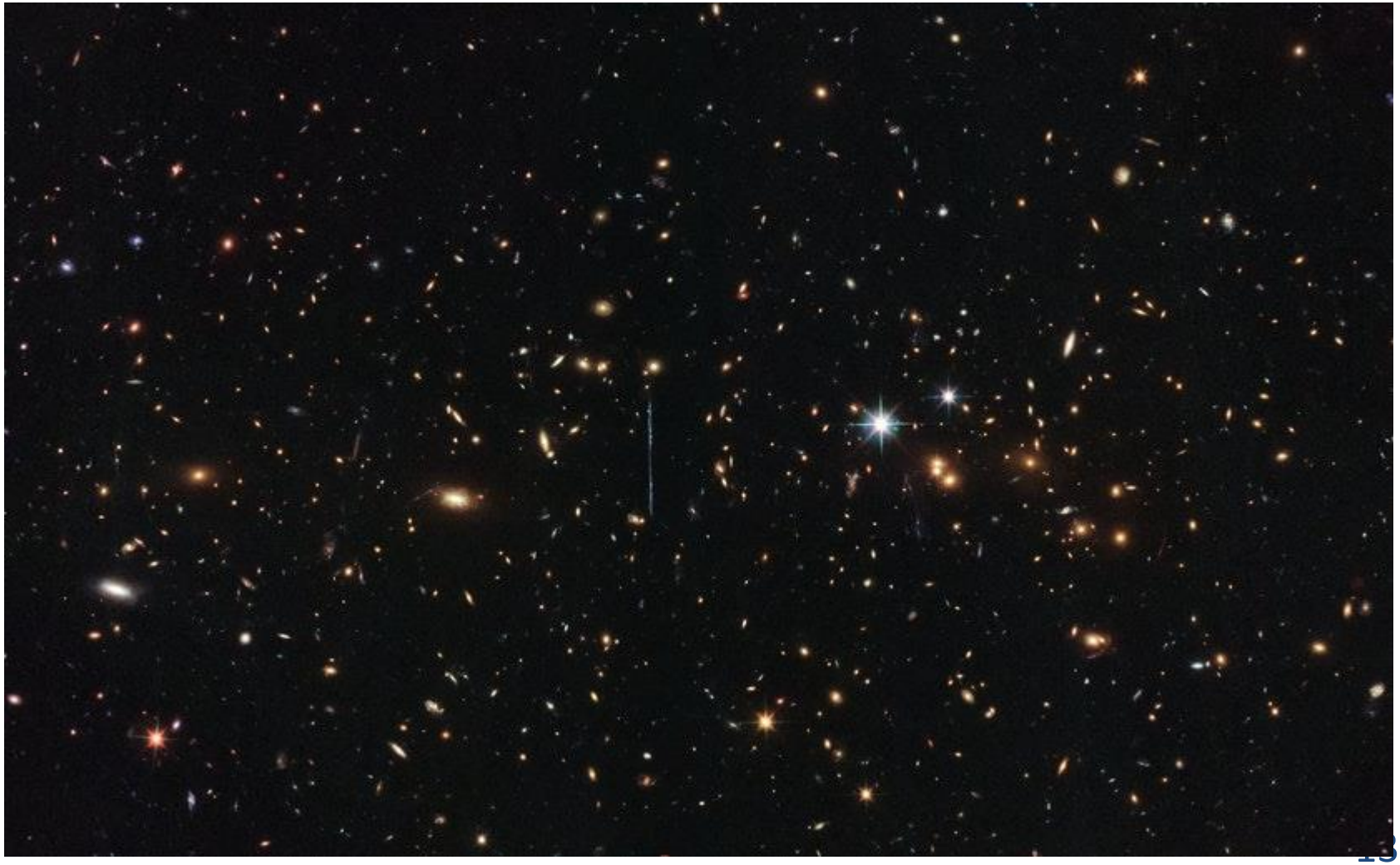
Biologicos



SCHO

Sociedad Colombiana de Higienistas Ocupacionales

2 Metodologia de Adopcion

Los Ingredientes Esenciales en el desarrollo de los TLVs

El Comité TLV® tiene 20 miembros y 3 miembros-candidatos, que ofrecen tiempo voluntario para desarrollar guías y publicaciones científicas

El objetivo principal es atender las necesidades científicas de los higienistas industriales.

Los gastos del comité son soportados por ACGIH®

El tiempo es donado por los miembros.

Ciencia publicada / revisada por pares

+

Voluntariado dedicado

+

Integridad & Juicio Profesional

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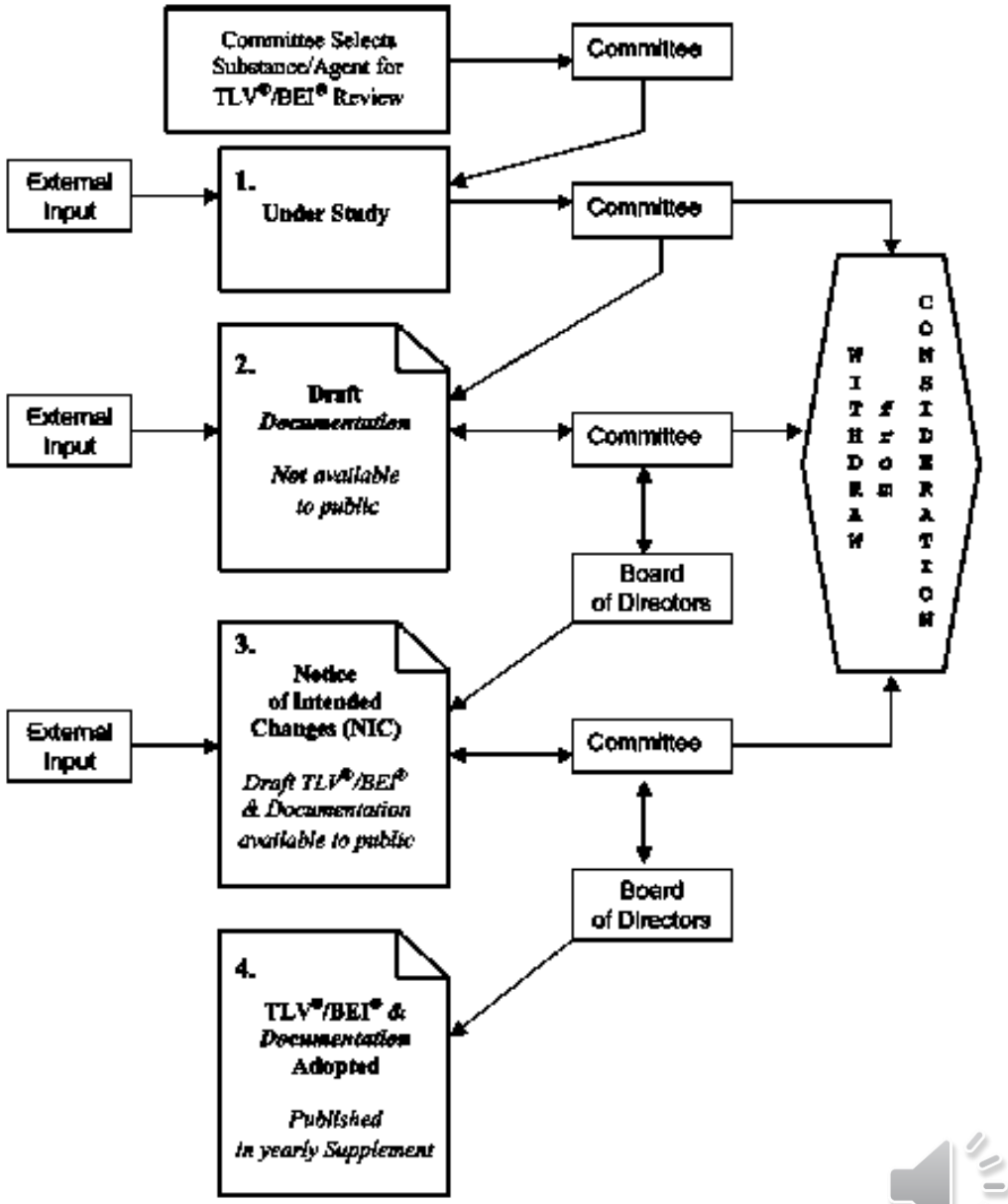


TLV®/BEI® DEVELOPMENT PROCESS: AN OVERVIEW

Provided below is an overview of the ACGIH® TLV®/BEI® Development Process. Additional information is available on the ACGIH® website (www.acgih.org). Please also refer to the attached Process Flowchart (Figure 1).

1. **Under Study:** When a substance or agent is selected for the development or revision of a TLV® or BEI®, the appropriate committee places it on its Under Study list. Each committee determines its own selection of chemical substances or physical agents for its Under Study list. A variety of factors is used in this selection process, including prevalence, use, number of workers exposed, availability of scientific data, existence/absence of a TLV® or BEI®, age of TLV® or BEI®, input from the public, etc. The public may offer input to any TLV® or BEI® Committee by e-mail to science@acgih.org.

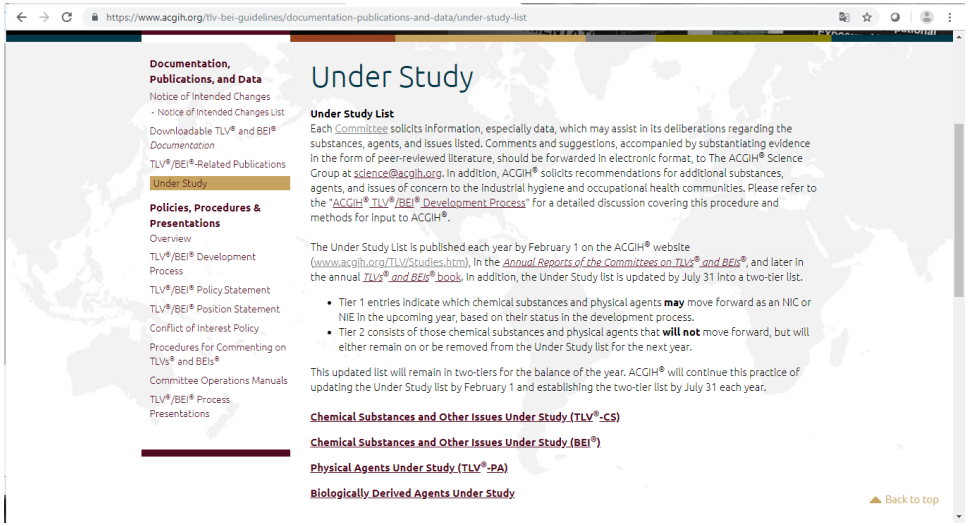
   The Under Study lists serve as notification and invitation to interested parties to submit substantive data and comments to assist the committees in their deliberations. Each committee considers only those comments and data that address issues of health and exposure, but not economic or technical feasibility. Comments must be accompanied by copies of substantiating data, preferably in the form of peer-reviewed literature. Should the data be from unpublished studies, ACGIH® requires written authorization from the owner of the studies granting ACGIH® permission to (1) use, (2) cite within the *Documentation*, and (3) upon request from a third party, release the information. All three permissions must be stated/covered in the written authorization. (See endnote for a sample permission statement.) Electronic submission of all information to the ACGIH® Science Group at science@acgih.org is preferred and greatly increases the ease and efficiency with which the committee can consider the comments or data.

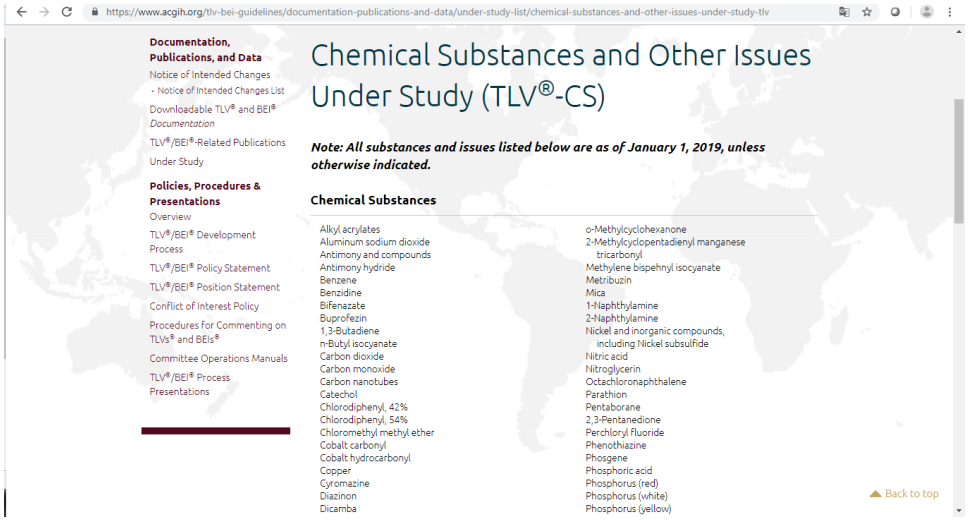
   The Under Study list is published each year by February 1 on the ACGIH® website (www.acgih.org/tlv-bei-guidelines/documentation-publications-and-data/under-study-list), in the *Annual Reports of the Committees on TLVs® and BEIs®*, and later in the annual *TLVs® and BEIs®* book. In addition, the Under Study list is updated by July 31 into a two-tier list.

   - Tier 1 entries indicate which chemical substances and physical agents **may** move forward as an NIC or NIE in the upcoming year, based on their status in the development process.
   - Tier 2 consists of those chemical substances and physical agents that **will not** move forward, but will either remain on, or be removed from, the Under Study list for the next year.

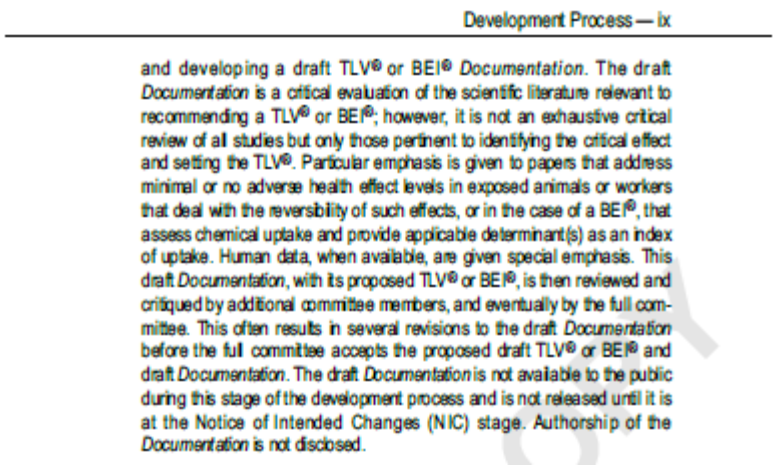
   This updated list will remain in two-tiers for the balance of the year. All updates to the Under Study lists and publication of the two-tier lists are posted on the ACGIH® website (www.acgih.org/tlv-bei-guidelines/documentation-publications-and-data/under-study-list).

2. **Draft *Documentation*:** One or more members of the appropriate committee are assigned the task of collecting information and data from the scientific literature, reviewing results of unpublished studies submitted for review,



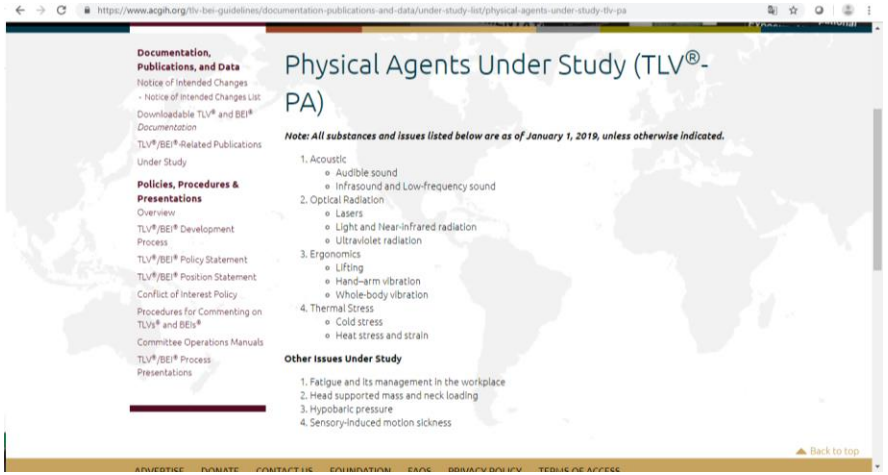


TLV CS|123 Sustancias Quimicas



Development Process — ix

and developing a draft TLV® or BEI® *Documentation*. The draft *Documentation* is a critical evaluation of the scientific literature relevant to recommending a TLV® or BEI®; however, it is not an exhaustive critical review of all studies but only those pertinent to identifying the critical effect and setting the TLV®. Particular emphasis is given to papers that address minimal or no adverse health effect levels in exposed animals or workers that deal with the reversibility of such effects, or in the case of a BEI®, that assess chemical uptake and provide applicable determinant(s) as an index of uptake. Human data, when available, are given special emphasis. This draft *Documentation*, with its proposed TLV® or BEI®, is then reviewed and critiqued by additional committee members, and eventually by the full committee. This often results in several revisions to the draft *Documentation* before the full committee accepts the proposed draft TLV® or BEI® and draft *Documentation*. The draft *Documentation* is not available to the public during this stage of the development process and is not released until it is at the Notice of Intended Changes (NIC) stage. Authorship of the *Documentation* is not disclosed.



https://www.acgih.org/tlv-bei-guidelines/documentation-publications-and-data/under-study-list/physical-agents-under-study-tlv-pa

Documentation, Publications, and Data
Notice of Intended Changes
- Notice of Intended Changes List
Downloadable TLV® and BEI® *Documentation*
TLV®/BEI®-Related Publications
Under Study

Policies, Procedures & Presentations
Overview
TLV®/BEI® Development Process
TLV®/BEI® Policy Statement
TLV®/BEI® Position Statement
Conflict of Interest Policy
Procedures for Commenting on TLVs® and BEIs®
Committee Operations Manuals
TLV®/BEI® Process Presentations

Physical Agents Under Study (TLV®-PA)

Note: All substances and issues listed below are as of January 1, 2019, unless otherwise indicated.

1. Acoustic
   - Audible sound
   - Infrasound and Low-frequency sound
2. Optical Radiation
   - Lasers
   - Light and Near-infrared radiation
   - Ultraviolet radiation
3. Ergonomics
   - Lifting
   - Hand–arm vibration
   - Whole-body vibration
4. Thermal Stress
   - Cold stress
   - Heat stress and strain

Other Issues Under Study

1. Fatigue and its management in the workplace
2. Head supported mass and neck loading
3. Hypobaric pressure
4. Sensory-induced motion sickness

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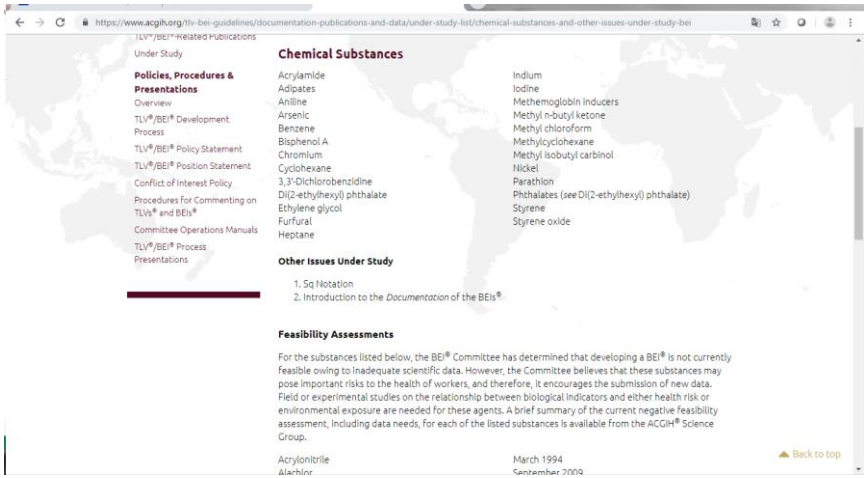

https://www.acgih.org/tlv-bei-guidelines/documentation-publications-and-data/under-study-list/chemical-substances-and-other-issues-under-study-bei

Under Study

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TLV®/BEI® Process Presentations

Chemical Substances

Acrylamide	Indium
Adipates	Iodine
Aniline	Methemoglobin inducers
Arsenic	Methyl n-butyl ketone
Benzene	Methyl chloroform
Bisphenol A	Methylcyclohexane
Chromium	Methyl isobutyl carbinol
Cyclohexane	Nickel
3,3'-Dichlorobenzidine	Parathion
Di(2-ethylhexyl) phthalate	Phthalates (*see* Di(2-ethylhexyl) phthalate)
Ethylene glycol	Styrene
Furfural	Styrene oxide
Heptane	

Other Issues Under Study

1. Sq Notation
2. Introduction to the *Documentation* of the BEIs®

Feasibility Assessments

For the substances listed below, the BEI® Committee has determined that developing a BEI® is not currently feasible owing to inadequate scientific data. However, the Committee believes that these substances may pose important risks to the health of workers, and therefore, it encourages the submission of new data. Field or experimental studies on the relationship between biological indicators and either health risk or environmental exposure are needed for these agents. A brief summary of the current negative feasibility assessment, including data needs, for each of the listed substances is available from the ACGIH® Science Group.

Acrylonitrile	March 1994
Alachlor	September 2009

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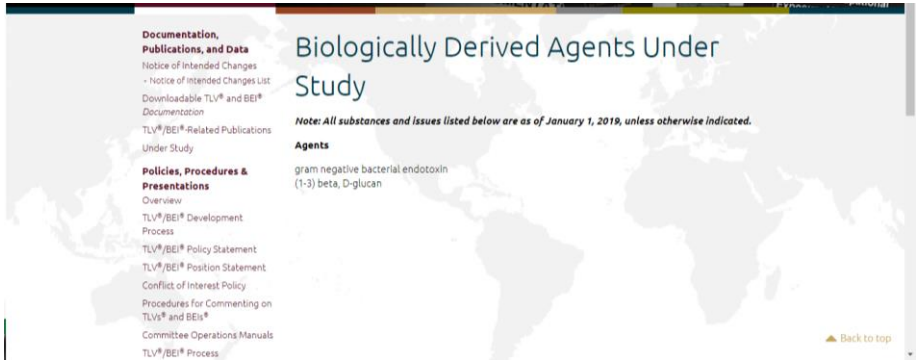

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Biologically Derived Agents Under Study

Note: All substances and issues listed below are as of January 1, 2019, unless otherwise indicated.

Agents

gram negative bacterial endotoxin
(1-3) beta, D-glucan

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BEI|25 Sustancias Quimicas

BEI FA|26 Sustancias Quimicas

3. **Notice of Intended Changes (NIC):**

[Notice of Intent to Establish (NIE): The Physical Agents section of the TLVs® and BEIs® book also uses the term Notice of Intent to Establish (NIE) in addition to NIC. An NIE follows the same development process as an NIC. For purposes of this process overview, only the term NIC is used.]

When the full committee accepts the draft *Documentation* and its proposed TLV® or BEI®, the *Documentation* and proposed values are then recommended to the ACGIH® Board of Directors for ratification as an NIC. If ratified, each proposed TLV® or BEI® is published as an NIC in the *Annual Reports of the Committees on TLVs® and BEIs®*, which is published in the ACGIH® member newsletter, *Today! Online* and is also available online for purchase at www.acgih.org/store. At the same time, the draft *Documentation* is made available through ACGIH® Customer Service or online at www.acgih.org/store. All information contained in the *Annual Reports of the Committees on TLVs® and BEIs®* is integrated into the annual *TLVs® and BEIs®* book, which is usually available to the general public in February or March of each year. Following the NIC ratification by the ACGIH® Board of Directors, interested parties, including ACGIH® members, are invited to provide data and substantive comments, preferably in the form of peer-reviewed literature, on the proposed TLVs® or BEIs® contained in the NIC. Should the data be from unpublished studies, ACGIH® requires written authorization from the owner of the studies granting ACGIH® permission to (1) use, (2) cite within the *Documentation*, and (3) upon request from a third party, release the information. All three permissions must be stated/covered in the written authorization. (See endnote for a sample permission statement.) The most effective and helpful comments are those that address specific points within the draft *Documentation*. Changes or updates are made to the draft *Documentation* as necessary. If the committee finds or receives substantive data that change its scientific opinion regarding TLV® or BEI® values or notations, the committee may revise the proposal(s) and recommend to the ACGIH® Board of Directors that it be retained on the NIC.

Important Notice: The comment period for an NIC or NIE draft *Documentation* and its respective TLV(s)®, notation(s), or BEI(s)®, will be limited to a firm 4-month period, running from February 1 to May 31 of each year. ACGIH® has structured the comment period to ensure all comments are received by ACGIH® in time for full consideration by the appropriate committee before its fall meeting. Because of the time required to properly review, evaluate, and consider comments during the fall meetings, any comments received after the deadline of May 31 will not be considered in that year's committee deliberations regarding the outcome for possible adoption of an NIC or NIE. As general practice, ACGIH® reviews all submissions regarding chemical substances and physical agents on the Under Study list, as well as NICs or NIEs, or currently adopted BEI(s)® or TLV(s)®. All comments received after May 31 will be fully considered in the following year. Draft *Documentation* will be available for review during the comment period.

When submitting comments, ACGIH® requires that the submission be limited to 10 pages in length, including an executive summary. The submission may include appendices of citable material not included as part of the 10-page limit. It would be very beneficial to structure comments as follows:

A. ***Executive Summary** – Provide an executive summary with a limit of 250 words.*
B. ***List of Recommendations/Actions** – Identify, in a vertical list, specific recommendations/actions that are being requested.*
C. ***Rationale** – Provide specific rationale to justify each recommendation/action requested.*
D. ***Citable Material** – Provide citable material to substantiate the rationale.*

The above procedure will help ACGIH® to more efficiently and productively review comments.

4. **TLV®/BEI® and Adopted *Documentation*:** If the committee neither finds nor receives any substantive data that change its scientific opinion regarding an NIC TLV® or BEI® (or notation), the committee may then approve its recommendation to the ACGIH® Board of Directors for adoption. Once approved by the committee and subsequently ratified by the Board, the TLV® or BEI® is published as adopted in the *Annual Reports of the Committees on TLVs® and BEIs®* and in the annual *TLVs® and BEIs®* book, and the draft TLV® or BEI® *Documentation* is finalized for formal publication.

5. **Withdraw from Consideration:** At any point in the process, the committee may determine not to proceed with the development of a TLV® or BEI® and withdraw it from further consideration. Substances or physical agents that have been withdrawn from consideration may be reconsidered by placement on the Under Study list (step 1 above).

Summary: There are *several important points* to consider throughout the above process:

i. The appropriate method for an interested party to contribute to the TLV® and BEI® process is through the submission of literature that is peer-reviewed and public. ACGIH® strongly encourages interested parties to publish their studies, and not to rely on unpublished studies as their input to the TLV® and BEI® process. Also, the best time to submit comments to ACGIH® is in the early stages of the TLV®/BEI® Development Process, preferably while the substance or agent is on the Under Study list.

ii. An additional venue for presentation of new data is an ACGIH®-sponsored symposium or workshop that provides a platform for public discussion and scientific interpretation. ACGIH® encourages input from external parties for suggestions on symposia topics, including suggestions about sponsors, speakers and format. ACGIH® employs several criteria to determine the appropriateness of a symposium. A key criterion is that the symposium must be the most efficient format to present the committee with information that will assist in the scientific judgment used for writing the *Documentation* and in setting the respective TLVs® or BEIs®. A symposium topic should be suggested while the substance/agent is under study, as symposia require considerable time, commitment, and resources to develop. Symposium topic suggestions submitted while a substance is on the NIC will be considered, but this is usually too late in the decision-making process. A symposium topic will not be favorably considered if its purpose is to provide a forum merely for voicing opinions about existing data. Rather, there must be on-going research, scientific uncertainty about currently available data, or another scientific reason for the symposium. Symposium topic suggestions should be sent to the ACGIH® Science Group (science@acgih.org).

iii. ACGIH® periodically receives requests from external parties to make a presentation to a committee about specific substances or issues. It is *strictly by exception* that such requests are granted. While there are various reasons for this position, the underlying fact is that the committee focuses on data that have been peer-reviewed and published and not on data presented in a private forum. A committee may grant a request when the data is significantly new, has received peer review, is the best vehicle for receipt of the information, and is essential to the committee's deliberations. The presentation is not a forum to merely voice opinions about existing data. In order for a committee to evaluate such a request, the external party must submit a request in writing that, at a minimum, addresses the following elements: (a) a detailed description of the presentation; (b) a clear demonstration of why the information is important to the committee's deliberations; and (c) a clear demonstration of why a meeting is the necessary method of delivery. This request must be sent to the ACGIH® Science Group (science@acgih.org).

Also, the committee may initiate contact with outside experts (a) to meet with the committee to discuss specific issues or to obtain addi-

tional knowledge on the subject, and (b) to provide written input or review of a *Documentation*. This is only done on an as needed basis, and not as a routine practice.

iv. ACGIH® does *not* commit to deferring consideration of a new or revised TLV® or BEI® pending the outcome of proposed or ongoing research.

***Important dates* to consider throughout each calendar year of the TLV®/BEI® Development Process:**

First Quarter:

- The *Annual Reports of the Committees on TLVs® and BEIs®* and the *TLVs® and BEIs®* book are published.

Year Round:

- Public comments are accepted. *See* Note below.
- Committees meet.

Note: It is recommended that comments be submitted as early as practical, and preferably no later than May 31st to allow sufficient time for their proper consideration/review. This is particularly important for an NIC TLV®/BEI®.

Important Notice: The comment period for an NIC or NIE draft *Documentation* and its respective TLV(s)®, notation(s), or BEI(s)® will be limited to a firm 4-month period, running from February 1 to May 31 of each year. (*See* Important Notice, step 3 above.)

Third Quarter:

- Two-tier Under Study list published on website (www.acgih.org/tlv-bei-guidelines/documentation-publications-and-data/under-study-list).

Fourth Quarter: *

- TLV®/BEI® Committees vote on proposed TLVs®/BEIs® for NIC or final adoption.
- ACGIH® Board of Directors ratifies TLV®/BEI® Committee recommendations.

*These actions typically occur early in the fourth quarter, but may occur during other periods of the quarter or year.

Endnote: Sample permission statement granting ACGIH® authorization to use, cite, and release unpublished studies:

[Name], [author or sponsor of the study**] grants permission to ACGIH® to use and cite the documents listed below, and to fully disclose them to parties outside of ACGIH® upon request. Permission to disclose the documents includes permission to make copies as needed.

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"Effects of Quartz Status on Pharmacokinetics of Intratracheally Instilled Cristobalite in Rats, March 21, 2003."

**This statement must be signed by an individual authorized to give this permission, and should include contact information such as title and address.

Last Revised April 2012

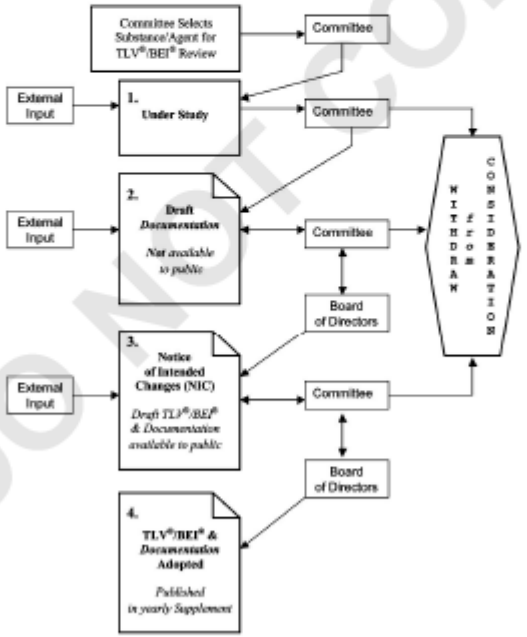

FIGURE 1. The TLV®/BEI® Development Process Flow Chart.

December 20, 2004

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Sociedad Colombiana de Higienistas Ocupacionales

3 NIC-C + NIE-C 2018

2018 NOTICE OF INTENDED CHANGES

These substances, with their corresponding values and notations, comprise those for which 1) a limit is proposed for the first time, 2) a change in the Adopted value is proposed, 3) retention as an NIC is proposed, or 4) withdrawal of the *Documentation* and adopted TLV® is proposed. In each case, the proposals should be considered trial values during the period they are on the NIC. These proposals were ratified by the ACGIH® Board of Directors and will remain on the NIC for approximately one year following this ratification. If the Committee neither finds nor receives any substantive data that change its scientific opinion regarding an NIC TLV®, the Committee may then approve its recommendation to the ACGIH® Board of Directors for adoption. If the Committee finds or receives substantive data that change its scientific opinion regarding an NIC TLV®, the Committee may change its recommendation to the ACGIH® Board of Directors for the matter to be either retained on or withdrawn from the NIC.

Documentation is available for each of these substances and their proposed values.

This notice provides an opportunity for comment on these proposals. Comments or suggestions should be accompanied by substantiating evidence in the form of peer-reviewed literature and forwarded in electronic format to the ACGIH® Science Group at science@acgih.org. Please refer to the ACGIH® TLV®/BEI® Development Process on the ACGIH® website (www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations/tlv-bei-development-process) for a detailed discussion covering this procedure, methods for input to ACGIH®, and deadline date for receiving comments.

http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations/tlv-bei-development-process

Substance [CAS No.]	2018 I TWA	STEL	Notations	MW	TLV® Basis
† Antimony trioxide [1309-64-4]	WITHDRAWN FROM NOTICE OF INTENDED CHANGES				
† Cobalt [7440-48-4] and inorganic compounds, as Co	0.02 mg/m³ (I)	—	DSEN; RSEN; A3; BEI	58.93	Pulm func
† Cumene [98-82-8]	1 ppm	—	A3	120.19	Liver dam
Cyanazine [21725-46-2]	0.1 mg/m³ (I)	—	A3	240.70	Body weight, CNS & teratogenic eff

2018 NOTICE OF INTENDED CHANGES

Substance [CAS No.]	TWA	STEL	Notations	MW	TLV® Basis
† Cyclopentadiene [542-92-7]	WITHDRAW ADOPTED TLV® AND *DOCUMENTATION*, *SEE* DICYCLOPENTADIENE, INCLUDING CYCLOPENTADIENE				
† Dicyclopentadiene [77-73-6], including Cyclopentadiene [542-92-7]	0.5 ppm	1 ppm	—	132.21	URT, LRT & eye irr; CNS eff
† Dimethylphenol, all isomers [95-65-8; 95-87-4; 105-67-9; 108-68-9; 526-75-0; 576-26-1; 1300-71-6]	1 ppm (IFV)	—	DSEN; A3	Varies	Hematologic & body weight eff
† Fluorine [7782-41-4], as F	0.1 ppm	C 0.5 ppm	—	37.99	Fluorosis; eye irr
† Indium tin oxide [50926-11-9], as In	0.0001 mg/m³ (R)	—	DSEN; A3	Varies	Pulm func; pulm fibrosis
† Iodine [7553-56-2] and Iodides, as I					
Iodine	0.015 mg/m³ (IFV)	—	Skin; A4	235.8	Hypothyroidism; repro eff
Iodides	0.015 mg/m³ (I)	—	Skin; A4	Varies	Hypothyroidism; repro eff
Iodoform [75-47-8]	0.2 ppm (IFV)	—	—	393.78	CNS & card system impair; liver & kidney dam
† Methyltetrahydrophthalic anhydride isomers [3425-89-6; 5333-84-6; 11070-44-3; 19438-63-2; 19438-64-3; 26590-20-5; 42498-58-8]	0.0005 mg/m³ SL 0.7 mg/100 cm²	0.002 mg/m³	Skin; DSEN; RSEN	166.70	Resp sens
† Methyl vinyl ketone [78-94-4]	—	C 0.01 ppm	—	70.10	Upper resp dam; leukopenia
† Monomethylformamide [123-39-7]	1 ppm	—	Skin	59.07	Embryo/fetal & liver dam; teratogenic eff

REVISIONS OR ADDITIONS
FOR 2019

All pertinent endnotes, abbreviations, and definitions relating to the materials in this publication appear on the inside back cover.

Introduction to the Chemical Substances

- The Threshold Limit Value–Surface Limit (TLV–SL) definition that appeared on the 2018 NIC is adopted.

Chemical Substances Section

- Proposed TLVs® that appeared on the 2018 NIC are adopted for the following substances:

Cobalt and inorganic compounds	Methyl vinyl ketone
Cyanazine	Monomethylformamide
Dicyclopentadiene, including Cyclopentadiene	o-Phthalaldehyde
Dimethylphenol, all isomers	Propylene glycol ethyl ether
Fluorine	Sulfoxaflor
Indium tin oxide	Tetramethyl succinonitrile
Methyltetrahydrophthalic anhydride isomers	Thiacloprid
	Tin and inorganic compounds, excluding Tin hydride and Indium tin oxide

- The following substances that appeared on the 2018 NIC for the proposed addition of the Inhalable fraction and vapor (IFV) endnote only are adopted:

Chlordane	Nitrapyrin
o-Chlorobenzylidene malononitrile	5-Nitro-o-toluidine
Dinitrobenzene, all isomers	Pentachloronaphthalene
Dinitro-o-cresol	Sulfometuron methyl
EPN	2,4,6-Trinitrotoluene
4,4-Methylene bis(2-chloroaniline)	

- The following substances that appeared on the 2018 NIC for the proposed withdrawal of the Inhalable fraction and vapor (IFV) endnote only are adopted:

Isobutyl nitrite	1,1,2,2-Tetrabromoethane

- The following substance that appeared on the 2018 NIC for the proposed withdrawal of the inhalable fraction and vapor (IFV) endnote and addition of the inhalable particulate matter (I) endnote only is adopted:

  Temephos

- The following substance that appeared on the 2018 NIC for the proposed withdrawal of the (V) endnote only is adopted:

  m-Xylene α,α′-diamine

  (Note: The (V) endnote withdrawn refers to the former vapor and aerosol endnote.)

- The adopted *Documentation* and TLV® for the following substance are withdrawn:

  Cyclopentadiene

- The following substances and proposed TLVs® new to this section are placed on the NIC:

4-tert-Butylbenzoic acid	Resin acids
Hexamethylenetetramine	Thiodicarb
Hexazinone	Titanium tetrachloride
Isoflurane	

- Revisions to adopted TLVs® are proposed for the following substances and placed on the NIC:

Acrylamide	Formamide
Antimony trioxide	Methyl isobutyl carbinol
Cyclohexene	Sulfur pentafluoride
Di(2-ethylhexyl) phthalate	

- The adopted *Documentation* and TLV® for the following substance are proposed to be withdrawn and are placed on the NIC:

  Rosin core solder thermal decomposition products (colophony)

- The following substances are retained on the NIC without revised TLV® recommendations or notations:

Cumene	Trimetacresyl phosphate
Iodoform	Triparacresyl phosphate
Styrene oxide	

- The following substance is retained on the NIC with revised TLV® recommendations or notations:

  Styrene

- The following substances have been withdrawn from the NIC:

Iodine and Iodides	Sodium sulfate

- *Documentation* was updated for the following substance without change to the recommended TLV®. *See* the 2019 *Supplement* to the *Documentation* of the TLVs® and BEIs®, 7th ed.:

  Phosphine

Definitions and Notations Section

- The Ototoxicant (OTO) notation that appeared on the 2018 NIC is adopted.

Introduction to the Biological Exposure Indices

- The Introduction to the *Documentation of the Biological Exposure Indices* that appeared on the 2018 NIC is adopted.

Biological Exposure Indices (BEIs®) Section

- Proposed BEIs® that appeared on the 2018 NIC are adopted for the following substances:

  Ethylene oxide
  n-Hexane
  N-Ethyl-2-pyrrolidone

- The adopted BEI® for the following substance proposed to be withdrawn is retained on the NIC:

  Methyl n-butyl ketone

- Revision to the BEI® for the following is proposed and placed on the NIC:

  Parathion

Introduction to the Physical Agents

- The Introduction to the Physical Agents in the *TLVs® and BEIs®* book that appeared on the 2018 NIC is adopted.

Physical Agents Section

- The following agent that appeared on the 2018 NIC with proposed changes or revisions is adopted:

  HAND–ARM VIBRATION

- The following appendix that appeared on the 2018 NIC is adopted:

  Appendix A: Statement on the Occupational Health Aspects of New Lighting Technologies — Circadian, Neuroendocrine and Neurobehavioral Effects of Light

- Under the *Optical Radiation* section, revision to the TLV® for the following is proposed and placed on the NIC:

  LASERS — The reason for this NIC is revision to the TLVs® for direct ocular exposures for all UV and UVC spectral regions; the addition of not to exceed (NTE) dual limits for direct ocular exposures and extended sources laser viewing conditions in the IRA spectral regions; and revision to TLVs® for skin exposure for UV and Light and IR regions.

- Under the *Ergonomics* section, revision to the TLV® for the following is proposed and placed on the NIC:

  WHOLE-BODY VIBRATION — The reason for this NIC is revision to the TLVs® including: TLVs® reduced by *R* (the stress variable) associated with a 10% risk of injury; addition of Note 8 regarding multiple shocks exceeding 1 g; reference to crest factor eliminated; and TLVs® and ALs plotted on both linear and natural log axes.

- Under the Physical Agents section, a new appendix is proposed and placed on the NIC as a Notice of Intend to Establish:

  Appendix B: Personal Physiologic Monitoring in the Workplace

Biologically Derived Airborne Contaminants Section

No new information for 2019.

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3 NIC + NIE 2019

2019 NOTICE OF INTENDED CHANGES

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Documentation is available for each of these substances and their proposed values.

This notice provides an opportunity for comment on these proposals. Comments or suggestions should be accompanied by substantiating evidence in the form of peer-reviewed literature and forwarded in electronic format to the ACGIH® Science Group at science@acgih.org. Please refer to the ACGIH® TLV®/BEI® Development Process on the ACGIH® website (www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations/tlv-bei-development-process) for a detailed discussion covering this procedure, methods for input to ACGIH®, and deadline date for receiving comments.

	2019 NOTICE OF INTENDED CHANGES				
Substance [CAS No.]	**TWA**	**STEL**	**Notations**	**MW**	**TLV® Basis**
† Acrylamide [79-06-1]	0.03 mg/m^3 (IFV)	—	Skin; DSEN; A2	71.08	CNS eff; cancer
† Antimony trioxide [1309-64-4]	0.02 mg/m^3 (I)	—	A2	291.50	Pneumonitis
† 4-tert-Butylbenzoic acid [98-73-7]	0.1 mg/m^3 (I)	—	Skin	178.20	Testicular dam; CNS & male repro eff
Cumene [98-82-8]	1 ppm	—	A3	120.19	Liver dam; resp tract inflammation
† Cyclohexene [110-83-8]	20 ppm	—	—	84.169	Liver eff

Substance [CAS No.]	2019 NOTICE OF INTENDED CHANGES TWA	STEL	Notations	MW	TLV® Basis
† Di(2-ethylhexyl) phthalate [117-81-7]	0.03 ppm	—	Skin; A3	390.54	Male repro system dam; teratogenic eff
† Formamide [75-12-7]	1 ppm	—	Skin; A3	45.04	Hematological eff; liver cancer
† Hexamethylenetetramine [100-97-0]	1 mg/m^3 (I)	—	DSEN; A4	140.20	Dermal sens
† Hexazinone [51235-04-2]	3 mg/m^3 (I)	—	A4	252.30	Hematological & liver eff
† Iodine [7553-56-2] and Iodides, as I	WITHDRAWN FROM NOTICE OF INTENDED CHANGES				
Iodoform [75-47-8]	0.2 ppm (IFV)	—	—	393.78	CNS & card system impair; liver & kidney dam
† Isoflurane [26675-46-7]	5 ppm	—	A4	184.49	Male repro system dam
† Methyl isobutyl carbinol [108-11-2]	20 ppm	40 ppm	—	102.18	Dizziness; headache; eye & URT irr
† Resin acids, as total Resin acids [8050-09-7]	0.001 mg/m^3 (I)	—	DSEN; RSEN		Asthma; resp & eye irr; dermal & skin sens
† Rosin core solder thermal decomposition products (colophony) [8050-09-7]	WITHDRAW ADOPTED TLV® AND *DOCUMENTATION*; *SEE* RESIN ACIDS				
† Sodium sulfate [7727-73-3; 7757-82-6]	WITHDRAWN FROM NOTICE OF INTENDED CHANGES				
† Styrene [100-42-5]	10 ppm	20 ppm	OTO; A3	104.16	URT irr; CNS impair; peripheral neuropathy; ototoxicity (hearing loss); visual disorders

Substance [CAS No.]	2019 NOTICE OF INTENDED CHANGES				
	TWA	STEL	Notations	MW	TLV® Basis
Styrene oxide [96-09-3]	1 ppm	—	Skin; DSEN; A3	120.15	URT irr; blood changes
† Sulfur pentafluoride [5714-22-7]	—	C 0.001 ppm	—	254.11	Pulm edema
† Thiodicarb [59669-26-0]	0.1 mg/m^3 (IFV)	—	DSEN; A3	354.50	Acetylcholinesterase inhib
† Titanium tetrachloride, as HCl [7550-45-0]	—	C 0.5 ppm	—	189.70	Upper resp tract irr & corrosion
Trimetacresyl phosphate [563-04-2]	0.05 mg/m^3 (IFV)	—	—	368.36	Adrenal gland & female repro system dam
Triparacresyl phosphate [78-32-0]	0.05 mg/m^3 (IFV)	—	—	368.36	Adrenal gland & female repro system dam

APPENDIX G: Substances Whose Adopted *Documentation* and TLVs® Were Withdrawn For a Variety of Reasons, Including Insufficient Data, Regrouping, Etc.

[Individual entries will remain for a 10-year period, commencing with the year of withdrawal]

Substance [CRN]	Year Withdrawn	Reason
Acetylene [74-86-2]	2015	*See* Appendix F: Minimal Oxygen Content
Aliphatic hydrocarbon gases, Alkanes [C_1–C_4]	2013	Methane, Ethane, Propane, Liquefied petroleum gas (LPG) and Natural gas — *see* Appendix F: Minimal Oxygen Content. Butane and Isobutane — *see* Butane, all isomers
Argon [7440-37-1]	2014	*See* Appendix F: Minimal Oxygen Content
n-Butyl acetate [123-86-4]	2016	*See* Butyl acetates, all isomers
sec-Butyl acetate [105-46-4]	2016	*See* Butyl acetates, all isomers
tert-Butyl acetate [540-88-5]	2016	*See* Butyl acetates, all isomers
Calcium chromate [13765-19-0], as Cr	2018	*See* Chromium and inorganic compounds
Calcium silicate, synthetic nonfibrous [1344-95-2]	2016	Insufficient data
Chromite ore processing (Chromate), as Cr	2018	*See* Chromium and inorganic compounds
Chromyl chloride [14977-61-8]	2018	*See* Chromium and inorganic compounds
Cyclopentadiene [542-92-7]	2019	*See* Dicyclopentadiene, including Cyclopentadiene
Ethyl cyanoacrylate [7085-85-0]	2018	*See* Cyanoacrylates, Ethyl and Methyl
Glycerin mist [56-81-5]	2013	Insufficient data relevant to human occupational exposure

APPENDIX G: Substances Whose Adopted *Documentation* and TLVs® Were Withdrawn For a Variety of Reasons, Including Insufficient Data, Regrouping, Etc.

[Individual entries will remain for a 10-year period, commencing with the year of withdrawal] (cont.)

Substance [CRN]	Year Withdrawn	Reason
Helium [7440-59-7]	2014	*See* Appendix F: Minimal Oxygen Content
Hydrogen [1333-74-0]	2014	*See* Appendix F: Minimal Oxygen Content
Isobutyl acetate [110-19-0]	2016	*See* Butyl acetates, all isomers
Isopropyl acetate [108-21-4]	2018	*See* Propyl acetate isomers
Methyl 2-cyanoacrylate [137-05-3]	2018	*See* Cyanoacrylates, Ethyl and Methyl
Neon [7440-01-9]	2014	*See* Appendix F: Minimal Oxygen Content
Nitrogen [7727-37-9]	2014	*See* Appendix F: Minimal Oxygen Content
Nonane [111-84-2], all isomers	2012	*See* Nonane
Oil mist, mineral	2010	*See* Mineral oil, excluding metal working fluids
Piperazine dihydrochloride [142-64-3]	2012	*See* Piperazine and salts
n-Propyl acetate [109-60-4]	2018	*See* Propyl acetate isomers
Soapstone	2011	*See* Talc
Strontium chromate [7789-06-2], as Cr	2018	*See* Chromium and inorganic compounds

APPENDIX G: Substances Whose Adopted *Documentation* and TLVs® Were Withdrawn For a Variety of Reasons, Including Insufficient Data, Regrouping, Etc.

[Individual entries will remain for a 10-year period, commencing with the year of withdrawal] (cont.)

Substance [CRN]	Year Withdrawn	Reason
Tantalum [7440-25-7] and Tantalum oxide [1314-61-0] dusts, as Ta	2010	Insufficient data
Zinc chromates [11103-86-9; 13530-65-9; 37300-23-5], as Cr	2018	*See* Chromium and inorganic compounds

2019 NOTICE OF INTENDED CHANGES

These substances, with their corresponding indices, comprise those for which (1) a BEI® is proposed for the first time, (2) a change in the Adopted index is proposed, (3) retention as an NIC is proposed, or (4) withdrawal of the *Documentation* and adopted BEI® is proposed. In each case, the proposals should be considered trial indices during the period they are on the NIC. These proposals were ratified by the ACGIH® Board of Directors and will remain on the NIC for approximately one year following this ratification. If the Committee neither finds nor receives any substantive data that change its scientific opinion regarding an NIC BEI®, the Committee may then approve its recommendation to the ACGIH® Board of Directors for adoption. If the Committee finds or receives substantive data that change its scientific opinion regarding an NIC BEI®, the Committee may change its recommendation to the ACGIH® Board of Directors for the matter to be either retained on or withdrawn from the NIC.

Documentation is available for each of these substances and their proposed values.

This notice provides an opportunity for comment on these proposals. Comments or suggestions should be accompanied by substantiating evidence in the form of peer-reviewed literature and forwarded in electronic format to the ACGIH® Science Group at science@acgih.org. Please refer to the ACGIH® TLV®/BEI® Development Process on the ACGIH® website (www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations/tlv-bei-development-process) for a detailed discussion covering this procedure, methods for input to ACGIH®, and deadline date for receiving comments.

2019 NOTICE OF INTENDED CHANGES

Chemical [CAS No.] / *Determinant*	*Sampling Time*	*BEI®*	*Notation*
METHYL n-BUTYL KETONE [591-78-6]	WITHDRAW ADOPTED BEI® AND *DOCUMENTATION*		
† PARATHION [56-38-2]			
Total p-Nitrophenol in urine	End of shift	0.5 mg/g creatinine	Ns
Acetylcholinesterase activity in red blood cells	End of shift	70% of individual's baseline activity**	Ns

** The average of two baseline respective acetylcholinesterase activity determinations 3 days apart, with no exposures to enzyme inhibiting pesticides for at least 30 days, is recommended for each worker prior to exposure to parathion because of large inter-individual differences in published baseline values. To be established at least once a year. Removal from workplace exposures is recommended until the acetylcholinesterase activity returns to within 20% of baseline.

† = 2019 Revision or Addition to the Notice of Intended Changes

NOTICE OF INTENDED CHANGE—

† LASERS

The reason for this NIC is revision to the TLVs® for direct ocular exposures for all UV and UVC spectral regions; the addition of not to exceed (NTE) dual limits for direct ocular exposures and extended sources laser viewing conditions in the IRA spectral regions; and revision to TLVs® for skin exposure for UV and Light and IR regions.

These TLVs® are for exposure to laser radiation under conditions to which it is believed nearly all workers may be repeatedly exposed without adverse health effects. The TLVs® should be used as guides in the control of exposures and should not be regarded as fine lines between safe and dangerous levels. They are based on the best available information from experimental studies. In practice, hazards to the eye and skin can be controlled by application of control measures appropriate to the classification of the laser.

Source Size and Correction Factor C_E

The following considerations apply only at wavelengths in the retinal hazard region, 400–1400 nanometers (nm). Normally, a laser is a small source, which approximates a "point" source and subtends an angle less than α_{min}, which is 1.5 mrad for all values of t. However, any source that subtends an angle, α, greater than α_{min}, and is measured from the viewer's eye, is treated as an "intermediate source" ($\alpha_{min} < \alpha \leq \alpha_{max}$) or a "large, extended source" ($\alpha > \alpha_{max}$). For exposure duration "t", the angle α_{max} is defined as:

α_{max} = 5 mrad for $t \leq 0.625$ ms

$\alpha_{max} = 200 \cdot t^{0.5}$ mrad for 0.625 ms < t < 0.25 s

α_{max} = 100 mrad for $t \geq 0.25$ s, and

α_{min} = 1.5 mrad

NOTICE OF INTENDED CHANGE—
† WHOLE-BODY VIBRATION

The reason for this NIC is revision to the TLVs® including: TLVs® reduced by *R* (the stress variable) associated with a 10% risk of injury; addition of Note 8 regarding multiple shocks exceeding 1 g; reference to crest factor eliminated; and TLVs® and ALs plotted on both linear and natural log axes.

The Threshold Limit Values (TLVs®), illustrated by the solid line in Figure 1 and tabulated at the center frequencies of one-third octave bands in Table 1, refer to the weighted root-mean-square (rms) acceleration magnitudes and durations of mechanically induced whole-body vibration (WBV). Operator or occupant exposures shall remain below the TLV® curve for the respective exposure duration occurring within a 24-hour period. The Action Levels (ALs) represented by the dashed line in Figure 1, and tabulated at the center frequencies of one-third octave bands in Table 1, also refer to the weighted rms acceleration magnitudes and durations of mechanically induced WBV. It is highly recommended that vibration mitigation activity be undertaken to reduce any operator or occupant exposures that occur within a 24-hour period and fall within the region bounded by the TLV® curve and AL curve. It is noted that unknown psychological or physiological influences may affect an individual's susceptibility to health risk. While the TLV® and AL curves may be used as a guide in the control of WBV exposure, they should not be regarded as defining a distinct boundary between safe and dangerous levels.