AUSTRALIAN INSTITUTE OF OCCUPATIONAL HYGIENISTS ®

AIOH Comments on Safe Work Australia Workplace Exposure Standards (WES) Release 15

Workplace Exposure Assessment Committee

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1.0 Introduction

The following represents consolidated feedback from a number of AIOH members. It does not necessarily represent the views of all AIOH members, some of whom may have responded separately as individuals.

It was noted that as part of the ongoing review of the WESs, Safe Work Australia are in particular seeking comments of a technical nature regarding:

- the toxicological information and data that the value is based upon, and
- the measurement and analysis information provided.

Regarding the latter point, the question is not whether the proposed WESs are measurable, but whether we can measure the contaminants accurately at levels well below the proposed WESs. This will always be the key requirement from a compliance monitoring perspective. When assessing whether or not accurate sampling and analytical methods are available to measure exposure to compare with or assess compliance against a recommended exposure standard, the European Commission (2017 - *Methodology for derivation of occupational exposure limits of chemical agents* - The General Decision-Making Framework of the Scientific Committee on Occupational Exposure Limits (SCOEL), Luxembourg: Scientific Committee on Occupational Exposure Limits) state that "Measurement techniques should be able to assess exposure at: 0.1 times the OEL for 8-hour TWA". The use of an action limit (e.g. half the WES) and application of a reduction factor due to extended or unusual shifts (> 8-h day / 40-hour week) would further complicate quantification of exposure concentrations against some proposed WESs. Where a health-based WES cannot be adequately quantified using current sampling / analytical methods, then exposures should be managed to ALARP.

In some cases, the chemical is either not used or banned in Australia. In such cases, no WES should be set as exposure is highly unlikely. It may be best to note they are banned substances and keep any potential exposures to ALARP. It would be important to add a historical note to HCIS explaining why a WES has been removed.

Regarding our comment as to the need for a WES for substances that are primarily an irritant, this is consistent with our feedback on the Safe Work Australia 'Consultation Regulation Impact Statement: Workplace exposure standards framework under the model Work Health and Safety laws". In our feedback to your question 5 (Are there any other options that could be considered to achieve the government's objectives?), the "AIOH suggests that mandatory WESs apply to priority health hazard substances, defined as those with a health effect other than irritation alone. WESs applicable to irritants could be advisory only. At the very least, if considering reducing the number of mandatory WESs, there should still be a mandatory WES for substances considered to be carcinogens, mutagens, teratogens, reproductive toxins or sensitizers, or where there is a requirement for health surveillance." This is not to say that controls should not be implemented if symptoms occur due to irritants. The AIOH supports advisory exposure limits for primary irritants if they are based on tolerable levels that are feasibly measured and controlled.

2.0 Comments

SWA Chemical Name	Revise	Comments
Ethylene glycol (particulate) (Ethane-1,2-diol)	Yes	Changed from TWA to STEL limit of 10 mg/m^3 based on ACGIH documentation. Being primarily an irritant, should we even consider assigning a WES? **Agree to proposed change from TWA to STEL value?**
Ethylene glycol (vapour) (Ethane-1,2-diol)	No	TWA set to protect against URT & eye irritation; STEL to protect against acute irritation effects. Human study found irritation at 55 ppm (long-term) and 73 ppm (15 min). Based on SCOEL documentation. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WESs**
Methyl 2-cyanoacrylate (mecrilate)	?	Could not find mention of this substance WES change?
Methyl ethyl ketone (MEK, 2-Butanone)	Yes	Proposed TWA and STEL are consistent with ACGIH, DFG & SCOEL recommendations. **Agree with proposed WES**
alpha-Methyl styrene (2-Phenylpropene)	No	Proposed TWA and STEL are consistent with SCOEL recommendations. **Agree to retain current WES**
Mineral turpentine	?	Could not find mention of this substance WES change?
Monocrotophos (Azodrin)	Yes	An organophosphorus insecticide. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. A review by the National Registration Authority for Agricultural and Veterinary Chemicals (2000) cancelled the registrations and all relevant approvals (including the active constituent approval) for monocrotophos. Proposed TWA consistent with ACGIH TLV. **Need for WES? If so, then agree to proposed WES**
Nicotine	No - interim	Proposed TWA is consistent with ACGIH & HCOTN recommendations. **Agree to retain current WES**
Nitrapyrin (N-Serve; 2-Chloro-6-(trichloromethyl) pyridine)	Remove	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
p-Nitroaniline	No	No quantitative human exposure data are available. Considered a more potent cyanogenic and anaemiagenic than aniline. Proposed TWA is consistent with ACGIH recommendation. **Agree to retain current WES**
Nitroethane	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 20 ppm (TWA) & 100 ppm (STEL), consistent with SCOEL. Human inhalational toxicity information is limited to a poorly documented irritation threshold at 100 ppm. **Disagree with proposed WES** - prefer SCOEL recommendation

SWA Chemical Name	Revise	Comments
2-Nitrotoluene	Yes	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA recommended WES based on assumption of no threshold level. However, the mode of action for tumour formation is unknown. There is uncertainty regarding quantification of the SWA value with available sampling and/or analysis techniques. **Disagree with proposed WES** - need for more study & a value that can be measured
2,2'-Oxybis[ethanol] (Diethylene glycol)	No	**Agree to retain current WES**
Oxygen difluoride	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Ozone	No	**Agree to retain current WES**
Paraffin wax (fume)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL. Retained TWA is consistent with ACGIH & HCOTN recommendations. It is based on protecting for discomfort and possible respiratory tract irritation - intrinsic toxicity is low. **Need for WES? If so, then agree to retain current WES**
Parathion	No - interim	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. Broad-spectrum organophosphorus non-systemic insecticide and acaricide formerly used in Australia to control a variety of insects. APVMA recommended cancelling all registrations and relevant approvals for parathion products, with effect from February 2000. **Need for WES? If so, then agree to retain current WES**
PCBs (42% Chlorine) (Polychlorinated biphenyls, Polychlorobiphenyls, Chlorobiphenyl)	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
PCBs (54% Chlorine) (Chlorobiphenyl)	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Pentachloronitrobenzene (quintozene)	No	**Agree to retain current WES**
Pentachlorophenol	No - interim	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. Listed in Stockholm Convention on Persistent Organic Pollutants (POPS). Thus, under Agricultural and Veterinary Chemicals (Administration) Act is prohibited from being imported, exported, manufactured and used in Australia. **WES should be withdrawn**

SWA Chemical Name	Revise	Comments
Perfluoroisobutylene (Octafluoroisobutylene)	No - interim	No human toxicological data are available. Based on limited animal data, acute studies appear to show an 'all or none' response that includes acute pulmonary and adverse systemic effects in other organs. Retained Peak value is consistent with ACGIH recommendation. **Agree to retain current WES**, but further evaluation recommended
Perfluorooctanoic acid (PFOA) and its inorganic salts	New - interim	A TWA is not recommended by SWA due to a lack of reliable human inhalation exposure data. Only DFG recommend a MAK. **Agree that further study required**
Phenothiazine	No	Retained TWA is consistent with ACGIH recommendations. **Agree to retain current WES**
Phenyl ether (vapour) (Diphenyl ether)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL. SWA noted very limited human toxicological data for phenyl ether alone is available. Retained TWA & STEL are consistent with ACGIH & SCOEL recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
o-Phenylenediamine (1,2-Benzenediamine)	No	Limited toxicological data available with no human data available. Retained TWA is consistent with ACGIH recommendation. **Agree to retain current WES**, but further evaluation recommended
Phenylphosphine	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Phorate (Thimet)	Yes – no STEL	APVMA only allows minor use permits for phorate. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. Inhalational exposure data are limited and no quantitative human toxicological data are available. SWA believe there is insufficient data available to recommend a STEL. Retained TWA is consistent with ACGIH recommendation. **Agree with proposed WES - removal of STEL**
Phosgene (Carbonyl chloride)	Yes	Quantitative human exposure data are limited. ACGIH, DFG & SCOEL derived a TWA of 0.1 ppm based on a threshold for respiratory irritation estimated from a series of animal inhalation studies. **Agree with proposed WESs**
Phosphorus pentasulphide (Diphosphorous pentasulphide)	No	There are limited exposure data in both human and animals. Retained TWA & STEL are consistent with ACGIH recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Picloram (Tordon)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL. SWA note there is no inhalational data available and limited human toxicological data available. Retained TWA is consistent with ACGIH recommendations. **Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Pindone (Pival; 2-Pivalyl-1,3-indandione)	No	Limited data are available, and no inhalational toxicology or bioavailability studies are reported. Retained TWA is consistent with ACGIH & HCOTN recommendations. **Agree to retain current WES**
Piperazine and salts	Yes	Proposed TWA & STEL values are consistent with those recommended by SCOEL & ACGIH (TWA only). STEL of 0.09 ppm (SCOEL) recommended to limit exposures that could result in asthmatic responses in sensitised individuals. **Agree with proposed WESs**
Piperidine	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their TWA-WEL of 1 ppm. SWA notes very limited human toxicological data are available. **Agree to retain current WES**
Platinum, metal	No	Limited data are available in humans and animals. Retained TWA is consistent with ACGIH & HCOTN recommendations. **Agree to retain current WES**
Platinum, soluble salts (as Pt)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their TWA-WEL of 0.002 mg/m^3. SWA also noted limited data are available in humans and animals. Retained TWA is consistent with ACGIH recommendation. **Agree to retain current WES**
Polycyclic aromatic hydrocarbon (PAH) mixture when containing benzo[a]pyrene	New	Recommended TWA is calculated through application of an inhalation slope factor derived from a chronic inhalation study identifying a dose-dependent increase in incidence of upper respiratory and upper digestive tract tumours in male hamsters. It assumes that B[a]P can be used for assessing risk from complex PAH mixtures, which is not the case across all industries with such exposure. The ratio of B[a]P to other carcinogens in PAHs can vary significantly. The variation of others such as benz[a]anthracene, benzo[b]fluoranthene, chrysene and anthracene will impact on the toxicity of exposure. Toxic equivalence factor should also be considered if using B[a]P as a marker. In addition, the proposed TWA value will be difficult to quantify, being at the analytical method limit of quantitation. **Disagree with using a single limit value based on B[a]P concentration to represent the WES for all PAH mixtures**
Propane-1,2-diol (total, vapour & particulates)	Yes	No suitable human data to derive TWA value. TWA based on evidence that 160 mg/m^3 is considered a threshold for eye irritation as seen in a study in rats. Human data indicate that acute exposure may result in minimal irritant and respiratory effects in some individuals. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES (should consider expressing in ppm for vapour)**
Propargyl alcohol (Prop-2-yn-1-ol)	No	No human exposure data are available. A NOAEC of 5 ppm for increased weight of liver and kidney is reported for sub-chronically exposed rats. Retained TWA is consistent with ACGIH & HCOTN recommendations. **Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Propionic acid	No	Limited data from human and animal studies. TWA assigned partially by analogy to acetic acid. Retained TWA is consistent with ACGIH, DFG & SCOEL recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Propyl acetate (all isomers)	Yes	Limited substance-specific human exposure data indicate concentrations of 100 ppm are tolerable over an 8-h period, supported by analogies to other structurally related acetate esters. Proposed TWA is consistent with ACGIH & DFG recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree with proposed WES**
Propyl alcohol (Propan-1-ol)	No	SWA note toxicological data are limited in humans and animals. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 200 ppm (TWA) & 250 ppm (STEL). ACGIH TLV based on structure-activity relationship to 2-propanol. Odour threshold in the range of 10–100 ppm; irritation threshold (eye & nose) in the range of 4,000–16,000 ppm. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Propylene dichloride (1,2-Dichloropropane)	Yes – interim	
Propylene glycol dinitrate	Yes	Used in propellants in torpedo manufacture - how relevant to Australian exposure potential? Also, not in HCIS! Proposed TWA based on DFG recommendation. **Need for WES? If so, then agree to proposed WES**
Propylene glycol monomethyl ether (1-Methoxypropan-2-ol)	No	Retained TWA & STEL are consistent with DFG & SCOEL recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Propylene imine (2-methylaziridine)	Yes	Limited data about the carcinogenic potential in humans. Given the limited available data and due to its carcinogenic potential in animals the ACGIH recommended TWA value is recommended. **Agree with proposed WES**
Pyrethrum	Yes	Quantitative human inhalational data are limited. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance, but retained their WEL of 1 mg/m^3, based on SCOEL recommendation. Proposed TWA based on SCOEL & HCOTN recommendations. **Agree with proposed WES**
Pyridine	Yes	Adverse health effects reported in humans exposed to airborne concentrations of 6 to 13 ppm. Proposed TWA based on ACGIH recommendation. **Agree with proposed WES**

SWA Chemical Name	Revise	Comments
Quinone	No	No chronic exposure data are available. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Retained TWA based on ACGIH recommendation. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Resorcinol	Yes	Toxicological data are limited. No complaints of irritation or discomfort are noted in a survey of 180 workers exposed at 10 ppm. SWA removed STEL value. Proposed TWA based on ACGIH & HCOTN recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree with proposed WES**
Rhodium, metal and compounds (as Rh)	No	Limited toxicological data are available in humans and animals. Its toxicity profile is like platinum; hence limit is analogous. Retained TWA based on ACGIH recommendation. **Agree to retain current WES**
Ronnel (Fenchlorphos)	Yes	Limited toxicological data are available. In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. There is no evidence in the APVMA or elsewhere that Ronnel has ever been registered or used in Australia. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. Proposed TWA based on ACGIH recommendation. **Need for WES - should be withdrawn? Otherwise, agree with proposed WES**
Rosin core solder pyrolysis products (as formaldehyde)	No	No exposure-response data is available. ACGIH don't recommend a TLV due to lack of data. There is uncertainty regarding quantification of the TWA value using NIOSH Methods. However, the UK HSE TWA-WEL of 0.05 mg/m^3 and a STEL of 0.15 mg/m^3 for rosin-based solder flux fume, which are aligned with the MDHS 83 method, may be a good alternative. **Suggest this WES requires further review - should consider the UK HSE approach**
Rotenone (commercial)	No - interim	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 5 mg/m^3 (TWA) & 10 mg/m^3 (STEL). Retained TWA based on ACGIH recommendation. **Agree to retain current WES & further study**
Rouge dust	?	Could not find mention of this substance WES change?
Selenium compounds (as Se) excluding hydrogen selenide	No	Selenium is an essential nutrient necessary for amino acid synthesis. Quantitative occupational exposure data are limited and are presented in combination with dietary supplementation studies. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 0.1 mg/m^3. **Agree to retain current WES**
Selenium hexafluoride (as Se)	Remove	Removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**

SWA Chemical Name	Revise	Comments
Sesone (2,4-DES sodium; Crag Herbicide; Sodium 2,4-dichloro phenoxyethyl sulfate)	Remove	Removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Silica – Amorphous	No	**Agree to retain current WESs**
Silicon	No - interim	The toxicological database is extremely limited. Epidemiological data indicate that critical effects are likely due to non-substance-specific effects arising from exposure to nuisance dusts. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their TWA WELs of 10 (inhalable) & 4 mg/m^3 (respirable). **Agree to retain current WES & further study**
Silicon carbide (non-fibrous dust)	Yes	SWA note limited data available. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their TWA WELs of 10 (inhalable) & 4 mg/m^3 (respirable). Proposed TWA based on ACGIH recommendation. **Agree with proposed WES**
Silicon carbide (fibres)	New – interim	Proposed WES based on animals' evidence and similarities to asbestos. **Agree to interim WES & further study**
Silicon tetrahydride (Silane)	No	Toxicity data are extremely limited. SWA consider it a mildly toxic gas by inhalation and irritating to the skin, eyes and mucous membranes. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 0.5 ppm (TWA) & 1 ppm (STEL). Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Silver, metal	No	Workplace studies from different industries indicate a threshold for argyria above 0.1 mg/m^3. Retained TWA based on ACGIH, DFG & SCOEL recommendations. **Agree to retain current WES**
Silver, soluble compounds (as Ag)	No	Workplace studies from different industries indicate a threshold for argyria above 0.04 mg/m^3. Retained TWA based on ACGIH & DFG recommendations. **Agree to retain current WES**
Soapstone (total dust)	No - interim	ACGIH & DFG don't recommend a TWA and recommend referring to talc. **Agree to retain current WES & further study**
Soapstone (respirable dust)	No - interim	ACGIH & DFG don't recommend a TWA and recommend referring to talc. **Agree to retain current WES & further study**
Sodium azide	Yes - interim	Headaches and mucous membrane irritation are reported at 0.3 to 0.5 ppm in occupationally exposed workers. Proposed TWA based on SCOEL recommendation. **Agree with proposed WES & further study**

SWA Chemical Name	Revise	Comments
Sodium bisulphite (Sodium hydrogen sulphite)	No	No inhalation data are available. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 5 mg/m^3 (TWA). Retained TWA based on ACGIH & HCOTN recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Sodium fluoroacetate	Yes	Quantitative exposure data are limited to acute and repeat oral dose studies in animals. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA retained TWA and removed STEL, consistent with ACGIH & DFG recommendations. **Agree to retain TWA-WES & remove STEL**
Sodium hydroxide	No	Very limited inhalation data are available with irritant effects of caustic mists. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their STEL of 2 mg/m^3. Retained TWA based on ACGIH & HCOTN recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Sodium metabisulphite (Disodium disulphite)	No	Limited data exists from both human and animal studies. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 5 mg/m^3 (TWA). Retained TWA based on ACGIH recommendation. Being primarily an irritant, should we even consider assigning a WES? Also, given that sodium metabisulphite releases SO_2 on contact with water/moisture and hence from mucous membranes, there is potentially some inconsistency regarding maintaining the TWA WES for sodium metabisulphite of 5 mg/m^3 and the proposed STEL WES for sulphur dioxide of 0.25 ppm. **Need for WES? If so, then agree to retain current WES pending further review pertinent to the sulphur dioxide WES**
Starch	No	Limited data from human and animal studies indicate that starch has negligible acute, chronic and dermal toxicity. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their TWA WELs of 10 (inhalable) & 4 mg/m^3 (respirable). Retained TWA based on ACGIH & HCOTN recommendations. **Agree to retain current WES**
Stearates	Yes	No data are available for human exposures to stearates at the workplace. TWA based on ACGIH recommendation. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree with proposed WES**
Stibine (Antimony hydride)	Remove	Quantitative exposure data are limited to acute inhalation studies with animals near maximally tolerable concentrations. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA recommend removal due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**

SWA Chemical Name	Revise	Comments
Strychnine	No	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain.
Styrene, monomer (Phenylethylene, Vinyl benzene)	Yes	Indications of central and peripheral neurologic, optic and irritant actions are reported in humans exposed at the workplace at airborne concentrations greater than 50 ppm. Headache, fatigue, nausea and dizziness are reported after exposure at concentrations greater than 100 ppm. Proposed TWA based on ACGIH & DFG recommendations. STEL based on ACGIH recommendation. **Agree with proposed WES**
Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme)	No	Available workplace studies indicate a high incidence of respiratory sensitisation, which may lead to pulmonary oedema. Retained WES is consistent with the ACGIH ceiling limit and NIOSH STEL for subtilisin. There is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques. **Agree to retain current WES**, but suggest that further review is required along the lines suggested in the publication 'Experiences from Occupational Exposure Limits Set on Aerosols Containing Allergenic Proteins'.
Sucrose	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 10 mg/m^3 (TWA) & 20 mg/m^3 (STEL). Recognised as a substance of low toxicity by all routes of exposure. Retained TWA based on ACGIH & HCOTN recommendations. **Agree to retain current WES**
Sulfotep (TEDP; O,O,O,O-Tetraethyl dithiopyrophosphate)	Remove	An organophosphorus insecticide. Main effect is inhibition of cholinesterase enzyme activity. However, SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Sulphur dioxide	Yes	SWA has proposed a WES that is based on the risk of exposure afforded to a sensitive subpopulation of the workforce (asthmatics), but which is applicable to the whole normal working population! In addition, the AIOH questions the measurability of a STEL of 0.25 ppm. We suggest that the SCOEL (2009) recommended STEL of 1 ppm would be more appropriate. **Disagree with proposed WES**
Sulphur hexafluoride	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance, but retained their WELs of 1,000 ppm (TWA) & 1,250 ppm (STEL). Retained TWA based on ACGIH & DFG recommendations. **Agree to retain current WES**
Sulphur monochloride (Disulphur dichloride)	No - interim	Limited data from human and animal studies are available. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their STEL of 1 ppm. Retained TWA based on ACGIH & HCOTN recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES & further study**

SWA Chemical Name	Revise	Comments
Sulphur pentafluoride (Disulphur decafluoride)	Remove	No data available in humans and limited data are available from animal studies. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Sulphur tetrafluoride	No - interim	HCOTN considers the toxicological database too poor to justify recommendation of a limit value. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. ACGIH notes definitive injury produced by relatively brief exposures at concentrations as low as 4 ppm. **Agree to retain current WES**
Sulphuric acid	Yes	The proposed reduced TWA-WES for sulfuric acid mist (0.1 mg/m^3) is consistent with the AIOH proposed value. **Agree with proposed WES** but should be expressed as the inhalable fraction.
Sulphuryl fluoride (Sulphurly)	Remove	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs. SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Sulprofos (Bolstar)	Yes	An organothiophosphate insecticide and an organosulfur compound. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. No human exposure data are available. **Need for WES? If so, then agree to proposed WES**
Synthetic mineral fibres (SMF) or Man-made vitreous fibres (MMVF)	No	SWA has retained the revised 2012 WES values of 0.5 f/mL (respirable) and 2 mg/m^3 (inhalable). The documentation however does not include the clarification that the 0.5 f/mL WES applies only to bio persistent fibres. The current notes in the national standards (e.g. R Note and Q note testing; alkaline earths etc.) need to be maintained. SMFs are not all of the same toxicity. **Agree to retain current WES values, but need to clarify applicability of the two different WES values regarding fibre bio persistence, as per the AIOH position paper, referenced as a secondary source in SWA documentation**.
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)	No	Herbicide listed in Stockholm Convention on Persistent Organic Pollutants (POPS). Thus, under Agricultural and Veterinary Chemicals (Administration) Act is prohibited from being imported, exported, manufactured and used in Australia. Available epidemiological studies are limited by confounding co-exposure to structurally related herbicides. Retained TWA based on ACGIH & DFG recommendations. **Need for WES? If so, then agree to retain current WES**

SWA Chemical Name	Revise	Comments
Talc (containing no asbestos fibres)	Yes	UK HSE has adopted 1 mg/m^3 (resp). DFG recommends exposure should be below 1.5 mg/m^3 (resp). ACGIH reference states no increased incidence in lung function impairment, small radiological opacities or respiratory symptoms during a 14.5 yr monitoring period at an average exposure concentration of 1.46 mg/m^3 in a follow-up study of workers from an Austrian mine. WES needs to be consistent with that for titanium dioxide, given same mechanism of health effect. **Agree with proposed WES**, bearing in mind above qualification and need to use respirable fraction
Tantalum, metal & oxide dusts	No	The limited available data do not indicate any substance-specific toxicity. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 5 mg/m^3 (TWA) & 10 mg/m^3 (STEL). Retained TWA based on HCOTN recommendation. **Agree to retain current WES**
Tellurium & compounds (as Te)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 0.1 mg/m^3 (TWA). Retained TWA based on ACGIH & HCOTN recommendation - no adverse effects on employee health found in 97% of iron foundry workers exposed for 22 months at 0.01-0.1 mg/m^3. **Agree to retain current WES**
Tellurium hexafluoride (as Te)	No	
Temephos (Abate)	Yes	A non-systemic organophosphorus insecticide and acaricide, still used in Australia. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. Human and animal inhalational data are limited. Recommended TWA based on conversion of reported oral dose NOAEL to inhalational equivalents. **Agree with proposed WES**
TEPP (Tetraethyl pyrophosphate)	Remove	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Terephthalic Acid	New	Limited data available. No local or systemic effects at exposures up to 10 mg/m^3. Proposed TWA based on DFG recommendation. **Agree with proposed WES**
Terphenyls	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their STEL of 0.5 ppm. Retained TWA based on ACGIH & HCOTN recommendations. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
1,1,2,2-Tetrabromoethane (Acetylene tetrabromide)	No	Limited data are available; however, the evidence in animals suggests a NOAEC of 1 ppm. **Agree to retain current WES**

SWA Chemical Name	Revise	Comments
1,1,2,2-Tetrachloro-1,2-difluoroethane	No	Limited toxicological data in humans are available. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Also, banned under Montreal Protocol. SWA notes currently prohibited for use in Australia, but some residual use or storage may occur in industry. **WES should be withdrawn**
1,1,1,2-Tetrachloro-2,2-difluoroethane	No - interim	Limited toxicological data in humans are available. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. **Need for WES? If so, then agree to retain current WES**
1,1,2,2-Tetrachloroethane	No	Very limited data from human studies are available with most data relating to accidental exposures. Retained TWA based on ACGIH, DFG & HCOTN recommendations. **Agree to retain current WES**
Tetrachloronaphthalene	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**
Tetraethyl lead (as Pb)	No	**Agree to retain current WES** - should group with tetramethyl lead
1,1,1,2-Tetrafluoroethane (HFC 134a)	No	Most common HFC refrigerant gas used in Australia. Retained TWA based on DFG recommendation. **Agree to retain current WES**
Tetrafluoroethylene	New	Data from human studies is not available. Sub-chronic and chronic inhalation studies in rats & mice identified a LOAEC of 156 ppm. New TWA based on ACGIH recommendation. **Agree with proposed WES**
Tetrahydrofuran	Yes	TWA based on evidence of irritation & nasal damage in animals at 100 ppm; also supported by data in humans. ACGIH & SCOEL have a STEL also. Proposed TWA based on ACGIH, DFG & SCOEL recommendations. **Agree with proposed WES**
Tetramethyl lead (as Pb)	No	**Agree to retain current WES** - should group with tetraethyl lead
Tetramethyl succinonitrile	No	Very limited data are available. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Retained TWA based on ACGIH & HCOTN recommendations. **Agree to retain current WES**
Tetranitromethane	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**

SWA Chemical Name	Revise	Comments
Tetrasodium pyrophosphate	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 5 mg/m^3 (TWA). A NOAEL of 500 mg/kg/day in rats is identified for kidney effects in a 90-day oral study (ECHA, 2011). No further information is available. **Agree to retain current WES & further study**
Tetryl (2,4,6-Trinitrophenylmethylnitramine; N-Methyl-N-2,4,6-tetranitroaniline)	No - interim	
Thallium, soluble compounds (as Tl)	Yes	Mean urinary levels of ~0.5 µg/L in exposed workers were not associated with adverse effects. Same study correlated these urinary levels with air concentrations between 0.014 & 0.022 mg/m^3, which are considered a NOAEC for the critical effects. Proposed TWA based on ACGIH recommendation. **Agree with proposed WES**
4,4'-Thiobis (6-tert-butyl-m-cresol)	No - interim	Human exposure data are limited and there are inconsistencies about the critical endpoints. Liver damage considered critical endpoint by SWA & HCOTN, but ACGIH uses URT irritation. **Agree to retain current WES & further study**
Thioglycolic acid (Mercaptoacetic acid)	No	Limited data available. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WES of 1 ppm (TWA). Retained TWA based on ACGIH recommendation. **Agree to retain current WES**
Thionyl chloride (thionyl dichloride)	Yes	Limited data exists from human and animal studies. Being primarily an irritant, should we even consider assigning a WES? Proposed Peak WES based on ACGIH recommendation. **Need for WES? If so, then agree with proposed WES**
Thiram (Tetramethyl thiuram disulphide)	No	In the absence of quantitative inhalation data for humans or animals, the recommended TWA is based on sub-chronic and chronic oral studies with animals. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Retained TWA based on DFG recommendation. **Agree to retain current WES & further study**
Tin (metal & inorganic compounds)	No	Limited toxicological data are available. Retained TWA based on ACGIH & HCOTN recommendations. **Agree to retain current WES**
Tin, organic compounds (as Sn)	Yes	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 0.1 mg/m^3 (TWA) & 0.2 mg/m^3 (STEL). SWA state critical effects of exposure are adverse effects on immune function and the CNS. They removed STEL value due to insufficient data relating to acute exposures. **Agree with proposed WES**

SWA Chemical Name	Revise	Comments
Titanium dioxide	Yes	NIOSH (2011) reviewed and considered all relevant data related to respiratory effects of TiO_2, including results from animal inhalation studies and epidemiologic studies. They concluded that titanium dioxide is not a direct-acting carcinogen, but that exposure to ultrafine titanium dioxide should be considered a potential occupational carcinogen. There is good evidence that nanoscale substances are more toxic than larger particle sizes of the same substance. NIOSH thus recommends TWA airborne exposure limits of 2.4 mg/m^3 for fine titanium dioxide and 0.3 mg/m^3 for ultrafine (including engineered nanoscale) titanium dioxide. WES needs to be consistent with that for talc, given same mechanism of health effect. **Disagree with proposed WES**, bearing in mind above qualification and need to use respirable fraction
o-Tolidine	New – interim	None of the SWA primary sources established a TWA value due to lack of adequate experimental or occupational data. Also, there is uncertainty regarding quantification of a recommended value with available sampling and/or analysis techniques. **Agree that no WES be recommended**
Toluene	Yes	SWA removed STEL value and adopted TWA-TLV from ACGIH (2007). SCOEL (2001) recommended a TWA 50 ppm (+ STEL=100ppm) mainly based on data from epidemiological studies, recognising a LOAEL of 60 ppm for neurobehavioral effects in humans. US EPA (2005) note that the highest NOAEL was 44 ppm while the LOAELs were 40 to 42 ppm. Other human studies suggest 50 ppm limit is applicable. A STEL is beneficial as exposure risk is typically during breaks of containment. A STEL is helpful for this purpose to measure actual exposure for these short-term tasks against a standard. TWA measurements are diluted for these types of workplace scenarios (e.g. in oil & gas) where measurements are collected over a TWA using passive badges. **Disagree with proposed WES. There should be both a TWA & STEL value – SCOEL recommendation could be adopted, although a TWA of 30 to 40 ppm may be more applicable.**
m-Toluidine	No - interim	Limited data available. Retained TWA based on ACGIH recommendation. All toluidine isomers have the same WES yet have different HCIS Hazard Categories! **Agree to retain current WES & further study**
o-Toluidine	No - interim	Poorly documented survey data indicate exposure above 5 ppm causes illness. Epidemiological data strongly associate occupational exposure with the development of bladder cancer. Retained TWA based on ACGIH recommendation. No primary source other than ACGIH provides an exposure limit value. All toluidine isomers have the same WES yet have different HCIS Hazard Categories! **Agree to retain current WES & further study**

SWA Chemical Name	Revise	Comments
p-Toluidine	No - interim	Substance-specific exposure data are limited, but the available database indicates toxicological similarities to structurally related aniline and other toluidine isomers. Retained TWA based on ACGIH recommendation. SCOEL recommendation is lower. All toluidine isomers have the same WES yet have different HCIS Hazard Categories! **Agree to retain current WES & further study**
Tributyl phosphate (Phosphoric acid, tributyl ester)	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance, but retained their WELs, based on SCOEL. Human exposure data are limited and no quantitative data on local irritation are available. All primary sources (including SCOEL) have higher TWA values than SWA. **Agree to retain current WES & further study**
1,1,2-Trichloro-1,2,2-trifluoroethane (Fluorocarbon 113, Freon 113)	No	Banned under Montreal Protocol. Australia has largely phased out the import of chlorofluorocarbons including R12. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. Retained TWA based on ACGIH recommendation. **Need for WES? If so, then agree to retain current WES**
Trichloroacetic acid (TCA)	No	
1,2,4-Trichlorobenzene	No	
1,1,1-Trichloroethane (Methyl chloroform)	No	A NOAEC of approximately 200 ppm for pre-narcotic effects, generally determined as increased reaction times, is reported in several acute and repeat inhalational studies in volunteers. This is consistent with the absence of neurological or psychological effects reported in workers exposed at 110 to 990 ppm. **Agree to retain current WES**
1,1,2-Trichloroethane	No	
Trichloroethylene (Ethene, trichloro)	No	
Trichlorofluoromethane (Fluorocarbon 11, Freon 11, Fluorotrichloromethane)	No	Banned under Montreal Protocol. Australia has largely phased out the import of chlorofluorocarbons including R12. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. Limited human data regarding exposure to trichlorofluoromethane alone. Retained TWA based on ACGIH & DFG recommendations. **Need for WES? If so, then agree to retain current WES**
Trichloronaphthalene	Remove	SWA removed due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. **Agree that no WES be recommended**

SWA Chemical Name	Revise	Comments
1,2,3-Trichloropropane	No - interim	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. ACGIH recommends a much lower TWA=0.005 ppm based on results of animal experiments however no quantitative derivation is provided. No other primary sources provide a TWA value. **Agree to retain current WES & further study**
Triethanolamine (Ethanol, 2,2',2''-nitrilotris-)	No	No inhalation exposure data for humans are available. Retained TWA based on ACGIH recommendation. DFG recommends 1 mg/m^3, extrapolated from animal data. **Agree to retain current WES**
Triethylamine (N,N-Diethylethanamine)	Yes	
Trifluorobromomethane (Fluorocarbon 13B1, Bromotrifluoromethane)	No	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. High TWA due to low acute toxicity, considered protective of the effects on the cardiovascular system and CNS. Retained TWA based on ACGIH & DFG recommendations. **Agree to retain current WES**
Triglycidylisocyanurate (TGIC; Araldite PT 810)	Yes - interim	
Trimellitic anhydride (Benzene-1,2,4-tricarboxylic acid-1,2-anhydride)	Yes	The proposed WES values cannot be quantified with available sampling and/or analysis techniques. **Disagree with proposed WESs - suggest they require further review**
Trimethyl benzene (all isomers)	New?	Neurotoxicity most consistently observed endpoint in toxicological database, and decreased pain sensitivity observed in multiple studies. Proposed TWA-WES based on DFG & SCOEL recommendations. **Agree with proposed WES**
Trimethyl phosphite (Phosphorous acid, trimethyl ester)	No	Limited human data are available. A threshold of 20 ppm is reported for significant nuisance odour in workers. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 2 ppm (TWA), as per ACGIH. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Trimethylamine	No	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA note inconsistent data and decisions about recommended occupational exposure limits by primary agencies. All primary sources have lower limit values than SWA. Has a highly offensive odour that is apparent at concentrations of less than 1 ppm. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**

SWA Chemical Name	Revise	Comments
2,4,5-Trimethylaniline	New	SWA note there are no human exposure data presented in the available source material and only limited animal exposure data available. They also note there is uncertainty regarding quantification of a recommended value with available sampling and/or analysis techniques. None of the primary sources recommend an exposure limit. **Agree that no WES be recommended, but need further study**
2,4,6-Trinitrotoluene (TNT)	Yes	Proposed TWA-WES is based on ACGIH recommendation. **Agree with proposed WES**
Triorthocresyl phosphate (Tri o-tolylphosphate)	No - interim	Limited available data in SWA sources and discrepancy in the reporting. ACGIH recommend a TLV-TWA= 0.02 mg/m^3 (inhalable fraction and vapour). **Agree to retain current WES & further study**
Triphenyl amine	No - interim	
Triphenyl phosphate	No	Limited human data are available. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WES of 3 ppm (TWA) & 6 ppm (STEL). Liver effects found in rats. Retained TWA-WES based on ACGIH documentation. **Agree to retain current WES**
Tungsten, soluble and insoluble compounds (as W)	Yes	SWA combined tungsten metal & all its compounds to the one TWA-WES of 3 mg/m^3 (resp fraction), based on ACGIH documentation. They note that there are limited animal and human exposure data available. **Agree with proposed WES**
Turpentine (wood)	Yes - interim	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WES of 100 ppm (TWA) & 150 ppm (STEL). SWA noted limited data available from its primary sources but proposed the ACGIH recommended TWA-WES of 20 ppm. **Agree with proposed WES & further study**
Uranium (natural), soluble & insoluble compounds (as H)	Yes	The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. SWA noted that most human exposure data are confounded by mixed exposures or inadequately designed studies. They removed the STEL value. Proposed TWA-WES is based on ACGIH & HCOTN recommendations. **Agree with proposed WES**
Urethane	New	No quantitative human exposure data are available. No epidemiological data are available to confirm carcinogenicity in humans. None of the primary sources recommend an exposure limit. **Agree that no WES be recommended, but need further study**
n-Valeraldehyde	No	
Vanadium (as V_2O_5) (divanadium pentaoxide), (respirable dust & fume)	No	Both human and animal exposure data available. SWA changed TWA value from respirable to inhalable fraction. Retained TWA-WES is based on ACGIH recommendation. **Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Vegetable oil mists (except castor oil, cashew nut or similar irritant oils)	Remove	SWA note that there are no available data to support recommending a TWA. **Agree that no WES be recommended**
Vinyl acetate	Yes	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WES of 5 ppm (TWA) & 10 ppm (STEL), based on SCOEL recommendation. SCOEL note that prevention of irritation should protect for carcinogenicity (Cat 2). Proposed WESs are based on ACGIH recommendation, using same data as SCOEL. **Agree with proposed WES**
Vinyl bromide (Bromoethylene)	Yes - interim	
Vinyl chloride, monomer (Chloroethylene; Ethene, chloro)	Yes	Proposed amended WES is set to protect against cancer, based on application of an inhalation risk factor derived from a chronic rat inhalation using a pharmacokinetic model (reducing the uncertainty in extrapolating from animals to humans). However, recent publication by Marsh et al (2021) 'Mortality Patterns Among Industrial Workers Exposed to Chloroprene and Other Substances; Extended Follow-Up' concluded "that the risk of death from lung or liver cancer is unrelated to exposure to CD or VC at levels experienced by workers in the two U.S. sites." Also, there is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques. **Disagree with proposed WES - suggest it requires further review**
4-Vinyl Cyclohexene	New	There are limited human studies available. SWA note limited data available from the primary sources and that no specific Australian use, import, or manufacturing information has been identified. Also, there are inconsistent data and decisions about the carcinogenic and genotoxic potential of VCH. **Need for WES? If so, then need further study**
Vinyl cyclohexene dioxide (1,2-Epoxy-4-(epoxy-ethyl)-cyclohexane)	No	
N-Vinyl-2-pyrrolidone	New	There is uncertainty regarding availability of sampling and/or analysis techniques to quantify exposures due to this chemical. Also, no quantitative human exposure data are available. ACGIH recommend a higher TWA-TLV=0.05 ppm. **Disagree with proposed WES - must be measurable**
Vinyl toluene (Methyl styrene)	Yes	As critical effects of exposure are objectionable odour and eye and upper respiratory tract irritation, should we even consider assigning a WES? ACGIH WESs (same as current SWA WESs) are based on a volunteer inhalation study. Proposed WES based on DFG animal studies. **Need for WES? If so, then disagree with proposed WES**
Vinylidene chloride (1,1-Dichloroethylene)	No	Retained TWA-WES based on ACGIH, DFG & SCOEL recommendations. Only SCOEL recommend a STEL. **Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Vinylidene fluoride	New	No human data are available. Limited data in animals are available. ACGIH recommend a TWA-TLV=500 ppm based on analogy to vinylidene chloride. **Agree that no WES be recommended**
Warfarin	Yes	No human or animal inhalational data are available. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Proposed TWA-WES is based on ACGIH & HCOTN recommendations. **Agree with proposed WES**
Welding fumes (not otherwise classified)	Yes Remove	While the AIOH agree that there be no single WES for welding fume, they note that it is therefore essential that WESs for welding fume constituents (e.g. CrVI, manganese, etc) are both health-based using realistic toxicology data and measurable. Also, based on the IARC 2017 reclassification of welding fumes (NOC) as a carcinogen, it may be likely that some organisations / regulators may move to reduce the exposure limit to address this change. **Agree that no WES be recommended**, bearing in mind our above comments
Wood dust	Yes	Single TWA-WES assigned in view of the qualitative evidence for asthma from other wood types, likely co-exposure to dusts from different tree species in occupational settings, and uncertainty in the database regarding a threshold for carcinogenicity. **Agree with proposed WES**
Xylene (o-, m-, p-isomers)	No	Limited data exists about long-term exposure in humans but evidence that 100 ppm for six hours produces neurological effects in human volunteers. **Agree to retain current WESs**
m-Xylene-alpha,alpha'-diamine (m-Xylylendiamine; 1,3-Benzenedimethanamine)	No	
Xylidine, all isomers (Dimethylaminobenzene, Aminodimethyl benzene)	No	No quantitative human exposure data are reported in the available SWA source material. The UK HSE removed their exposure limit (WEL) for this substance due to there being limited documentation or the basis of the limit was uncertain. Retained TWA-WES is based on ACGIH recommendation. **Agree to retain current WES & further study**
Yttrium, metal & compounds (as Y)	No - interim	Human and animal exposure data are extremely limited. A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WELs of 1 mg/m^3 (TWA) & 3 mg/m^3 (STEL). Retained TWA-WES is based on ACGIH & HCOTN recommendations. **Agree to retain current WES & further study**

SWA Chemical Name	Revise	Comments
Zinc chloride (fume)	Yes	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 1 mg/m^3 (TWA) & 2 mg/m^3 (STEL). SWA believe there is limited evidence regarding chronic exposure. A TWA is thus not recommended based on the available data but retained STEL. **Agree with proposed WES & further study**
Zinc oxide (fume & dust)	Yes	The critical health effect of zinc oxide on humans, metal fume fever, is due to the fume, NOT the dust. As such, it should be emphasised that the WES relates to the respirable fraction of zinc oxide only. **Agree to consolidated & changed WES**, as long as respirable fraction only is used
Zirconium compounds (as Zr)	Yes - interim	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance but retained their WEL of 5 mg/m^3 (TWA) & 10 mg/m^3 (STEL). SWA noted limited data available from its primary sources and removed STEL. ACGIH TLV-TWA & STEL based on results of inhalation studies with animals. DFG provided MAK=1 mg/m^3, based on interstitial pneumonitis and slight fibrogenic effects in sub-chronically exposed rodents. **Agree with proposed removal of STEL & further study**