



safe work australia

Discussion Paper

The role of chemical exposure standards in
work health and safety laws

NOVEMBER 2015

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Exposure Standards: Seeking your views

Exposure standards represent airborne concentrations of individual chemical substances in the worker's breathing zone, which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers.

Exposure standards are referenced in the model Work Health and Safety (WHS) Regulations as mandatory legal limits which must not be exceeded.

Australia's workplace exposure standards were first adopted from the standards set by the American Conference of Governmental Industrial Hygienists (ACGIH) in the 1980s by the National Health and Medical Research Council. They were first published by Safe Work Australia's predecessor the National Occupational Health and Safety Commission (NOHSC) in 1990. About 80 of the 644 standards were updated between 1995-2005 by NOHSC, however the vast majority have not been updated since they were adopted.

This discussion paper examines the role of exposure standards in the regulatory framework and considers how they could be reviewed and maintained. The following issues are discussed:

- Safe Work Australia's exposure standards need to be updated. Research has revealed that one third of Australia's exposure standards are out of date.
- Exposure standards are designed to protect the health of workers but out of date standards are unlikely to sufficiently protect worker health.
- Anecdotal evidence suggests exposure standards are not used by small business and are not routinely used for compliance and enforcement.
- Because exposure standards are mandatory, a review of an exposure standard will generally require the preparation of a regulatory impact statement (RIS) including a cost benefit analysis of the proposed change. This can be a lengthy and costly process which makes it difficult to update exposure standards in a timely and efficient way.
- The original intent of exposure standards was to enable health and safety professionals like occupational hygienists to do their jobs more effectively. The move to make these standards mandatory has provided some clarity for duty holders, however exposure standard must still be considered in the context of the duty to eliminate or minimise exposure to hazards so far as is reasonably practicable.
- Safe Work Australia is considering how it could review exposure standards and keep them up to date in a timely and efficient way.

Feedback is particularly sought on:

- How exposure standards are currently used.
- What impact does compliance with exposure standards have for business and workers.
- What role should exposure standards have in the regulatory framework.
- What process should be used to review and maintain Australia's exposure standards.

Feedback is sought from interested stakeholders including:

- workers who use or handle chemicals in their day-to-day work
- businesses using, storing, handling or generating hazardous chemicals
- occupational hygienists and safety practitioners who use exposure standards in determining appropriate workplace controls and ensuring compliance
- medical practitioners and occupational physicians who monitor workers' health

- regulators with a role in determining compliance with the WHS Regulations
- academics and toxicologists with an interest in exposure standards, and
- unions and industry groups.

A number of questions have been developed to assist in gathering information on the use of workplace exposure standards and the ways in which they might be updated.

For ease of reference, the questions appearing throughout this discussion paper are listed below:

	Questions
1.	Do you use exposure standards in your workplace? If yes—how do you use exposure standards? (e.g. to assess or control exposure, review controls etc.) If yes—do you meet exposure standards or seek to minimise chemical exposures further?
2.	How much does ensuring compliance with exposure standards cost your business (including air monitoring costs)? Please provide examples if possible.
3.	Are you aware of other exposure or advisory standards in Australia or overseas (e.g. developed by international bodies or companies)? Do you use them? If so, please explain how.
4.	Should Australia's exposure standards be health-based or pragmatic? Why?
5.	Should exposure standards be mandatory (e.g. prescribed by law) or advisory? Please provide reasons.
6.	If exposure standards became advisory, would this change the way you approach the management of risks? Please provide reasons.
7.	Do you support mandating a smaller number of exposure standards and keeping them up to date? Please provide reasons.
8.	Do you have any views on how to prioritise which chemicals should have a mandatory exposure standard?
9.	What process should be used to review and keep exposure standards up to date?

Making a submission

You are invited to respond to some or all of the questions in this paper, or provide any other feedback on workplace exposure standards. Comments received in this public consultation process will be used to inform the development of a Consultation Regulatory Impact Statement.

Submissions are sought by 5.30 pm on **18 December 2015**. Submissions can be made either online via the Safe Work Australia submissions website, by email to WES@swa.gov.au or by post to:

The Director
Occupational Hygiene Section
Safe Work Australia
GPO Box 641
Canberra ACT 2601

Respondents may elect to have their submissions published online.

Glossary

Term	Definition
Airborne contaminant	Contaminant in the form of a fume, mist, gas, vapour or dust, and includes micro-organisms
ACGIH	American Conference of Governmental Industrial Hygienists
RIS	Regulatory Impact Statement
DNEL	Derived No Effect Level
DFG (Germany)	Deutsche Forschungsgemeinschaft Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area
Exposure standard	See Section 1.1 Equivalent terms used overseas include: occupational exposure limit (OEL), workplace exposure limit (WEL), threshold limit value (TLV), permissible exposure limit (PEL), recommended exposure limit (REL), workplace environmental exposure level (WEEL) and maximum concentration of a chemical substance (Maximale Arbeitsplatzkonzentrationen) (MAK)
HSE (United Kingdom)	Health and Safety Executive
ILO	International Labour Organisation
Model Work Health and Safety (WHS) laws	Includes model Work Health and Safety (WHS) Act and Regulations, as published on the Safe Work Australia website and adopted by all Australian jurisdictions except Victoria and Western Australia
NICNAS	National Industrial Chemical Notification and Assessment Scheme
NOHSC (Safe Work Australia's predecessor)	National Occupational Health and Safety Commission
OSHA (United States)	Occupational Safety and Health Administration
SCOEL (European Union)	Scientific Committee on Occupational Exposure Limits
Safe Work Australia	Australian Government Agency established under the <i>Safe Work Australia Act 2008</i> (Cwlth)
Substance	A reference to a substance includes a reference to a mixture.
WHS	Work health and safety (also known as occupational health and safety)

1. Introduction

1.1. What are exposure standards?

Exposure standards represent airborne concentrations of individual chemical substances in the workers' breathing zone which, according to current knowledge, should neither cause adverse health effects or undue discomfort to nearly all workers.

Airborne contaminants in the workplace may lead to illness, respiratory diseases like asthma, pneumoconiosis and silicosis, cardiovascular diseases and occupational cancers like mesothelioma, leukaemia and lymphoma.

Exposure standards aim to minimise the risk of adverse health effects by establishing precise targets for businesses to follow.

Safe Work Australia and its predecessors established exposure standards for 644 substances. These standards are given effect under Commonwealth, state and territory work health and safety laws.

There are three types of exposure standard:

- Time-Weighted Average (TWA)—the maximum average airborne concentration of a substance when calculated over an eight-hour working day, for a five-day working week
- Short Term Exposure Limits (STEL)—the time-weighted average maximum airborne concentration of a substance calculated over a 15 minute period, and
- Peak Limitations—a maximum or peak airborne concentration of a substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

Depending on the substance, an exposure standard may be expressed as:

- ppm – parts of vapour or gas per million parts of contaminated air by volume
- mg/m³ - milligrams of substance per cubic metre of air, or
- f/mL – fibres per millilitre of air¹.

Australia's workplace exposure standards were first adopted from the standards set by the American Conference of Governmental Industrial Hygienists (ACGIH) in the 1980s by the National Health and Medical Research Council. They were published in the NOHSC publication *Worksafe National Exposure Standards* [NOHSC:1003(1990)], updated in the publication [Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment](#) [NOHSC:1003(1995)] and were subsequently republished in 2012 as the Safe Work Australia publication [Workplace Exposure Standards for Airborne Contaminants](#).

1.2. Legal requirements

Under the model WHS laws (adopted in all jurisdictions except Victoria and Western Australia), persons conducting a business or undertaking must eliminate risks to health and safety so far as is reasonably practicable, and if it is not reasonably practicable to eliminate the risk, to minimise those risks so far as is reasonably practicable (s17).

In Australia exposure standards are mandatory in all jurisdictions (i.e. given effect under regulations). They are legally enforceable and not qualified by what is reasonably practicable. To comply with WHS Regulations, businesses must not exceed these minimum standards.

The model WHS Regulations require persons conducting a business or undertaking to:

¹ As determined by the membrane filter method.

- ensure that no person is exposed to airborne contaminants above the workplace exposure standard for the chemical (r49), and
- conduct air monitoring if it is not known whether exposure will exceed the exposure standard or monitoring is necessary to determine if there is a risk to health (r50).

The model WHS Regulations also contain detailed requirements for managing the risks of hazardous chemicals in workplaces, including asbestos and lead.

1.3. The purpose of exposure standards

Exposure standards are primarily designed to protect the health of most workers.

Safe Work Australia's [Guidance on the Interpretation of Workplace Exposure Standards for Airborne Contaminants](#) clarifies what exposure standards are and how they should be used:

Exposure standards do not identify a dividing line between a healthy or unhealthy working environment. Natural biological variation and the range of individual susceptibilities mean some people might experience adverse health effects below the exposure standard. Therefore, exposure standards should not be considered as representing an acceptable level of exposure to workers. They establish a statutory maximum upper limit.

All reasonably practicable steps must be taken to eliminate or minimise exposure to a level well below the exposure standard. Sections 17 and 19 of the WHS Act require that the risks posed by exposure to substances in the workplace are eliminated or kept as low as is reasonably practicable.

For this reason, it is important the airborne concentration of a substance or mixture hazardous to health is kept as low as is reasonably practicable to minimise the risk to health, regardless of whether or not there is an exposure standard or what the value of the exposure standard is.

Where there is no mandatory exposure standard in Australia, other established exposure standards or action levels should be used to assist in minimising exposure to chemicals.

Exposure measurement must not be used as an alternative to controlling exposure by putting in place hazard controls.²

As tools to eliminate or minimise injury and illness, exposure standards are used to:

- provide information to duty holders about the health risks of work-related exposures to chemicals
- provide guidance to work health and safety professionals (for example industrial hygienists, occupational physicians and safety engineers)
- help select effective risk controls, and
- determine the effectiveness of existing controls.

If there is no Australian exposure standard for a particular substance, the hazards of that substance should be managed in accordance with the duty to eliminate, or minimise risks to health and safety so far as is reasonably practicable. This may include using international standards as evidence of what is known about a hazard and how it should be controlled. Leading international standards include those set by the United Kingdom's Health and Safety Executive (HSE), the American Conference of Governmental Industrial Hygienists (ACGIH) and the German DFG Commission.

² Safe Work Australia (2013), *Guidance on the interpretation of workplace exposure standards for airborne contaminants*

Preliminary consultation with stakeholders indicates health and safety professionals use both Australian and international exposure standards in their work.

Questions	
1.	Do you use exposure standards in your workplace? If yes—how do you use exposure standards? (e.g. to assess or control exposure, review controls etc.) If yes—do you meet exposure standards or seek to minimise chemical exposures further?
2.	How much does ensuring compliance with exposure standards cost your business (including air monitoring costs)? Please provide examples if possible.

1.4. International exposure standards

Exposure standards are widely used around the world. They are known by a variety of terms including threshold limit values (TLVs) and occupational exposure limits (OELs). Exposure standards have been developed for almost 1500 substances. Most are developed by governments or expert scientific bodies. See [Attachment A](#) for further information on international standards-setting bodies.

Some large businesses are also opting to develop their own exposure standards, to address the risks of using out-dated standards set by government.

In Europe under the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulations manufacturers and importers of chemicals produced in quantities of 10 tonnes or more per year must prepare a chemical safety report and develop Derived No Effect Levels (DNELs). A DNEL is ‘the level of exposure above which humans should not be exposed’³.

While DNELs are similar to exposure standards they are set differently, so the resulting values can be different.

Additionally DNELs are set for both inhalation and other routes of exposure like skin exposure, and different groups of people like children, pregnant women and workers.

As DNELs are developed by individual manufacturers and importers, different DNELs have been set for almost identical chemicals produced by different manufacturers.

Over time every chemical produced in quantities of 10 tonnes or more per year in the European Union will have a DNEL and there will be many more DNELs than there are exposure standards.

Further discussion of DNELs is beyond scope of this paper. For purposes of the discussion below however it is important to note that DNELs are increasingly being viewed as de-facto exposure standards in Europe.

It is also noteworthy that one international regulator has effectively made a decision on the use of DNELs as standards. Dutch legislation ‘requires compliance with the Occupational Exposure Limit Value (OELV). However, if the DNEL is lower than the legal OELV, then Dutch law enforcement now advises use of DNEL, based on the precautionary principle...’⁴

With more information about chemicals and how to use them safely internationally, the role of Australian exposure standards in regulation will need to be carefully considered and evaluated to maintain consistency with good practice.

³ [European Chemicals Agency, Guidance on Registration](#)

⁴ Theo Scheffers & Geert Wieling, [Care with the DNEL, Occupational Hygienist!](#) June 2014

Question
3. Are you aware of other exposure or advisory standards in Australia or overseas (e.g. developed by international bodies or companies)? Do you use them? If so, please explain how.

1.5. Limitations of exposure standards

Limitations of exposure standards include:

- although they provide a way to objectively assess exposure to a hazardous chemical, they are not in themselves a means of eliminating or minimising exposure
- there is anecdotal evidence that small to medium-sized businesses do not understand or use exposure standards and may have difficulty complying with them, and
- of all the substances and mixtures used in workplaces only a relatively small number of have exposure standards.

These limitations have meant their effectiveness in protecting worker health is increasingly being questioned.⁵ Various jurisdictions have considered whether there is a better way, including the United States⁶ and the European Union.⁷

2. The role of exposure standards

Although mandatory exposure standards have played an important role in protecting the health of workers, some international regulators have considered whether there are better ways of reducing the risks to worker health, including the United States⁸ and the European Union.⁹ John Howard, the Director of NIOSH, goes so far as to ask, 'Are we living in a post-OEL [Occupational Exposure Limit] world?'¹⁰

This section considers the role of exposure standards in the regulatory framework and how effective they are in practice.

2.1. Compliance challenges

The experience of occupational hygienists and regulators suggests that small businesses in particular have a low level of understanding of exposure standard requirements and may not use them in controlling exposures.

HSE's survey, *Industry's Perception of Use of Occupational Exposure Limits*, provides useful background for the Australian environment as the UK has comparable regulatory frameworks and cultures. In that study, it was found there was limited use and understanding of exposure standards in British workplaces^{11,12}. The survey found that while most companies were taking some steps to protect workers from exposure to airborne contaminants:

⁵ John Howard, [Setting Occupational Exposure Limits: Are we Living in a Post-OEL World?](#), 2005

⁶ [Chemical Management and Permissible Exposure Limits \(PELs\)](#); Proposed Rule, 2014

⁷ [The role of occupational exposure limits in the health and safety systems of EU Member States](#), Research Report 172, 2003

⁸ [Chemical Management and Permissible Exposure Limits \(PELs\)](#); Proposed Rule, 2014

⁹ [The role of occupational exposure limits in the health and safety systems of EU Member States](#), Research Report 172, 2003

¹⁰ John Howard, [Setting Occupational Exposure Limits: Are we Living in a Post-OEL world?](#), 2005

¹¹ Health and Safety Executive, [Industry's perception and use of occupational exposure limits](#). Contract Research Report 144/1997

¹² MD Topping, CR Williams and JM Devine, [Industry's perception and use of occupational exposure limits](#)

- two-thirds of users of potentially hazardous substances did not know the legal requirements for working with hazardous substances, and
- many small businesses just want to be told what they need to do.

Similar results were found in a study in Sweden¹³ which identified that awareness and understanding of exposure standards was low.

A 2013 Productivity Commission report states 'limited resources, capability and sophistication of most small businesses means that a significant proportion will have insufficient understanding of what needs to be done to comply with certain regulations' and '...many small businesses want to be told, simply and concisely, what to do in order to meet their compliance obligations. Small business especially value guidance ... that is specific to their business's context'¹⁴.

In contrast, it appears large businesses tend to be more aware of regulatory requirements. Many employ occupational hygienists to control chemical exposures or have the capacity to engage consultants to undertake this work. In addition some large businesses set their own internal exposure standards in line with international 'best practice' and emerging health and toxicological information.

Exposure standards appear to be used predominantly by occupational hygienists and large businesses.

Some regulators do not actively use exposure standards for compliance and enforcement purposes.

There are no known prosecutions for non-compliance with exposure standards. In situations where regulators find that controls are inadequate, duty holders are generally charged for breaches of the primary duty of care under the WHS Act.

Some regulators have reported that workplace inspections generally focus on workplace controls rather than exposure standards.

2.2. Should Australia's exposure standards be health-based or pragmatic standards?

All exposure standards are established taking account of the health hazards or health effects of the chemical.

Health based exposure standards

Health-based exposure standards are those that have been set at a level where known adverse health effects are unlikely to occur. This level is sometimes referred to as the 'no observed adverse effect level' (or the NOAEL). Where the exposure standard is set at or below the NOAEL for a chemical, the exposure standard is health-based.

For some chemicals, the level of exposure where adverse health effects are unlikely to occur cannot be determined and a health-based standard cannot be set. For example, for some carcinogens there is no known safe level of exposure. In this case a health-based exposure cannot be set and the exposure standard needs to be set at a pragmatic or 'hazard-control' level.

¹³ L Schenk, Awareness and understanding of occupational exposure limits in Sweden. Regulatory Toxicology and Pharmacology, 2013 Apr;65(3):304-10

¹⁴ Productivity Commission, [Regulator engagement with small business, Productivity Commission Research Report](#), September 2013

Pragmatic exposure standards

Pragmatic exposure standards are set at a level higher than the NOAEL and where health effects are expected to occur if exposed at that level. Pragmatic exposure standards may also be set in situations where it is not reasonably practicable to comply with a NOAEL in the workplace¹⁵. These exposure standards are set at a level that is reasonably practicable to achieve and is a trade-off between the health costs and compliance costs to control exposure to the required level. Pragmatic exposure standards are also set where there are measurement difficulties.

Most of Australia's exposure standards are health-based standards which were established purely on the basis of health effects. A small number are 'pragmatic' exposure standards which take a range of factors into account—like costs of compliance and technical feasibility—not just health considerations.

Australia's list of exposure standards does not identify which exposure standards are health-based and which are pragmatic standards¹⁶.

Question
4. Should Australia's exposure standards be health-based or pragmatic? Why?

2.3. Should exposure standards be mandatory or advisory?

Exposure standards were not always used as mandatory legal limits. They became legal limits in most jurisdictions following the introduction of NOHSC's hazardous substances regulatory framework. Prior to this, they were used as guidance values rather than for compliance purposes. This is consistent with the approach advocated by the ACGIH. The ACGIH documentation notes:

'The Threshold Limit Values (TLVs) ... are developed as guidelines to assist in the control of health hazards. These recommendations or guidelines are intended for use in the practice of industrial hygiene, to be interpreted and applied only by a person trained in this discipline. They are not developed for use as legal standards and the ACGIH does not advocate their use as such.'¹⁷

Exposure standards were adopted into Commonwealth, state and territory health and safety laws between 1995 and 2003. From 2012 onwards most jurisdictions (all except Victoria and Western Australia) adopted uniform model WHS laws that maintained previous arrangements—that is, mandatory exposure standards.

What are the benefits of mandatory exposure standards?

Mandatory exposure standards represent the maximum concentration of airborne contaminants in the breathing air of the worker. While they do not provide a line between safe and unsafe exposure, they do set a legal limit which may provide certainty for businesses on minimum requirements and how regulators will assess compliance.

It is argued that having a mandatory exposure standard as opposed to an advisory standard provides more protection to the health of workers because there is a greater compulsion on employers to control exposures to a low enough level.

¹⁵ An example is benzene which has an exposure standard of 1 ppm even though 0.5 ppm was considered to be the most appropriate level to protect worker health. A cost-benefit analysis showed it was not reasonably practicable to achieve the 0.5 ppm level using existing, known controls.

¹⁶ All exposure standards that were adopted from the ACGIH are health-based. Standards that have been reviewed by NOHSC or Safe Work Australia are considered to be pragmatic standards as their development process included cost benefit analysis.

¹⁷ ACGIH, 2015 TLVs and BEIs

Compliance and enforcement action may be simpler in that regulators can check air monitoring results to see whether an exposure standard has been exceeded. Initial stakeholder feedback indicates that state and territory WHS regulators support mandatory exposure standards as they are enforceable limits.

The model WHS laws also require duty holders to ensure air monitoring is conducted in situations where there is uncertainty about whether an exposure standard has been exceeded (r50).

What are the benefits of advisory exposure standards?

Advisory exposure standards would be provided as guidance to help businesses assess exposure to airborne contaminants and determine the effectiveness of control measures. It could be argued that making exposure standards advisory would allow greater focus on the primary duty of care, that is—to eliminate or minimise risks to health and safety so far as is reasonably practicable.

It has been suggested that it may be easier to update advisory standards. For example, it would be possible to adopt exposure standards from an international body such as the ACGIH, the Deutsche Forschungsgemeinschaft (DFG) (Germany) or the Commission on the Scientific Committee on Occupational Exposure Limits (SCOEL) (EU). These international bodies issue updates to a small number of exposure standards each year and Safe Work Australia could keep exposure standards up-to-date by adopting these revisions annually. This could be done more quickly and easily if exposure standards had advisory rather than mandatory status because assessment of regulatory impact for each change would not be necessary.

Questions	
5.	Should exposure standards be mandatory (e.g. prescribed by law) or advisory? Please provide reasons.
6.	If exposure standards became advisory, would this change the way you approach the management of risks? Please provide reasons.

3. Keeping exposure standards up to date

Safe Work Australia conducted preliminary consultation through an expert working group comprised of representatives from WHS Regulators, industry, unions, the Australian Institute of Occupational Hygienists (AIOH), the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and the Cancer Council of Australia.

The expert working group agreed that Safe Work Australia's exposure standards do not reflect the latest scientific information and may not be adequate to protect the health of workers in some cases.

3.1. How many exposure standards are out of date?

Australia's current list of 644 exposure standards was adopted in 1995. Approximately 80 of those have been reviewed since being implemented.

To estimate the extent of the problem Safe Work Australia recently compared the Australian exposure standards with those of a leading international body, the ACGIH. A comparison with the ACGIH's 2014 standards indicates:

- 153 (24%) of Australia's exposure standards are higher than equivalent ACGIH values, and
- 35 (5%) of Australia's exposure standards are lower than equivalent ACGIH values.

This indicates almost a third of Australia's exposure standards are out-of-date when compared with the ACGIH's standards.

See [Attachment B](#) for a comparison of 20 international exposure standards. While Australia's exposure standards are more closely aligned with those of the UK and ACGIH, the comparison highlights inconsistencies between standards for 18 of the 20 substances.

To a large extent inconsistencies are due to the different processes used for setting and reviewing exposure standards; however they also provide evidence of the difficulties faced by standard setting bodies in keeping exposure standards up to date.

3.2. Challenges of reviewing and updating exposure standards

Australian perspective

Safe Work Australia relies on other Australian Government agencies—like the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and the Office of Chemical Safety—to carry out research and assess the safety of new and existing chemicals.

Safe Work Australia then uses this information to inform its policy development and produce guidance material for the Australian community. However, there are significant resource challenges in reviewing existing exposure standards and introducing new exposure standards based on new evidence.

It can take several months to more than a year to carry out the necessary consultation and complete a review of a single exposure standard, depending on the complexity of the review and the level of consultation required.

Significant resources are required to:

- establish panels of experts or consultancies to examine, analyse and review relevant research and international developments
- draft reports of findings
- consult with industry, unions and workers
- undertake surveys about regulation impact, and
- undertake a regulation impact assessment.

For example a review of the exposure standard for crystalline silica, undertaken by NOHSC, cost \$170,000 and spanned several years. The majority of this funding was used to assess the regulation impact of the proposed changes.

The investment required to review Australian exposure standards means only a very limited number of the 644 exposure standards may be reviewed at any given time.

Steps have previously been taken by NOHSC in the 1990s to minimise the cost of reviews and improve the efficiency of the process. This involved undertaking approximately 80 reviews of exposure standards over seven years which could be 'fast-tracked' because the process relied on the research, regulation impact analysis, and recommendations of the United Kingdom's Health and Safety Executive (HSE) and the Australian Government's National Industrial Chemical Notification and Assessment Scheme (NICNAS).

This fast-track process is no longer an option—primarily because the HSE no longer sets its own standards, so is not in a position to share the necessary information previously provided to NOHSC.¹⁸

¹⁸ The HSE updates its standards in line with European Union (EU). In the EU the key standards-setting body is the Scientific Committee on Occupational Exposure Limits (SCOEL).

While some evaluation of regulation impact may be completed in-house, Safe Work Australia usually engages consultants to undertake cost-benefit analyses. It is estimated the cost-benefit analysis for each review of an exposure standard would cost at least \$20,000. On this basis it is estimated it would cost almost \$13 million to update Australia's exposure standards (excluding costs of commissioning toxicological reports).

International perspective

Other countries have also struggled to keep their exposure standards up-to-date. Reviews are resource intensive, so only a very small proportion of exposure standards are made or reviewed each year. For example:¹⁹

- the Nordic Expert Group has published 154 toxicological evaluations since 1978 (four per year)
- the Swedish Criteria Group has completed 250 (about seven per year)
- SCOEL has published 125 summary documents in 20 years (5.25 per year), and
- ACGIH have produced 700 TLVs and 50 biological exposure standards since the mid-1940s (roughly 11 per year). More recently they have reviewed approximately 20 per year.

Strategies adopted by other countries to address resource constraints include , for example:

- moving from country to region-based standards (e.g. the United Kingdom is updating their list with the European SCOEL standards)
- relying more heavily on other non-government sources of authoritative research and information
- relying more heavily on producing advisory standards rather than mandatory standards (e.g. United States)
- relying more on manufacturers and importers to generate product-specific information (e.g. European Union's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) policy²⁰)
- moving to a different regulatory model (e.g. OSHA is consulting on exposure standards and other strategies to address chemical exposures in the US—see *Chemical Management and Permissible Exposure Limits (PELs): Request for Information, 2014*²¹).

In the United States, exposure standards are regulated by the Occupational Safety and Health Administration (OSHA). It sets both mandatory and recommended Permissible Exposure Limits (PELs). Many of OSHA's PELs are outdated and inadequate for ensuring protection of worker health. OSHA recommends employers consider using alternative occupational exposure limits. It explains:

OSHA recognizes that many of its permissible exposure limits (PELs) are outdated and inadequate for ensuring protection of worker health. ...

Industrial experience, new developments in technology, and scientific data clearly indicate that in many instances these adopted limits are not sufficiently protective of worker health. This has been demonstrated by the reduction in allowable exposure limits recommended by many technical, professional, industrial, and government organizations, both inside and outside the United States. Many large industrial organizations have felt obligated to

¹⁹ Linda Schenk, [Setting occupational exposure limits](#)

²⁰ European Commission, [REACH](#)

²¹ OSHA, [Chemical Management and Permissible Exposure Limits](#)

supplement the existing OSHA PELs with their own internal corporate guidelines. To provide employers, workers, and other interested parties with a list of alternate occupational exposure limits that may serve to better protect workers, OSHA has [supplemented its information] with other selected occupational exposure limits²².

This policy encourages businesses to look beyond government-regulated standards to other sources of authoritative standards to protect the health of workers.

4. Establishing a process for reviewing exposure standards and keeping them up to date

This section explores how Safe Work Australia could review exposure standards and keep them up to date in a timely and efficient way.

4.1. Reinstating the NOHSC ‘fast track’ process

Some stakeholders have suggested Safe Work Australia could reinstate the NOHSC ‘fast-track’ process to review exposure standards. As outlined in Section 3.2 above, this option is no longer available due to changes internationally.

Even if the NOHSC ‘fast track’ process was reinstated, or a new equivalent process was established, it is unlikely that Safe Work Australia could keep the current exposure standards list up to date. The ‘fast-track’ process allowed NOHSC to complete approximately 11 reviews each year. Assuming Safe Work Australia could review exposure standards at this rate, it would take 56.5 years to review all 644 exposure standards and exposure standards would never be up to date.

4.2. Replacing exposure standards in line with international updates

Safe Work Australia could undertake an internal process to replace Australia’s exposure standards in line with those international standards that have been reviewed recently. For example, in 2015 the ACGIH noted intended changes to 22 Threshold Limit Values. Rather than undertaking its own reviews, Safe Work Australia could simply replace exposure standards with the recently updated ACGIH standards.

This would require unqualified acceptance of international standards and would simplify maintaining exposure standards because Safe Work Australia would not undertake any reviews.

While this would simplify the process of reviewing exposure standards, Safe Work Australia would still need to undertake regulatory impact analysis if standards were mandatory.

4.3. Adopting international exposure standards

Safe Work Australia could adopt all exposure standards from an international standards setting body, such as the ACGIH or DFG, and regularly update them to ensure they stay up to date with international standards. This approach would simplify the process by updating all exposure standards at the same time. While it would reduce the work involved in undertaking the review, regulatory impact analysis would be extremely expensive. It is also likely that in many cases, data for cost-benefit analysis would not be available or could not be determined.

4.4. Keeping a smaller number of mandatory exposure standards up to date

It has been suggested it would be more efficient to keep a smaller number of mandatory exposure standards up to date. For example, exposure standards could be retained for high-

²² OSHA, [Permissible Exposure Limits – Annotated Tables](#)

hazard or high-risk chemicals such as lead and asbestos. Criteria would need to be developed to determine which exposure standards should be retained and it is likely there would be many different views on which standards are necessary.

This option allows for a risk-based approach, depending on the level of risk associated with a particular chemical. Reviews for high-hazard/high-risk chemicals would be complex and require significant time and resources; however having a smaller number of exposure standards would significantly reduce the costs associated with reviewing standards and associated regulatory impact analysis.

Questions	
7.	Do you support mandating a smaller number of exposure standards and keeping them up to date? Please provide reasons.
8.	Do you have any views on how to prioritise which chemicals should have a mandatory exposure standard?

4.5. What happens in other countries?

- Some standards setting bodies, such as the ACGIH and DFG, update a small number of exposure standards each year.
- Many countries use ACGIH standards as the basis of their exposure standards.
- In Europe, there has been a shift from country-based to region-based standards. In the EU, member states must adopt a legally binding OEL at or below a binding occupational exposure limit value (BOELV) set by SCOEL²³.
- In the UK, HSE updates OELs in line with SCOEL standards.
- In the US, OSHA has been unable to update its exposure standards due to court challenges. The OSHA website publishes a statement acknowledging that permissible exposure limits are outdated and insufficient to protect worker health. It provides alternative lists of up to date and more protective advisory standards²⁴.

Attachment A provides summary information on international exposure standards.

While exposure standards are used and maintained around the world, other mechanisms are also being used to control exposures to workplace hazardous chemicals.

- In Europe, the EU's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulations require manufacturers and importers to generate product-specific information to show how a chemical may be used safely in the workplace²⁵.
- In the US, OSHA is exploring alternative regulatory models and is currently consulting on exposure standards and other strategies to address chemical exposures—see *Preventing occupational illnesses through safer chemical management: Request for Information*, 2014²⁶.
- In the Netherlands, the government sets general goals but not the means by which these goals are achieved. Less detail is provided in legislation and agreements are made between employers, unions and government²⁷.

²³ European Union, [IOELV and BOELV](#)

²⁴ OSHA, [Permissible Exposure Limits – Annotated Tables](#)

²⁵ European Commission, [REACH](#)

²⁶ OSHA, [Preventing occupational illnesses through safer chemical management](#)

²⁷ R Frencken, [Arbocatalogue: A Dutch Phenomenon](#), London, 2015

Question
9. What process should be used to review and keep exposure standards up to date?

5. Conclusion

The use of chemicals in Australia is extensive. Around 40,000 chemicals are listed by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) on the Australian Inventory of Chemical Substances (AICS).²⁸ These are formulated into over 400,000 trademarked products²⁹. Of these, less than one per cent have an exposure standard.

To help assess the options for a review of exposure standards and work health and safety laws, we need to know more about the businesses who use these chemicals, including if they are aware of their legal obligations to:

- meet mandatory exposure standards
- if required—carry out ad hoc or routine air monitoring to ensure compliance with mandatory exposure standards, and
- minimise chemical exposures, so far as is reasonably practicable.

It is also important to understand how exposure standards are being used in the broader context, for example where it is reasonably practicable to reduce exposure below the prescribed standard. This is particularly important where an exposure standard has not been updated for some time, and might not be adequate to protect the health and safety of workers.

The different approaches being taken to setting exposure standards internationally demonstrates the level of complexity involved in maintaining up-to-date exposure standards in Australia.

The question then is whether it is useful to continue mandating an Australian list of workplace exposure standards, or look to current international practice for alternative ways to manage these risks.

In order to be effective, exposure standards must be based on current toxicological and health data available. The current Australian regulatory arrangements which mandate exposure standards makes it difficult to respond to changes in evidence in a timely way because of the resources needed to assess regulatory impact.

²⁸ [AICS](#) is a regulatory device that distinguishes new from existing industrial chemicals used in Australia. Australian Government, Department of Health, National Industrial Chemicals Notification and Assessment Scheme, Australian Inventory of Chemical Substances (AICS). 17/02/14. Note that not all chemicals listed on AICS are hazardous.

²⁹ COAG (2008): Report on the Control of Chemicals of Security Concern, Canberra

Attachment A: Leading exposure standards-setting bodies

Exposure standards are known by a variety of terms around the world including threshold limit values, occupational exposure limits and permissible exposure limits.

There are significant differences in how often exposure standards are reviewed and their legal status in different parts of the world.

While some countries set their own exposure standards, many adopt exposure standards from leading standards-setting organisations.

Two organisations set the majority of exposure standards around the world:

- the ACGIH, and
- the European Union's Scientific Committee on Occupational Exposure Limits (SCOEL).

United States (non-government): ACGIH

The [ACGIH](#) is recognised internationally as an authoritative source of exposure standards. It conducts reviews and publishes updates annually.

The ACGIH's threshold limit values form the original basis of many exposure standards world-wide.

More recently some stakeholders have raised concerns about the effects of the ACGIH's threshold limit values on industry. In some cases this has extended to legal proceedings.

European Union: SCOEL

The European Union established [SCOEL](#) in 1995 to advise it on occupational exposure limits for workplace chemicals. The SCOEL sets binding and indicative exposure limits.

If SCOEL sets a binding exposure standard, European Union Member states must adopt it under their laws. The standard Member states set may be stricter than the binding occupational exposure limit but must not be less protective.

The SCOEL have set approximately 180 occupational exposure limits—only 10 of which are binding.

Over time it is expected there will be greater standardisation across Europe as occupational exposure limits are set at the same or similar levels.

Other exposure standards-setting bodies

Nordic Expert Group

The Nordic Expert Group for Criteria Documentation of Health Risks of Chemicals consists of scientific experts from Nordic countries including Sweden, Norway, Denmark, Finland and Iceland. It sets exposure standards for the five Nordic countries.

It collaborates closely with other leading international groups.

Germany: Deutsche Forschungsgemeinschaft (DFG) Commission

The [Deutsche Forschungsgemeinschaft \(DFG\) Commission](#) for the Investigation of Health Hazards of Chemical Compounds in the Work Area is a German research organisation.

The DFG Commission maintains exposure standards and publishes annual updates.

United Kingdom: Health and Safety Executive (HSE)

The [HSE](#) set occupational exposure limits for the United Kingdom until 2005 but is no longer setting standards. Their list is now maintained by adopting standards set by SCOEL.

In 2003-04 the HSE reviewed its occupational exposure limits. It deleted over 100 due to concerns about the inadequate standard of health protection they provided.

United States: Occupational Safety and Health Administration (OSHA)

OSHA established 'permissible exposure limits' in 1971. The majority have **not** been updated since then. This has been largely attributed to stringent regulation impact requirements and legal action. For more information see [Chemical Management and Permissible Exposure Limits \(PELs\): Proposed Rule](#), 2014.

OSHA's position is that many of its permissible exposure limits are inadequate to protect worker health. It publishes alternative exposure limits for use by industry, which are not mandatory. The annotated tables list permissible exposure limits alongside exposure limits published by the ACGIH and the National Institute for Occupational Safety and Health.

OSHA is currently reviewing its approach to managing chemical exposures in the workplace. It is investigating options for more effective and efficient approaches to address the challenges associated with its current regulatory approach.

Summary table

Country/ region	Standard setting body	Name of exposure standard	Other information
Pacific			
Australia	Safe Work Australia	Workplace Exposure Standards	<ul style="list-style-type: none"> Originally adopted from ACGIH's TLVs No updates to WES since 2005³⁰
New Zealand	Department of Labour	Workplace Exposure Standards	<ul style="list-style-type: none"> Adopted from ACGIH's TLVs Last updated 2013
Asia			
Japan	National Institute for Occupational Health and Safety, Japan (JNIOSH)	Permissible Exposure Limits (PELs)	<ul style="list-style-type: none"> Annual updates The majority of PELs are the same as ACGIH's values
Hong Kong	Labour Department	Occupational Exposure Limits (OELs)	<ul style="list-style-type: none"> Based on ACGIH's TLVs Last updated 2002
European Community			
European Union (EU)	Scientific Committee on Occupational Exposure Limits (SCOEL)	Binding Occupational Exposure Limit Value (BOELV) Indicative Occupational Exposure Limit Value (IOELV)	<ul style="list-style-type: none"> Annual updates Member states must adopt a legally binding OEL at or below the BOELV
United Kingdom	Health and Safety Executive (HSE)	Workplace Exposure Limits (WELs)	<ul style="list-style-type: none"> OELs adopted from SCOEL Ceased developing/reviewing OELs
Germany	DFG Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area	TRKs (Technische Richtkonzentrationen) (technical guidance concentrations) MAKs (Maximale Arbeitsplatzkonzentrationen) (maximum concentration of a chemical substance)	<ul style="list-style-type: none"> Annual updates
Nordic countries			
	Nordic Expert Group		<ul style="list-style-type: none"> Produces criteria documentation used for setting OELs in Nordic countries Annual updates

³⁰ Except Man-Made Vitreous Fibres (updated April 2012)

Country/ region	Standard setting body	Name of exposure standard	Other information
Denmark	Arbejdsmiljørådet (Council on Working Environment)	Grænseværdier for stoffer og materialer (limit values for substances and materials)	<ul style="list-style-type: none"> • Annual updates
Norway	Arbejdstilsynet (Central Labour Inspectorate)	Administrative Standards (Norms)	<ul style="list-style-type: none"> • Annual updates
Sweden	Arbetsmiljöverket (Swedish Work Environment Authority)	Hygienic limit values and measures for air pollutants	<ul style="list-style-type: none"> • Last updated 2011
The Netherlands	Dutch Expert Committee on Occupational Safety (DECOS), Ministry of Social Affairs and Employment	Private OELs (derived by industries using chemicals) Public OELs (adopted from EU)	<ul style="list-style-type: none"> • The majority of 770 Dutch OELs were removed in 2007 • Not setting any new OELs
Finland	Ministry of Social Affairs and Health	Sitovat raja-arvot	<ul style="list-style-type: none"> • Last updated 2012
USA			
	American Conference of Governmental Industrial Hygienists (ACGIH)	Threshold Limit Values (TLVs)	<ul style="list-style-type: none"> • Annual updates
	Occupational Safety and Health Administration (OSHA)	Permissible Exposure Limits (PELs)	<ul style="list-style-type: none"> • Established in 1971 • Based on ACGIH's TLVs
	National Institute for Occupational Safety and Health (NIOSH)	Recommended Exposure Limits (REL)	<ul style="list-style-type: none"> • Last updated 2013
	Toxicology Excellence for Risk Assessment (TERA)	Workplace Environmental Exposure Levels (WEELs)	<ul style="list-style-type: none"> • Annual updates
Canada			
Quebec	Commission de la santé et de la sécurité du travail (CSST)	Valeurs d'exposition admissible (VEA) (occupational exposure limit values)	<ul style="list-style-type: none"> • Updated annually
British Columbia	WorkSafeBC	OELs	<ul style="list-style-type: none"> • Updated annually • Adopted ACGIH's TLVs

Attachment B: Comparison between Australian and international exposure standards for 20 substances

Substance	Unit (ppm/ mg/m ³ f/ml)	HSE UK WEL 2011	NIOSH REL	OHSA US PEL (3M US 2012)	ACGIH TLV (3M US 2012)	AIHA WEEL (3M US 2012)	DFG German MAK	Ontario Canada 2013	Australia	NZ
Magnesium oxide fume	mg/m ³	4		15					10	10
Platinum metal dust	mg/m ³	5	1		1			1	1	1
tert-Butyl acetate	ppm	200	200	200	200		20	200	200	200
Pyrocatechol (Catechol)	ppm	5	5		5			5	5	5
Xylene (o-isomer)	ppm	50	100	100	100		100	100	80	50
1,2-Dichlorobenzene	ppm	25	50	50	25		10	25	25	50
Dimethylamine	ppm	2	10	10	5		2	5	2	10
Sulphuric acid mist	mg/m ³	0.05	1	1	0.2		0.1	0.2	1	1
Toluene	ppm	50	100	200	20		50	20	50	50
Arsine	ppm	0.05	0.0006	0.05	0.005			0.005	0.05	0.05

Substance	Unit (ppm/ mg/m ³ f/ml)	HSE UK WEL 2011	NIOSH REL	OHSA US PEL (3M US 2012)	ACGIH TLV (3M US 2012)	AIHA WEEL (3M US 2012)	DFG German MAK	Ontario Canada 2013	Australia	NZ
Halothane	ppm	10	2		50		5	2	0.5	0.5
Hydrogen cyanide	ppm	10	4.7	10	4.7		1.9	4.7	10	10
n-Hexane	ppm	20	50	500	50		50	50	20	20
Nickel- metal dust /solubles	mg/m ³	0.1	0.015	1	0.1			0.1	0.1	0.1
Phosphine	ppm	0.1	0.3	0.3	0.3		0.1	0.3	0.3	0.3
Styrene	ppm	100	50	100	20		20	35	50	50
Trichloro-nitromethane	ppm	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chromium (VI) compounds	mg/m ³	0.05	0.001	0.0005	0.01			0.01	0.05	0.05
Formaldehyde	ppm	2	0.016	0.75	0.3		0.3	1	1	0.5
Methyl isocyanate	ppm	0.02	0.02	0.02	0.02		0.01	0.02	0.02	0.02