AUSTRALIAN INSTITUTE OF OCCUPATIONAL HYGIENISTS ®

AIOH Comments on Safe Work Australia Workplace Exposure Standards (WES) Releases 2 – 14

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.

With regard to 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.

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.

2.0 Comments

SWA Chemical Name	Revise	Comments
Acetaldehyde	Yes – interim value	Main ACGIH documentation references are from 1946 (2) and 1957. Variable study results – All of 14 reported mild irritation after 30 minutes at 135 ppm, sensitive people at 25 ppm for 15 minutes. 100 ppm was tolerated. Is primarily an eye and respiratory tract irritant, plus GHS category 2 carcinogen and mutagen. **Agree that further assessment of genotoxicity and mutagenicity data needs to be undertaken**.
Acetic acid	No	WES based on ACGIH documentation - 1943 & 1956 references are the main acute limit papers. Acute effects occur somewhere around 10 to 30 ppm. Some longer-term respiratory effect noted. If acute effects are controlled there is no issue. **Agree to retain current WES**
Acetic anhydride	Yes	Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES**.
Acetone	Yes	WES based on ACGIH documentation, which indicates variable results with 250 ppm being the lowest irritant effect level observed. Other primary sources (DFG & SCOEL) recommend leaving as is, same as UK HSE. Can be measured to the lower level. Can be absorbed through skin.

SWA Chemical Name	Revise	Comments
		US EPA 'Toxicological Review of Acetone (2003 – see https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/0128tr.pdf) concluded: "Overall, the most pronounced effect of acetone reported in human inhalation studies is irritation of the eyes and respiratory tract. Additionally, human data indicate that exposure to acetone may produce neurobehavioral effects. Studies that report responses over time note that the most pronounced effects occur during initial exposure and dissipate over time. Although the available data base may be sufficient to support concerns for short-term exposure (based largely on irritation) extrapolation to chronic exposure is not recommended. More research is needed on the toxicity of acetone following inhalation exposure." They also state that "Several studies in humans and animals suggest that acetone has a short persistence in the bloodstream. Following exposure, acetone is rapidly absorbed and distributed throughout the body and is rapidly lost." There is a BEI available, hence is there a need for a WES? **Should retain current WES** until more research is conducted, and assess exposures through biological monitoring.
Acetonitrile	Yes	Proposed WES is 34 mg/m^3 (20 ppm), half the current value of 67 (40ppm). Recommended WES is well within sampling and analysis (NIOSH 1606, LOD 0.8 ug). This recommendation matches the ACGIH TLV. Limited human exposure studies, NOAEL of 100ppm from animal studies, 100ppm being lowest concentration tested. Most human health effect studies are clinical – high dose incidents. Agree that the **WES should be changed as suggested**.
Acetylsalicylic acid	No	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance. The recommended therapeutic oral dose of acetylsalicylic acid (aspirin) is a total of up to 4000 mg per day, but the WES is 5 mg/m^3 (a total inhalation dose of between 40 and 80 mg/day). The ACGIH TLV documentation says it's to minimise skin, eye, and gastric irritation, anaphylactic phenomenon, increased clotting time and interference with platelet aggregation – why would you set an inhalation WES to stop skin and eye irritation and anaphylaxis? ACGIH documentation is confused, hence nothing is clear. The one piece of epidemiology is for a different chemical SALICYLAMIDE and is from 1946. **WES should be withdrawn**
Acrolein	Yes	SWA Recommended WES of 0.05 mg/m^3 is at or below NIOSH 2501 LOD of 2ug; under the OSHA Method 52 Quantitation limit of 6.1 ug/m^3 (as noted in the WES draft evaluation report). 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) state that "Measurement

SWA Chemical Name	Revise	Comments
		techniques should be able to assess exposure at: 0.1 times the OEL for 8-hour TWA". **Proposed WES should be a measurable value**
Acrylamide	Yes	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance. Should be no ppm value, as is a solid.
Acrylic acid	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.
Acrylonitrile	Yes	Set to protect for excess cancers and also considered to be protective of respiratory and central nervous system effects. However, the recommended value is below the current limit of detection for available sampling and analysis techniques. 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) state that "Measurement techniques should be able to assess exposure at: 0.1 times the OEL for 8-hour TWA". **Proposed WES should be a measurable value**
Aldrin	Yes	The UK HSE removed their exposure limit (WEL) for this substance due to it being no longer authorised as a pesticide. ACGIH documentation noted no adverse effects in 22 workers exposed to ≈1-3 mg/m^3 (1-3 yr); primarily through inhalation with some skin contact. Also, there is uncertainty regarding quantification of recommended value with currently available sampling and/or analysis techniques. According to the APVMA Gazette of May 2007: *Aldrin, chlordane, dieldrin and heptachlor are listed in the Stockholm Convention on Persistent Organic Pollutants (POPS). This means that under the Agricultural and Veterinary Chemicals (Administration) Act these chemicals are prohibited from being imported, exported, manufactured and used and thus no further active constituent approvals, product registration or permits may be issued in respect of these chemicals.* Hence, no one in Australia is (theoretically) occupationally exposed to aldrin and therefore, the **WES should be withdrawn**.
Allyl alcohol	Yes	
Allyl chloride	Yes – interim value	
Allyl glycidyl ether (AGE)	Yes – interim value	Proposed value is below LOD / LOQ of commonly used method (NIOSH Method 2545). There is no robust human exposure data on which to base a WES. Perhaps adopt ACGIH value.

SWA Chemical Name	Revise	Comments
		Adopt lowest measurable value and do further study.
Allyl propyl disulfide	No	
Aluminium & compounds	Yes – interim value	All aluminium compounds listed as one, despite different toxicities dependent on solubility. Based on ACGIH TLV documentation. TLV-TWA of 1 mg/m^3 is recommended based on the neurological effects from the inhalational of 1.6 mg/m^3 for 40 yr, considering all available animal and human. Fluorides are the more relevant exposures to worker health (pulmonary effects) in aluminium smelters. Meta-analysis by Virk & Eslick (2015) did not support a causative role of aluminium in the pathogenesis of Alzheimer's Disease. Documentation recommends review of additional data sources for determining a dose response. **Agree with need for further study and use of interim WES**.
Al metal dust	Deleted	
Al welding fumes	Deleted	
Al oxide	Deleted	
Al alkyls (NOC)	Deleted	A UK HSE 2003 review determined there was limited documentation or the basis of the limit was uncertain for this substance. Agree that the **WES should be withdrawn**.
Al pyro powders	Deleted	
2-Aminopyridine	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. WES is based on ACGIH documentation - 1950 & 1951 references - 2 acute poison cases, no exposure quoted in one, the other non-fatal exposure estimated at 5.2 ppm. SWA draft evaluation report states there is very limited data available for humans and animals. The **WES should be withdrawn**.
Amitrole	No	
Ammonia	Yes	SWA recommended value is readily quantifiable and documentation supports irritant effects down to 20 ppm. There may be potential for low exposures to ammonia to act as a risk factor of respiratory disorders (see Mahdinia et al (2020), *Respiratory Disorders Resulting from Exposure to Low Concentrations of Ammonia - A 5-Year Historical Cohort Study* in JOEM 62(8)). Agree that the **WES should be changed as suggested**.
Ammonium chloride (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. WES is based on ACGIH documentation - there is no epidemiology presented in the documentation. SWA draft evaluation report states there is limited data available on adverse effects associated with exposure. Being an irritant only, should we even consider assigning a WES? The **WES should be withdrawn**.
Ammonium perfluorooctanoate	Yes	Listed in Annex A (Elimination) under the Stockholm Convention as a persistent organic pollutant (POP) and its global manufacture is being phased out (the US stopped producing it in 2015 after

SWA Chemical Name	Revise	Comments
		pressure from the USEPA). It is used as an intermediate in the manufacture fluoropolymers, mainly in China these days. As far as we know, there are no manufacturers, importers or users of APFO in Australia. Also, there is uncertainty regarding quantification of recommended value with currently available sampling and/or analysis techniques. The **WES should be withdrawn**.
Ammonium persulfate	Deleted	
Ammonium sulphamate	No	
Amyl acetate (iso-, n-, sec- isomers)	No	
Aniline and homologues	Yes	Proposed WES is within quantification of recommended value with currently available sampling and/or analysis techniques. Revised WES is based on SCOEL 2010: human study - tolerable levels of methemoglobin (MHb) in blood. (ACGIH reports that the 35 mg daily allowable dose corresponds to 1 ppm). However, SCOEL /REC/153 Aniline is 2ppm (TWA) and 5ppm (STEL). Recommend including more recent SCOEL documentation in SWA review. Dermal adsorption is identified as a significant exposure route. **WES should be reviewed to include SCOEL 2015**
Anisidine (o-, p-isomers)	Yes – interim value	
Antimony and compounds	No	The recommended WES is based on ACGIH documentation and is readily quantifiable. Due to the variety of potential antimony compounds, the recommended TWA is derived from the acute symptoms of antimony pentachloride ($SbCl_5$), which causes the most intense effects of these compounds. Antimony pentachloride may produce up to five molar equivalents of HCl upon hydrolysis in moisture, which is assumed to be the primary cause of irritation. A TLV-TWA of 12.3 mg/m^3 for antimony pentachloride is calculated that results in 5 mg/m^3 for antimony, which is converted to the recommended TWA of 0.5 mg/m^3 by applying an uncertainty factor of 10 to account for reported symptoms of $SbCl_5$ exposure being more intense than those of HCl alone. **Agree to retain current WES.**
Antimony trioxide	Yes	**Agree that no WES be recommended**.
α-Naphthyl thiourea (ANTU)	Yes – removal	**Agree that no WES be recommended**.
Arsenic and soluble compounds	Yes	The recommended WES is based on ACGIH documentation and is measurable (NIOSH methods). **Agree to proposed WES**
Arsine	Yes – interim value	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 Chemical Name	Revise	Comments
		The proposed order of magnitude reduction in WES is based on ACGIH documentation, which seems confused and is based entirely on a NIOSH investigation at a lead acid battery plant in 1980. They looked at urinary As and correlated it with AsH_3. Particulate As_2O_3 didn't correlate so was left out. Vapour phase As_2O_3 wasn't measured in personal measurements, just area, so was left out as well. Of the 10 AsH_3 exposures measured at essentially zero (<0.1 mg/m^3) the urinary As ranged from 3 to 45 µg/L. The ACGIH documentation takes a formula from a graph in the paper: Urine arsenic (µg/L) = 11.99 + 2.43 × arsine in air (µg/m^3); inserts the BEI for arsenic and solves for arsine. Answer is 10, so we suggest a WES of 0.005 ppm! Arsine in air is very difficult to measure accurately. The easiest way to measure exposure to arsine is to do biological monitoring in urine. However, the analysis should be speciated arsenic (inorganic + metabolites) not total arsenic (as done by most path labs) as was presented in the NIOSH paper. It is very hard to correlate air measurements to total arsenic in urine as there are too many interferences, mainly resulting from the diet. Seafood can take over a week to be excreted from the body. Suggest **withdraw current WES and focus on a BEI** for arsine.
Atrazine	Yes	A WES of 1 or 2 mg/m^3 seems appropriate given the ACGIH and DFG documentation, noting that there are no human studies available detailing effects related to measured air concentrations and animal oral dosage data was used to calculate the exposure limit value. Which value is used should be dependent on the analytical detection limit and limit of quantitation that best allows determination of legal compliance. **WES should be changed to either 1 or 2 mg/m^3**
Azinphos-methyl	Yes	The UK HSE removed their exposure limit (WEL) for this substance due to it being no longer authorised as a pesticide. The APVMA has done a preliminary review of the potential occupational exposure to azinphos-methyl (an organophosphate (OP) pesticide) https://apvma.gov.au/sites/default/files/publication/14391-azinphos-methyl-prelim-review-ohs-res-env.pdf. Their exposure estimates for mixers/loaders, spray applicators and post-application scenarios concluded that in all cases, the potential dose from inhalation exposures were 2-3 orders of magnitude less than from dermal exposure. Given this fact, and also that the main effect is the inhibition of cholinesterase enzyme activity, we believe that the **WES should be withdrawn** and that exposures should be monitored through biological monitoring only. This is likely going to be the case for all of the organophosphate pesticides.
Barium sulphate	Yes	The recommended WES has been derived from the MAK values for bio-persistent dusts: • Respirable dusts : 1.35 mg/m^3; and • Inhalable dusts : 4.0 mg/m^3.

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		The draft evaluation report concludes that health effects from barium sulphate are in line with particulates not otherwise specified (NOS), generally defined as being non-toxic. Although limited information exists on reliable airborne concentration levels, one study suggested exposure to an estimated 3.5 mg/m^3 (considered to be respirable) is associated with baritosis, a benign, non-collagenous pneumoconiosis. Suggest that AIOH Position Paper on Dusts NOS be reviewed - recommends trigger levels of 1 and 5 mg/m^3 for respirable and inhalable dusts NOS, respectively. **WES should be further reviewed and reduced** in line with Dusts NOS.
Barium & soluble compounds	Yes – interim value	
Benomyl	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. The APVMA states clearly on their web site that: *Currently there are no products containing benomyl registered for use in Australia. It became illegal to supply or use products containing benomyl after 6 December 2006*. Therefore **WES should be withdrawn**.
Benzene	Yes	Most relevant studies show effects at concentrations of around 0.5 ppm in petroleum refinery workers. In the range below 0.1 ppm, no relevant effects are reported in the more reliable studies reviewed. **Accept recommended WES, but should be ALARP**.
Benzidine	New	
1H-Benzotriazole	New	Not in HCIS as this!
Benzoyl chloride	New	
Benzoyl peroxide (Dibenzoyl peroxide)	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. GHS classification is for eye irritation and skin sensitiser. Given that there do not appear to be any health effects due to inhalation of this substance, we suggest that a WES should not be considered. Principal hazards are due to flammable and explosive properties. **WES should be withdrawn**?
Benzyl chloride (alpha-Chlorotoluene)	No	
Beryllium & compounds	Yes	There are papers that challenge the classification of Beryllium as a human carcinogen. Based on aluminium industry experience, the 0.0002 mg/m^3 (as total) TWA-OEL is recognised as being safe in the context of primary aluminium production where beryllium compounds are mainly water soluble. See Taiwo et al (2008). Beryllium Sensitization in Aluminum Smelter Workers. *J Occup & Environ Med, 50(2)*; 157-162 and Taiwo et al (2010). Prevalence of beryllium sensitization among aluminium smelter workers. *Occup Med, 60(7)*; pp 569-571. In addition, there is evidence for a genetic sensitivity to beryllium (e.g. Kreiss et al, 2016) and a skin

SWA Chemical Name	Revise	Comments
		component for beryllium sensitization (Virji et al, 2019). Fireman et al (2014) concluded that Biological monitoring is more informative than environmental monitoring in the surveillance and monitoring of workers in beryllium industries. The aluminium industry experienced difficulty in finding laboratory facilities within Australasia capable of analysing to the required LoQ to meet the 0.0002 mg/m^3 industry OEL. Laboratories in North America were used to meet this limit. **In the interim, probably make sense to adopt the OSHA limit value as a WES**.
Biphenyl (Diphenyl, Phenylbenzene)	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. ACGIH TLV and GHS hazard category point to short-term effects related to irritation mainly. Limited data from human studies to support carcinogenicity effects from chronic exposures, although heavy & prolonged exposure of humans suggest serious nerve and liver damage - 1973 paper. **WES should be withdrawn**?
Bismuth telluride (Dibismuth tritelluride)	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.
Bismuth telluride, Se-doped	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.
Bisphenol-A	New	There is uncertainty regarding quantification of the recommended value with currently available sampling and/or analysis techniques. Limited data available in humans other than reports of contact allergic reactions and local effects on mucous membranes of nose and eyes in occupational settings. Recommended WES is based on extrapolation of respiratory effects in rats. **Accept recommended WES**.
Bisphenol A diglycidyl ether	New	This substance is an eye/skin irritant and sensitiser. Given that there do not appear to be any health effects due to inhalation of this substance, we would agree that a WES should not be considered. If a WES is not recommended, why list it? **Agree – no WES should be given**.
Bitumen fumes (Asphalt (petroleum))	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. **Accept recommended WES**
Borate compounds	Yes	The recommended TWA of 0.75 mg/m^3 for borate compounds (as boron) is recommended by SWA to protect for irritation of the mucous membranes in exposed 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 1 mg/m^3. Reproductive effects for males occur at much higher levels than the current exposure standard. We agree that the main effect

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		is irritation. DFG misinterpreted the Cain et al (2004, 2008) studies it based its recommendation on. The Maier et al (2014) publication 'Derivation of an occupational exposure limit for inorganic borates using a weight of evidence approach' using a weight of evidence approach recommended a TWA-OEL of 1.4 mgB/m^3. **Disagree with proposed WES** - should remain as 1 mg/m^3
Borates, tetra, sodium salts (anhydrous) (Disodium tetraborate anhydrous)	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. Reproductive effects for males occur at much higher levels than the current exposure standard. Main effect is irritation. **Accept recommended WES**
Boron oxide (Diboron trioxide)	Yes – interim value	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. **Agree with proposal**
Boron tribromide	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. As there is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques - perhaps best to leave at current value. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, suggest make no change to current WES**
Boron trifluoride	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 review also suggests limited data for WES. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, suggest make no change until additional review completed**
Bromacil	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 review also suggests limited data for WES. **Agree to no change until additional review completed**
Bromine	Yes – interim value	**Agree to no change until additional review completed**
Bromine pentafluoride	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.
Bromoform (Tribromomethane)	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.
1-Bromopropane	New	
1,3-Butadiene	Yes	

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Butane	Yes – interim value	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.
2-Butoxyethanol (Butyl cellosolve, Butyl glycol, Ethylene glycol)	Yes	
2-Butoxyethyl acetate	No	
n-Butyl 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 WEL.
sec-Butyl 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 WEL.
tert-Butyl 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 WEL.
n-Butyl acrylate (Acrylic acid, n-butyl ester)	Yes – interim value	
n-Butyl alcohol (n-Butanol)	Yes	Changed from a peak limitation to a TWA value. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES**.
sec-Butyl alcohol (sec-Butanol, Butan-2-ol)	Yes – interim value	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. **Agree to retain current WES**.
tert-Butyl alcohol (tert-Butanol, 2-Methylpropan-2-ol)	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.
tert-Butyl chromate (as CrO3)	No	Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**.
n-Butyl glycidyl ether (BGE) (1-Butoxy-2,3-epoxypropane, Butyl-2,3-epoxypropyl ether)	Yes	
n-Butyl lactate	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. **Agree to retain current WES**
Butyl mercaptan (Butanethiol)	No	
Butylamine	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.
But-2-yne-1,4-diol	New	

SWA Chemical Name	Revise	Comments
o-sec-Butylphenol	Yes – interim value	**Agree to retain current WES**.
p-tert-Butyltoluene	Yes – interim value	
Cadmium and compounds (as Cd)	Yes	Mechanisms of systemic toxicity of cadmium are relatively well understood; dose-effect/response relationships are well documented in a number of human studies. Critical effects in humans include systemic long-term effects on the kidneys and lung cancer. **Accept recommended WES, although should be in conjunction with a BEI value as proposed by SCOEL.**
Caesium hydroxide	Yes – interim value	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. **Agree to retain current WES**.
Calcium carbonate (Limestone, Marble)	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. **Agree to retain current WES**
Calcium cyanamide (Calcium carbimide)	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. Being an irritant only, should we even consider assigning a WES?
Calcium hydroxide (slaked lime)	Yes	Being an irritant only, should we even consider assigning a WES?
Calcium oxide (lime)	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. Being an irritant only, should we even consider assigning a WES?
Calcium silicate	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. **Agree to retain current WES**
Calcium sulphate (Gypsum, Plaster of Paris)	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. Being an irritant only, should we even consider assigning a WES?
Camphor, synthetic (Bornan-2-one)	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. **Agree to retain current WES**
e-Caprolactam (dust and vapour) (1,6-Hexanelactam, Hexahydro-2H-azepin-2-one)	Yes	Being an irritant only, should we even consider assigning a WES?

SWA Chemical Name	Revise	Comments
Caprolactam (dust)	Yes	Being an irritant only, should we even consider assigning a WES?
Captafol (Difolatan)	No	Fungicide - no longer authorised, hence WEL removed by UK HSE. According to the Cancer Council of Australia, no countries allow use of captafol! **WES should be withdrawn**
Captan	Yes – interim value	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.
Carbaryl (Sevin)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.
Carbofuran (Furadan)	No	Pesticide - no longer authorised, hence WEL removed by UK HSE. Insecticide and nematicide that is registered for use only in certain states - Schedule 7 substance. The Australian APVMA noted that the registration of the final remaining products containing the active constituent carbofuran and the labels for containers of those products have been voluntarily cancelled at the request of the holder in December 2019. There are no longer any registered products containing this active constituent in Australia. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to retain current WES**.
Carbon black	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. Yong et al (2019) conducted a meta-regression analysis of three cohort studies of carbon black production workers from US, UK, and Germany. They found that historic workplace exposures to carbon black were not associated with a significant risk of lung cancer and no exposure-response relationship was observed. **Agree to retain current WES**
Carbon dioxide	No	**Agree to retain current WES**
Carbon dioxide in coal mines	No	Toxicity of CO_2 has been established for close to a century. At concentrations > 10,000 ppm, there is potential for impact on fitness for work. **Agree that separate WES for CO_2 in coal mines not required**
Carbon disulphide	Yes	Critical effects are neurotoxicity and cardiotoxicity. SCOEL reported various NOAEL values for various health endpoints, but say that overall, the threshold/NOAEL for the earliest non-clinical changes appear to be in the range of 3-10 ppm. **A WES of 2 ppm is probably most appropriate**
Carbon monoxide	Yes	Critical effect in humans is its binding to haemoglobin to form carboxyhaemoglobin, thus reducing oxygen uptake. **ACGIH TWA of 25 ppm may be more appropriate, particularly given its alignment with the BEI value**
Carbon tetrabromide (Tetrabromomethane)	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.

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Carbon tetrachloride (Tetrachloromethane)	Yes	Banned under Montreal Protocol – should there be a WES? **Need for WES? If so, then agree to proposed WES**.
Carbonyl fluoride	No	
Catechol (Pyrocatechol, o-Dihydroxybenzene, 1,2-Benzenediol)	Yes – interim 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.
Cellulose (paper fibre)	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. **Agree to retain current WES**
Chlordane	No	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**.
Chlorinated camphene (Camphechlor)	No	
Chlorinated diphenyl oxide	No	
Chlorine	Yes	Proposed WES is NOT readily quantifiable through currently available sampling and analysis techniques. Being an irritant only, should we even consider assigning a WES? **TWA of 0.5 ppm & STEL of 1 ppm may be more appropriate**
Chlorine dioxide	Yes – interim value	
Chlorine trifluoride	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. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**.
1-Chloro-1-nitropropane	No	
Chloroacetaldehyde	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. Listed as a Cat 2 carcinogen, but has only a peak limitation? **Further assessment required**
Chloroacetone	No	
alpha-Chloroacetophenone (Phenacyl chloride)	Yes	Being an irritant only, should we even consider assigning a WES?
Chloroacetyl chloride (Chloroacetic acid chloride)	No	
Chlorobenzene	Yes	

SWA Chemical Name	Revise	Comments
o-Chlorobenzylidene malononitrile	Yes	
Chlorobromomethane (Bromochloromethane)	No	
Chlorodifluoromethane (Difluorochloromethane, Fluorocarbon 22, Freon 22)	No	Banned under Montreal Protocol. Australia has largely phased out the import of hydrochlorofluorocarbons including R22. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. **WES should be withdrawn**.
Chloroform (Trichloromethane)	Yes	
bis(Chloromethyl) ether	Yes	
Chloromethyl methyl ether	New	
Chloropentafluoroethane (Fluorocarbon 115, Freon 115)	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. Banned under Montreal Protocol. Australia has largely phased out the import of hydrochlorofluorocarbons including R115. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. **WES should be withdrawn**.
Chloropicrin (Trichloronitromethane)	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. **Agree to retain current WES**
beta-Chloroprene (2-Chloro-1,3-butadiene)	Yes	Proposed amended WES is set to protect against cancer, based on data from a study reporting the incidence of tumours in multiple organ systems in rodents and derivation of human equivalent dose. 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, the proposed WES is below the current limit of detection for available sampling and analysis techniques. **Disagree with proposed WES** – needs to be measurable at the least – ACGIH TLV may be applicable
2-Chloropropionic acid	No	
o-Chlorostyrene	No	
Chlorosulphonic acid	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. Being an irritant only, should we even consider assigning a WES?

SWA Chemical Name	Revise	Comments
		Agree to retain current WES?
o-Chlorotoluene	Yes	
Chlorpyrifos (Dursban)	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. The Australian APVMA announced in June 2019 they were cancelling the registration of chlorpyrifos in domestic and home garden products, and in certain public spaces such as parks and footpaths. The proposed decision is to suspend the remaining high concentration products with these uses after 28 days and to cancel all product registrations with these uses after three months. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES.**
Chromium (II, III, metal) compounds (as Cr)	Yes – interim value	WES extrapolated from animal data. SWA note that the available toxicological data are inconsistent and investigation of additional data sources is recommended. SCOEL note that for chromium III, there is evidence from investigations in both animals and man that repeated exposure to concentrations in the region of 0.5 - 2.3 mg Cr(III)/m^3 does not result in adverse effects on the lungs. WES set to minimise irritation and lung effects. Being an irritant only, should we even consider assigning a WES? **Suggest make no change until additional review completed**
Chromium (VI) compounds (as Cr)	Yes	The ACGIH (SWA primary data source for WES review) released their updated chromium 6+ TLV of 0.0002 mg/m^3 in 2017. The USEPA (SWA secondary data source) has calculated a cancer unit risk estimate for Cr6+ which was last updated in 1998 and is based on a 1975 conference paper by Mancusso of a proportional mortality study of a cohort of chromate workers from 1931-1937 with exposure data derived from a hygiene study in 1949 where the concentration of chromium in the air of mist and dust was determined by precipitating electrostatically on a bright-line haemocytometer. Why give precedence to a secondary data source over a primary source? Additionally, given that the IRIS unit cancer risk estimate is based on what could only be described as “questionable” grab sample exposure estimates, one has to be somewhat sceptical about the SWA proposed Cr6+ WES of 0.000007 mg/m^3. As it is there are peer-reviewed papers that suggested a possible threshold effect of occupational Cr6+ exposure on lung cancer. In addition, the proposed WES cannot be measured with current methods. In addition, available respiratory protection would not provide adequate protection relative to such a low WES. **Use OSHA final rule 8-h TWA exposure limit of 0.005 mg/m^3 as interim value until further review is conducted**
Clopidol (Coyden)	Yes	
Coal tar pitch volatiles (as benzene solubles)	Yes	SWA proposed WES is based on US EPA Inhalation Unit Risk for benzo(a)pyrene (B[a]P) to minimise potential for lung cancers and other tumours – noting that critical effects of CTPV exposure are unclear as separation of various components not practicable,

SWA Chemical Name	Revise	Comments
		hence based on identified key solvent components (B[a]P, benzene, etc). SWA also noted that there is uncertainty regarding quantification of recommended 0.0001 mg/m^3 WES value with currently available sampling and/or analysis techniques. AIOH PAH Position Paper suggests a more appropriate approach would be to place the emphasis of exposure on the measurement of the levels of the 16 priority EPA PAHs and specifically B[a]P, and that the CTPV WES should be replaced by a B[a]P 8-h TWA WES of 0.0002 mg/m^3. Due to skin absorption, AIOH also recommend that biological monitoring of 1-hydroxypyrene be used and exposures interpreted against a biological guidance value of 4.0 µmol/mol cr. **Suggest adopt AIOH recommendation**
Cobalt compounds (as Co)	No	
Cobalt, metal dust & fume (as Co)	Yes	
Copper	Yes	Preferable that there are separate WESs for copper fume (0.05 mg/m^3 respirable fraction) and copper dust and mist (0.1 mg/m^3 inhalable fraction), as per an old ACGIH notification of change. Quantification of recommended values using currently available sampling and analysis techniques needs to be checked. A recent publication by Brand et al (2020) 'No Observed Effect Level (NOEL) for Systemic Inflammation by Copper and Zinc in Welding Fumes' suggests a NOEL for copper to be between 0.2 and 0.3 mg/m^3. **Need separate WESs, as above**
Cotton dust, raw	Yes	
Cresol, all isomers	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. Being an irritant only, should we even consider assigning a WES? **WES should be withdrawn**.
Crotonaldehyde (trans-But-2-enal)	Yes	
Crufomate	No	
Cumene (Isopropyl benzene)	Yes	Has acute as well as long term-health effects. Note that there appears to be a discrepancy between the proposed WES of 0.005 ppm on the SWA engage webpage and what appears to be the recommended WES in the accompanying documentation of 0.1 ppm. The ACGIH is currently reviewing the TLV for Cumene and has a Notice of Intended Change from 50 ppm to 1 ppm based on liver damage and respiratory tract irritation and a carcinogenicity category of A3 (Confirmed animal carcinogen with unknown relevance to humans). The SWA review uses a different critical end point of nasal cancers in rats to which they have applied a safety factor of 10,000 to the dose-response departure point and then multiplied this by 20 because of the conflicting information about the chemical-specific genotoxicity in humans. They have also assigned it with a carcinogenicity category of 1B - presumed to have carcinogenic potential for humans (the placing of a substance

SWA Chemical Name	Revise	Comments
		in Category 1B is largely based on animal evidence), despite the ACGIH classification of A3 and the IARC classification as 2B. The German MAK (set in 2018) for Cumene is 10 ppm. **Disagree with proposed WES. Needs further study**.
Cyanamide	Yes	Being an irritant only, should we even consider assigning a WES?
Cyanides (as CN)	Yes	**Agree with proposed TWA-WES, but suggest STEL value of 5 mg/m^3** more appropriate than the proposed peak value
Cyanogen (Oxalonitrile)	Yes	Being an irritant only, should we even consider assigning a WES?
Cyanogen chloride	No	
Cyclohexane	Yes	
Cyclohexanol	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. **Agree to retain current WES**.
Cyclohexanone (Anone)	Yes	Being an irritant only, should we even consider assigning a WES?
Cyclohexene	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. Being an irritant only, should we even consider assigning a WES? **WES should be withdrawn**.
Cyclohexylamine (Aminocyclohexane)	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. Being an irritant only, should we even consider assigning a WES?
Cyclonite (Hexahydro-1,3,5-trinitro-1,3,5-triazine, RDX)	Yes	
Cyclopentadiene	No	Being an irritant only, should we even consider assigning a WES?
Cyclopentane	No	
Cyhexatin (Tricyclohexyltin hydroxide, Plictran)	No	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. According to APVMA, this substance is no longer registered for pesticide and veterinary uses. **Need for WES? If so, agree to retain current WES**
2,4-D (2,4-Dichlorophenoxyacetic acid)	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. **Agree to retain current WES**
DDT (Dichlorodiphenyl-trichloroethane)	No	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. The Australian APVMA states that DDT is no longer used in agricultural practice, being banned in Australia since 1987. **WES should be withdrawn**.
Decaborane	No	What is its use in Australia?

SWA Chemical Name	Revise	Comments
		Agree to retain current WES
Demeton (Systox)	No	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, agree to retain current WES**
Diacetone alcohol (4-Hydroxy-4-methyl-2-pentanone)	Yes	
Diacetyl	New	
Diatomaceous earth (uncalcined)		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.
Diazinon	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.
Diazomethane	Yes	
Diborane	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.
1,2-Dibromo ethane (ethylene dibromide)	New	
Dibutyl phenyl phosphate	No	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to retain current WES**.
Dibutyl phosphate (Dibutyl hydrogen phosphate)	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.
Dibutyl phthalate	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.
2-N-Dibutylaminoethanol (N,N-Di-n-butylaminoethanol)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.
1,1-Dichloro-1-nitroethane	No	
1,4-Dichloro-2-butene	New – interim	
1,3-Dichloro-5,5-dimethyl hydantoin	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. Being an irritant only, should we even consider assigning a WES? **Agree to retain current WES**
Dichloroacetic acid	New	
Dichloroacetylene	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. Peak limitation assigned, BUT classified as Carcinogen – category 2 & STOT (repeated exposure) – should have TWA value?

SWA Chemical Name	Revise	Comments
		Disagree with retaining current peak limitation
o-Dichlorobenzene (1,2-dichlorobenzene)	No	**Agree to retain current WES**.
p-Dichlorobenzene (1,4-dichlorobenzene)	Yes	
3,3'-Dichlorobenzidine	New	
Dichlorodifluoromethane (Fluorocarbon 12, Freon 12)	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. 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. **WES should be withdrawn**.
1,1-Dichloroethane (Ethylidene chloride)	No	**Agree to retain current WES**.
Dichloroethyl ether (bis-(2-Chloroethyl)-ether)	Yes	
1,2-Dichloroethylene (Acetylene dichloride)	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. **Agree to retain current WES**
Dichlorofluoromethane (Fluorocarbon 21, Freon 21)	Yes – interim	The UK HSE noted there was limited documentation or the basis of the limit was uncertain. Banned under Montreal Protocol. Australia has largely phased out the import of chlorofluorocarbons including R21. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. **WES should be withdrawn**.
Dichloropropene (gamma-Chloroallyl chloride, 1,3-dichloropropene)	Yes – interim	**Agree to retain current WES**.
2,2-Dichloropropionic acid (Dalapon)	No	
Dichlorotetrafluoroethane (Fluorocarbon 114, Freon 114, R-114, Tetrafluoro dichloroethane)	No	Banned under Montreal Protocol. Australia has largely phased out the import of chlorofluorocarbons including R114. The Government's *Ozone Protection and Synthetic Greenhouse Gas Management* legislation sets out legal requirements for handling controlled HFC, HCFC and CFC refrigerants. **WES should be withdrawn**.
Dichlorvos (DDVP)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.

SWA Chemical Name	Revise	Comments
Dicrotophos (Bidrin)	Yes – interim	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.
Dicyclopentadiene (3a,4,7,7a-tetrahydro-4,7-methanoindene)	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. Being an irritant only, should we even consider assigning a WES?
Dicyclopentadienyl iron (Ferrocene)	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.
Dieldrin	Yes	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**.
Diesel engine emissions	New	Agree that there is insufficient data available to recommend a suitable TWA for newer diesel engines. **Agree that further study required - use AIOH recommendations as interim value! Perhaps use best practice controls code of practice?**
Diethanolamine (2,2'-Iminodiethanol)	Yes	
Diethyl ketone (3-Pentanone)	Yes	
Diethyl phthalate	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. Being an irritant only, should we even consider assigning a WES? **Agree to retain current WES?**
Diethyl sulfate	New – interim	Neither the SCOEL nor DFG review proposed OELs or tolerable cancer risk estimates for workplace exposures to diethyl sulfate, because of the established genotoxicity, which precluded a threshold OEL, and the lack of robust data to calculate a cancer risk. **Agree to not adopt a WES** due to insufficient data. Exposures should be ALARP.
Diethylamine	Yes	
2-Diethylaminoethanol	Yes – 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. Being mainly a skin corrosive with URT irritation, should we even consider assigning a WES?
Diethylene glycol monobutyl ether	New	
Diethylene triamine (2,2'-Diaminodiethylamine, 1,4,7-Tri-(aza)-heptane)	No	**Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Difluorodibromomethane (Dibromodifluoromethane)	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.
Diglycidyl ether (DGE, bis(2,3-Epoxy propyl) ether)	Yes – interim	
Diglycidyl resorcinol ether	New – interim	
Diisobutyl ketone (2,6-Dimethyl-4-heptanone)	No	**Agree to retain current WES**
Diisopropylamine	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 WEL. Being mainly a skin corrosive, should we even consider assigning a WES? **Agree to retain current WES**
Dimethyl acetamide	No	**Agree to retain current WES?**
Dimethyl carbomoyl chloride	New – interim	
Dimethyl ether	No	**Agree to retain current WES**
Dimethyl sulfide	New	
Dimethyl sulphate	Yes – interim	
Dimethylamine	Yes	
Dimethylaminoethanol	No	**Agree to retain current WES**
N,N-Dimethylaniline	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. **Agree to retain current WES**
N,N-Dimethylethylamine (ethyldimethylamine)	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. Being mainly a skin corrosive, should we even consider assigning a WES? **Agree to retain current WES?**
Dimethylformamide	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.
1,1-Dimethylhydrazine	Yes – interim	**Agree to retain current WES**.
Dimethylphthalate	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. Being an irritant only, should we even consider assigning a WES? **Agree to retain current WES.**

SWA Chemical Name	Revise	Comments
Dimethylsulfamoyl chloride	New	
Dinitolmide (3,5-Dinitro-o-toluamide, Zoalene)	Yes	
m-Dinitrobenzene (1,3-dinitrobenzene)	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. **Agree to retain current WES**
o-Dinitrobenzene (1,2-dinitrobenzene)	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. **Agree to retain current WES**
p-Dinitrobenzene (1,4-dinitrobenzene)	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. **Agree to retain current WES**
Dinitro-o-cresol (DNOC, 2-Methyl-4,6-dinitrophenol)	No	In the UK, this herbicide is no longer authorised, hence WEL removed by UK HSE. DFG have withdrawn their limit values due to lack of robust data, and SCOEL determined not to set an OEL due to the lack of robust data and the significance of any potential dermal exposure. **WES should be withdrawn**!
Dinitrotoluene	Yes	
1,4-Dioxane (Diethylene dioxide)	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. SCOEL documentation is supportive of the HCOTN proposed value. **Agree to proposed WES**
Dioxathion (Delnav)	No	In the UK, this organophosphate pesticide is no longer authorised, hence WEL removed by UK HSE. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to retain current WES**
1,3-Dioxolane	New	
Diphenylamine	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.
Dipropyl ketone (4-Heptanone)	No	
Diquat (Diquat dibromide (ISO))	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. **Agree to proposed WES**
Di-sec-octyl phthalate (DOP, Di (2-ethylhexyl) phthalate, bis(2-Ethylhexyl) phthalate)	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. **Agree to proposed WES**

SWA Chemical Name	Revise	Comments
Disulfiram (Tetraethyl thiuram disulphide)	No	
Disulfoton (Disyston)	Yes	In the UK, this organophosphate pesticide is no longer authorised, hence WEL removed by UK HSE. In Australia, the APVMA cancelled the registration of the only remaining disulfoton product and associated label approval in June 2013. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **WES should be withdrawn**.
2,6-Di-tert-butyl-p-cresol	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 WEL. **Agree to retain current WES**
Diuron	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. The Australian APVMA has been cancelling registrations for products containing this substance and is looking to an orderly phaseout of it with restrictions on use. **Agree to retain current WES**
Divinyl benzene	No – interim	
2,6-Dimethylaniline (DMA)	New	**Agree that no WES be recommended**.
Ethylenediaminetetra acetic acid (EDTA)	New	**Agree that no WES be recommended**.
Emery (dust)	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. **Agree to retain current WES**
Endosulfan (Thiodan)	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. The Australian APVMA cancelled all active constituent approvals for endosulfan, as a consequence, on 12 October 2010 the APVMA cancelled all endosulfan product registrations. **WES should be withdrawn**
Endrin	No	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**
Enflurane (2-Chloro-1,1,2-trifluoroethyl difluoromethyl ether)	Yes	
Epichlorohydrin (1-Chloro-2,3-epoxy-	Yes	

SWA Chemical Name	Revise	Comments
propane; Oxirane, (chloromethyl)-)		
EPN (O-Ethyl-O-(4-nitrophenyl) phenylthiophosphonate)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES.**
Ethanolamine (2-Aminoethanol)	No	
Ethion (Nialate)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES.**
2-Ethoxyethanol (Cellosolve; Ethyl glycol; Ethylene glycol, monoethyl ether; Glycol, monoethyl ether)	Yes	
2-Ethoxyethyl acetate (Cellosolve acetate; Glycol, monoethyl ether acetate; Ethylene glycol, monoethyl ether acetate; Ethyl glycol acetate)	Yes	
Ethyl acetate (Acetic acid ethyl ester, Acetic ester)	No	**Agree to retain current WES.**
Ethyl acrylate (Acrylic acid, ethyl ester)	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. Should have TWA value based on GHS chronic health and acute toxicity. **Agree to proposed WES.**
Ethyl alcohol (Ethanol)	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.
Ethyl benzene	Yes	
Ethyl bromide (Bromoethane)	No – interim	
Ethyl butyl ketone (3-Heptanone)	Yes	
Ethyl chloride (Chloroethane)	Yes	
Ethyl cyanoacrylate	New	
Ethyl ether (Diethyl ether)	No	

SWA Chemical Name	Revise	Comments
Ethyl formate (Formic acid, ethyl ester)	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.
Ethyl mercaptan (Ethanethiol)	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. **Agree to retain current WES**
Ethyl silicate (Tetraethyl orthosilicate)	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.
Ethylamine	Yes	
Ethylene	New – interim	
Ethylene chlorohydrin (2-Chloroethanol)	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. **Agree to retain current WES**
Ethylene dichloride (1,2-Dichloroethane)	Yes	
Ethylene glycol (particulate) (Ethane-1,2-diol)		
Ethylene glycol (vapour) (Ethane-1,2-diol)		
Ethylene glycol dinitrate (EGDN, Ethylene dinitrate, Glycol dinitrate, Nitroglycol)	Yes	
Ethylene oxide (Oxirane)	Yes	
Ethylene thiourea	New	
Ethylenediamine (1,2-Diaminoethane)	No	
Ethylenimine (Aziridine)	Yes – interim	
2-Ethylhexanoic acid	New	
2-Ethylhexanol	New	
Ethylidene norbornene	Yes	Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES**.
N-Ethylmorpholine	No	**Agree to retain current WES**
Fenamiphos (Nemacur)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.

SWA Chemical Name	Revise	Comments
Fensulfothion (Dasanit)	Yes	
Fenthion (Baytex, Lebaycid)	No	A broad spectrum organophosphorus insecticide. According to the Australian APVMA, most products containing the chemical fenthion were cancelled in 2014. **Need for WES? If so, then agree to retain current WES.**
Ferbam	Yes	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. **Need for WES? If so, then agree to retain current WES.**
Ferrovanadium dust	No	
Flour Dust (cereal)	New	
Fluorides (as F)	No – interim	Most epidemiological studies have investigated whether there is a connection between the fluoride concentration in drinking water and adverse effects on health, particularly with skeletal effects and cancer. The major health effect of chronic inhalation exposure to fluoride, as for other routes of uptake, is skeletal fluorosis. Given the ACGIH & SCOEL documentation, noting the consistent NOAEL value for fluorosis consistent with the TWA value for > 10 years of exposure, we agree with the proposal. The DFG use of total body intake of fluoride per day to derive a workplace airborne contaminant limit is tenuous. **Agree to retain current WES**
Fluorine	No	**Agree to retain current WES**
Fonofos (Dyfonate)	No	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to retain current WES.**
Formaldehyde	Yes	The SCOEL and ANSES documentation both suggest a TWA value of 0.3 ppm and a STEL of 0.6 ppm using essentially the same studies as ACGIH®. As noted by SWA, data from human studies indicate short term exposure to concentrations of approximately 1 ppm results in slight eye irritation (quoting ACGIH & HCOTN); i.e. a 0.3 or a 0.6 ppm STEL could be considered protective. **Agree to proposed WES, as long as it is achievable, otherwise use SCOEL recommendations.**
Formamide	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. **Agree to retain current WES**
Formic acid	No	**Agree to retain current WES**
Fumed silica (respirable dust)		
Furfural (2-Furaldehyde; 2-Furancarboxaldehyde)	Yes	
Furfuryl alcohol	Yes	
Gallium arsenide	New	

SWA Chemical Name	Revise	Comments
Germanium tetrahydride (Germane)	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. **Agree to retain current WES**
Glutaraldehyde (1,5-Pentanedial)	Yes	Should have a TWA value based on GHS chronic health and acute toxicity, but there is only a peak limitation! **Disagree with only a peak limitation**.
Glycerin mist	No	**Agree to retain current WES**
Glycidol (2,3-Epoxy-1-propanol)	Yes – interim	
Glyoxal	New	
Grain dust (oats,wheat, barley)	Yes	
Graphite (all forms except fibres) (respirable dust) (natural & synthetic)	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. **Agree to retain current WES**
Hafnium	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. **Agree to retain current WES?**
Halothane (1,1,1-Trifluoro-2-chloro-2-bromoethane)	Yes – interim	**Agree to retain current WES**
Hard metals (containing cobalt and tungsten carbide)	New – interim	
Heptachlor	Yes	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**
Heptane (n-Heptane)	No	**Agree to retain current WES?**
Hexachlorobenzene	New	
Hexachlorobutadiene	No	
Hexachlorocyclopentadiene	Yes – interim	
Hexachloroethane	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. **Agree to retain current WES?**
Hexachloronaphthalene	Yes – interim	
Hexafluoroacetone	Yes – interim	
Hexahydrophthalic anhydride	New	

SWA Chemical Name	Revise	Comments
Hexamethylene diisocyanate (HDI)	Yes	See entry for isocyanates
Hexamethyl phosphoramide	New	
Hexane (n-Hexane)	Yes	Given the ACGIH & DFG documentation, plus the OSHA / NIOSH documentation, we agree with the proposal. **Agree with proposed TWA-WES**
Hexane, other isomers	No	
sec-Hexyl acetate (1,3-Dimethyl butyl acetate)	Yes – interim	
Hexylene glycol (2-Methylpentane-2,4-diol)	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 WELs. Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES**
Hydrazine (Diamine)	Yes	
Hydrogen bromide	Yes – interim	Should have a TWA value based on GHS STOT hazard category! Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to further review of WES**.
Hydrogen chloride (Hydrochloric acid)	Yes	Being primarily an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES**.
Hydrogen cyanide (Hydrocyanic acid)	Yes	As for cyanides: **Agree with proposed TWA-WES, but prefer SCOEL STEL value of 5 mg/m^3**
Hydrogen fluoride (as F)	Yes	Epidemiology studies reviewed by ACGIH indicated no significant changes in pulmonary function due to occupational exposure to an average of 1.03 ppm HF, no increase in worker respiratory complaints for HF concentrations less than 3 ppm, and a threshold for minimal increase in fluorosis (Grade I) being below 4.3 ppm. Being an irritant only, should we even consider assigning a WES? SWA need to clarify quantification of their recommended values with currently available sampling and analysis techniques in Australia. **A TWA of 1 ppm and a STEL of 3 ppm should be sufficiently protective of health and irritation for the majority of workers.**
Hydrogen peroxide	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. Being mainly a skin corrosive & irritant, should we even consider assigning a WES?
Hydrogen selenide (as Se)	No	**Agree to retain current WES?**
Hydrogen sulphide	Yes	Both the ACGIH TWA and STEL values were based on human data that indicated the start of the dose-response curve for short-term human exposure was around 5 ppm. The same study showing a NOAEL “of 10 ppm for nasal lesions, as identified in rats

SWA Chemical Name	Revise	Comments
		and mice exposed for six hours per day for up to 90 days", is used by each of the primary sources to assign different exposure standard recommendations. WHO (2003 - http://www.inchem.org/documents/cicads/cicads/cicad53.htm) noted no adverse cardiovascular or respiratory effects for healthy human volunteers for acute exposure (15-30 mins) to 10 ppm H_2S. SWA need to clarify quantification of their recommended values with currently available sampling and analysis techniques in Australia. **A TWA of between 1 to 5 ppm and a STEL of between 5 to 10 ppm should be sufficiently protective of health and irritation for the majority of workers.**
Hydrogenated terphenyls	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.
Hydroquinone (p-Dihydroxybenzene)	Yes – interim	It is noted that HCOTN states "Most occupational exposure limits for hydroquinone of other countries are 2 mg/m^3 or lower. In general, these are based on its eye and skin irritation properties. But the quantitative data of these properties date from over four decades ago, with exposure data that are not very reliable in view of the then available chemical analytical power. Moreover, there were co-exposures to benzoquinone and aniline which are likely to have influenced negatively the eye and skin irritations observed. Although only limited data are available, the Committee expects that at the level of 4 mg/m^3 the risk for eye and skin irritation and sensitization is negligible." **Agree to no change until additional review completed**.
Hydroxyacetic acid butyl ester	New	
Hydroxypropyl acrylate	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. **Agree to retain current WES**
Indene	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 WEL. **Agree to retain current WES**
Indium & compounds (as In)	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.
Iodine	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 STEL WEL. ACGIH recommend a STEL rather than a peak limitation! Is the peak value measurable? **Agree with proposed TWA. Consider STEL rather than peak limitation**.
Iodoform	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.

SWA Chemical Name	Revise	Comments
		Agree to retain current WES
Iron oxide fume (Fe_2O_3) (as Fe)	Yes – interim	Recommendation that a prioritised review of the available carcinogenicity data, and therefore the suitability of the interim 5 mg/m^3 TWA, be undertaken. However, such review has already been undertaken and the determination is that iron oxides are not human carcinogens - see Bourgkard et al (2009 - https://oem.bmj.com/content/66/3/175), Lewinski et al (2013 - https://www.degruyter.com/view/j/biomat.2013.14.issue-1-2/bnm-2013-0007/bnm-2013-0007.xml?lang=en) and Pease et al (2016 - https://pubs.acs.org/doi/pdf/10.1021/acs.chemrestox.5b00448). **Agree to retain current WES - further study involving a review of the available carcinogenicity data for iron oxides is NOT required**.
Iron pentacarbonyl (as Fe)	Yes	
Iron salts, soluble (as Fe)	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 WEL. SWA also note limited documentation, hence propose future literature review. Being mainly an irritant, should we even consider assigning a WES? **Agree to retain current WES**
Isoamyl acetate (Isopentyl acetate)		
Isoamyl alcohol (3-Methylbutan-1-ol)	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. Being mainly an irritant, should we even consider assigning a WES?
Isobutyl acetate		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. Being mainly an irritant, should we even consider assigning a WES? **Agree to retain current WES?**
Isobutyl alcohol (2-Methylpropan-1-ol; iso-Butanol)	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. Being mainly an irritant, should we even consider assigning a WES? **Agree to retain current WES?**
Isocyanates, all (as-NCO)	Yes	Proposed TWA value is at LOD / LOQ of best measurement method. Proposed value appears focussed on adverse effects on airways that can occur after sensitisation to isocyanates, as determined by the Health Council of the Netherlands report. Studies used had limitations. Should focus on preventing sensitisation and take into account skin route of exposure. See latest publication by ECHA (2019) - https://echa.europa.eu/documents/10162/db15bfdf-eec8-c10a-67c4-f65166c5110a **Disagree with proposed WES - needs to take into account measurability, skin exposure route & protection against sensitisation. Agree that further in-depth assessment of this WES is required**.

SWA Chemical Name	Revise	Comments
Isooctyl alcohol	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. **Agree to retain current WES**
Isophorone (3,5,5-Trimethylcyclohex-2-enone)	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 WEL. Should have a STEL & TWA value based on GHS acute effects, but there is only a peak limitation! Is the peak value measurable? **Disagree to retain current peak limitation only**
Isophorone diisocyanate (3-isocyanatomethyl-3,5,5-trimethylcyclohexyl isocyanate)	Yes	See entry for isocyanates
Isopropoxyethanol (2-(1-methylethoxy)-ethanol)	Yes	
Isopropyl acetate (Acetic acid, 1-methylethyl ester)		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. **Agree to retain current WES?**
Isopropyl alcohol (Propan-2-ol)	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.
Isopropyl ether (Diisopropyl ether)	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. Being mainly an irritant, should we even consider assigning a WES? **Agree to retain current WES**
Isopropyl glycidyl ether (IGE, 2,3-Epoxypropyl isopropyl ether)	Yes – interim	**Agree to retain current WES?**
Isopropylamine (2-Aminopropane)	No	
N-Isopropylaniline	Yes – interim	
Kaolin	No – interim	**Agree to retain current WES?**
Ketene	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. **Agree to retain current WES**
Lead arsenate (as $Pb_3(AsO_4)_2$)	Remove	**Agree that no WES be recommended**
Lead chromate (as Cr)	Yes	

SWA Chemical Name	Revise	Comments
Lead, inorganic dusts & fumes (as Pb)	No	**Agree with current WES**
Lindane (Gammexane, gamma-Hexachlorocyclohexane)	No	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**
Lithium hydride	Yes	
LPG (liquified petroleum gas)	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 WEL. **Agree to retain current WES**
Magnesite	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. **Agree to retain current WES**
Magnesium oxide (fume)	No	**Agree to retain current WES?**
Malathion (Maldison)	Yes	Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**
Maleic anhydride	Yes	
Manganese cyclopenta-dienyl tricarbonyl (as Mn)	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. **Agree to retain current WES or withdraw WES?**
Manganese, fume, dust & compounds (as Mn)	Yes	Two entries combined to one. SCOEL (2011) used many of the same studies used by ACGIH, which showed adverse neurological effects and identified a point-of-departure in the dose-effect/response relationship relevant to an exposure limit. They further noted that the reported changes in these studies are subtle early neurofunctional effects which are non-clinical in nature and are only detected at a statistical level between groups of workers. In addition, they noted that their recommended exposure limits were conservative due to a number of factors. ATSDR (2012) derived a respirable manganese concentration of 0.142 mg/m^3 as the point of departure (considered approximately equivalent to a NOAEL). **Disagree with proposed ACGIH TWA WESs - prefer SCOEL TWA values of 0.05 mg/m^3 (resp) & 0.2 mg/m^3 (inhal).**
Mercury, alkyl compounds (as Hg)	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. **Agree to retain current WES**
Mercury, aryl compounds (as Hg)	No – interim	**Agree to retain current WES**
Mercury, elemental vapour (as Hg)	No – interim	**Agree to retain current WES**

SWA Chemical Name	Revise	Comments
Mercury, inorganic divalent compounds (as Hg)	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 WEL. **Agree to retain current WES**
Mercury, inorganic monovalent compounds (as Hg)	No – interim	**Agree to retain current WES**
Mesityl oxide (4-Methylpent-3-en-2-one)	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.
Methacrylic acid	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. **Agree to retain current WES?**
Methomyl (Lannate)	Yes	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. Approved for use in Australia by APVMA, who note that potential mammalian developmental and reproductive effects require evaluation. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.
1-Methoxy-2-propanol acetate	No	**Agree to retain current WES**.
Methoxychlor (2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane; DMDT)	No – interim	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. According to APVMA, this substance is no longer used in agricultural practice. **Need for WES? If so, then agree to retain current WES**.
2-Methoxyethanol (Methyl cellosolve, Methyl gylcol, Glycol monomethyl ether, Ethylene glycol monomethyl ether)	Yes	
2-Methoxyethyl acetate (Ethylene glycol monomethyl ether acetate, Glycol monomethyl ether acetate, Methyl glycol acetate, Methyl cellosolve acetate)	Yes	
(2-Methoxymethylethoxy) propenol (Dipropylene glycol (mono) methyl ether)	No	**Agree to retain current WES**.
4-Methoxyphenol (Mequinol (INN))	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. **Agree to retain current WES?**

SWA Chemical Name	Revise	Comments
Methyl 2-cyanoacrylate (mecrilate)		
Methyl acetate	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. **Agree to retain current WES**
Methyl acetylene (Propyne)	No	
Methyl acetylene-propadiene mixture (MAPP)	No	
Methyl acrylate (Acrylic acid, methyl ester)	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.
Methyl alcohol (Methanol)	Yes	
N-Methyl aniline	No – interim	**Agree to retain current WES**
Methyl bromide (Bromomethane)	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.
2-Methylbutyl acetate	New	
Methyl chloride (Chloromethane)	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.
Methyl demeton (Demeton-O-methyl plus demeton-S-methyl; Metasystox)	No – interim	APVMA cancelled the registration of demeton-S-methyl in June 1998. There are currently no products containing demeton-S-methyl registered for use in Australia. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **WES should be withdrawn**
Methyl ethyl ketone (MEK, 2-Butanone)		
Methyl ethyl ketone peroxide (2-Butanone, peroxide)	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 STEL WEL. Has a GHS STOT hazard category, but there is no TWA WES! **Agree to retain current WES?**
Methyl formate (Formic acid, methyl ester)	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.
Methyl hydrazine	No	
Methyl iodide (Iodomethane)	No	**Agree to retain current WES**.
Methyl isoamyl ketone (Isoamyl methyl ketone; 5-Methyl-2-hexanone)	Yes	

SWA Chemical Name	Revise	Comments
Methyl isobutyl carbinol (Methyl amyl alcohol; 4-methyl-2-Pentanol)	No	**Agree to retain current WES**.
Methyl isobutyl ketone (MIBK, Hexone, 4-Methyl-2-pentanone)	Yes	
Methyl isocyanate	Yes	
Methyl isopropyl ketone (3-Methyl-2-butanone)	Yes	
Methyl mercaptan (Methanethiol)	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. **Agree to retain current WES**
Methyl methacrylate (Methacrylic acid, methyl ester)	No	**Agree to retain current WES**.
Methyl n-amyl ketone (2-Heptanone; Heptan-2-one)	No	**Agree to retain current WES?**
Methyl n-butyl ketone (2-Hexanone)	Yes	
Methyl parathion	Yes	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. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **WES should be withdrawn?**
Methyl propyl ketone (2-Pentanone)	Yes	
Methyl silicate (Tetramethyl orthosilicate)	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.
alpha-Methyl styrene (2-Phenylpropene)		
1-Methyl-2-pyrrolidone	Yes	
Methylacrylonitrile	No	**Agree to retain current WES**.
Methylal (Dimethoxymethane)	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. **Agree to retain current WES**
Methylamine	Yes - 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.
Methylcyclohexane	Yes	

SWA Chemical Name	Revise	Comments
Methylcyclohexanol	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. **Agree to retain current WES?**
o-Methylcyclohexanone	No	**Agree to retain current WES**
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	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. **Agree to retain current WES?**
4,4'-Methylene bis (2-chloroaniline) (MOCA, MBOCA, 2,2'-Dichloro-4,4'-methylenedianiline)	No – interim	
Methylene bis (4-cyclo-hexylisocyanate)		
Methylene bisphenyl isocyanate (MDI, Diphenylmethane diisocyanate)	Yes	See entry for isocyanates
Methylene chloride (Dichloromethane)	No	
4,4'-Methylene dianiline (MDA, DADPM, DDM, p,p'-Diaminodiphenylmethane)	No	
5-Methylheptan-3-one (Ethyl amyl ketone)	No	**Agree to retain current WES**
Methyl-tert butyl ether	Yes	
Methyl vinyl ketone	New - interim	
Metribuzin (Sencor)	No	
Mevinphos (Phosdrin)	Yes	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. APVMA noted there was only one remaining product in Australia with one use and that it has been declared a restricted product to be used by authorised persons only. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES.**
Mica	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. **Agree to retain current WES**
Mineral turpentine		

SWA Chemical Name	Revise	Comments
Molybdenum, insoluble compounds (as Mo)	Yes	Both limits assigned to protect against irritant effects in exposed workers. Being an irritant only, should we even consider assigning a WES? **Need for WES? If so, then agree to proposed WES**.
Molybdenum, soluble compounds (as Mo)	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. Based on ACGIH TWA TLV, in turn based on NOAEL for alveolar inflammation with UF of 10 and adjusting for 8-h workday from 6 h exposures used in the animal study.
Monochloroacetic acid	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.
Monocrotophos (Azodrin)		
Morpholine	No	
Naled (Dibrom; Dimethyl-1,2-dibromo-2,2-dichloroethylphosphate)	Yes	In the UK, this pesticide is no longer authorised, hence WEL removed by UK HSE. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to proposed WES**.
Naphthalene	Yes	
Natural rubber latex	New - interim	
Nickel carbonyl (as Ni) (Tetracarbonyl nickel)	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.
Nickel dichloride		
Nickel dinitrate		
Nickel, metal & insoluble compounds	Yes	Proposed TWA value is consistent with the limit value recommended by the AIOH (2016) position paper for both soluble and insoluble compounds. **Agree to proposed WES**.
Nickel, powder	Deleted	**Agree**
Nickel salt, nitric acid		
Nickel, soluble compounds (as Ni)	No	**Agree to retain current WES.**
Nickel sulphide roasting (fume & dust) (as Ni)		
Nicotine		
Nitrapyrin (N-Serve; 2-Chloro-6-(trichloromethyl) pyridine)		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.
Nitric acid	Yes	

SWA Chemical Name	Revise	Comments
Nitric oxide (Nitrogen monoxide)	Yes	A NOAEC of 2.5 ppm based on effects on lung function is reported in a longitudinal study in workers, used by SCOEL to recommend 2 ppm limit. Causes respiratory tract irritation and lung damage. **Agree to proposed WES**.
p-Nitroaniline		
Nitrobenzene	No	
p-Nitrochlorobenzene (p-Chloronitrobenzene; 1-chloro-4-nitrobenzene)	No	
Nitroethane		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.
Nitrogen dioxide	Yes	Based on ACGIH TLV - set to protect from respiratory tract irritation in asthmatics, who are more sensitive. **Believe SCOEL recommended TWA= 0.5 ppm & STEL=1 ppm more appropriate**
Nitrogen trifluoride	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. **Agree that no WES be recommended**.
Nitroglycerin (NG, Glyceryl trinitrate)	Yes	**Agree to proposed WES**.
Nitromethane	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.
5-Nitro-o-toluidine	New	
1-Nitropropane	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.
2-Nitropropane	No	
N-nitrosodimethylamine	New - interim	Recommended value is likely to be below the current limit of detection for standard sampling and analysis techniques. Uncertainties exist regarding carcinogenicity in humans. **Agree that no WES be recommended**.
2-Nitrotoluene		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.
3-Nitrotoluene	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.
4-Nitrotoluene	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.
Nitrous oxide (Dinitrogen monoxide, Laughing gas)	Yes	

SWA Chemical Name	Revise	Comments
Nonane	No	
Octachloronaphthalene	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.
Octane	No	
Oil mist, refined mineral	No - interim	
Osmium tetroxide (as Os)	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.
Oxalic acid	No	Being mainly an irritant, should we even consider assigning a WES? **Need for WES? If so, then agree to retain current WES.**
2,2'-Oxybis[ethanol] (Diethylene glycol)		
Oxygen difluoride		
Ozone		
Paraffin wax (fume)		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.
Paraquat (respirable sizes) (Paraquat dichloride (ISO))	Yes	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?**
Parathion		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. **WES should be withdrawn**
PCBs (42% Chlorine) (Polychlorinated biphenyls, Polychlorobiphenyls, Chlorobiphenyl)		
PCBs (54% Chlorine) (Chlorobiphenyl)		
Pentaborane	Yes	
Pentachloronaphthalene	Remove	**Agree that no WES be recommended**.
Pentachloronitrobenzene (quintozene)		
Pentachlorophenol		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

SWA Chemical Name	Revise	Comments
		and Veterinary Chemicals (Administration) Act is prohibited from being imported, exported, manufactured and used in Australia. **WES should be withdrawn?**
Pentaerythritol	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. **Agree to retain current WES**.
Pentane	Yes	
2,3-Pentanedione	New	
2,4-Pentanedione	New	
Peracetic acid	New	
Perchloroethylene (Tetrachloroethylene)	Yes	**Agree to proposed WES**.
Perchloromethyl mercaptan	Remove	**Agree that no WES be recommended**.
Perchloryl fluoride	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.
Perfluoroisobutylene (Octafluoroisobutylene)		
Perlite dust	No	
Persulfates, ammonium- and alkali metal salts	No	Combines Ammonium Persulfate, Potassium Persulfate & Sodium persulfate to one.
Petrol (gasoline)	Yes	
Phenol	No	SCOEL documentation is the most comprehensive. **Agree to retain current WESs**.
Phenothiazine		
Phenyl ether (vapour) (Diphenyl ether)		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.
Phenyl glycidyl ether (PGE; Phenyl-2,3-epoxypropyl ether; Oxirane, (phenoxymethyl)-)	No	
Phenyl mercaptan (Benzenethiol)	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.
m-Phenylenediamine (1,3-Benzenediamine)	No	**Agree to retain current WES**

SWA Chemical Name	Revise	Comments
o-Phenylenediamine (1,2-Benzenediamine)		
p-Phenylenediamine (1,4-Benzenediamine)	No	**Agree to retain current WES**
Phenylhydrazine	No	
Phenyl isocyanate	New	
Phenylphosphine		
Phorate (Thimet)		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. APVMA only allows minor use permits for phorate. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring.
Phosgene (Carbonyl chloride)		
Phosphine	Yes	
Phosphoric acid (Orthophosphoric acid)	No	**Agree to retain current WES**
Phosphorus (yellow)	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.
Phosphorus oxychloride (Phosphoryl trichloride)	Yes	
Phosphorus pentachloride	No	**Agree to retain current WES**
Phosphorus pentasulphide (Diphosphorous pentasulphide)		
Phosphorus trichloride	No	**Agree to retain current WES**
Phthalic anhydride	Yes	
m-Phthalodinitrile	No	
Picloram (Tordon)		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.
Picric acid (2,4,6-Trinitrophenol)	No	**Agree to retain current WES**
Pindone (Pival; 2-Pivalyl-1,3-indandione)		

SWA Chemical Name	Revise	Comments
Piperazine dihydrochloride		
Piperidine		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.
Platinum, metal		
Platinum, soluble salts (as Pt)		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.
Polyvinyl chloride	New	
Portland cement	Yes	
Potassium hydroxide	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. Being primarily an irritant, should we even consider assigning a WES? Maybe STEL rather than Peak limitation! **Need for WES? If so, then agree to retain current WES**
Potassium Persulfate	Deleted	Combined to the one – 'Persulfates' **Agree**
Precipitated silica		
Propane-1,2-diol total: (vapour & particulates)		
Propane-1,2-diol: particulates only		
Propane sultone (1,3-propanesultone)	New	
Propargyl alcohol (Prop-2-yn-1-ol)		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.
beta-Propiolactone	No	
Propionic acid		
Propoxur (PHC, Baygon, Arprocarb)	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. Main effect is inhibition of cholinesterase enzyme activity, hence use biological monitoring. **Need for WES? If so, then agree to retain current WES**.
Propranolol	Yes - interim	Insufficient data exists to perform a risk-based assessment, hence no limit values assigned. **Agree that no WES be recommended**.
n-Propyl acetate		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 Chemical Name	Revise	Comments
Propyl alcohol (Propan-1-ol)		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.
n-Propyl nitrate	Yes	
Propylene dichloride (1,2-Dichloropropane)		
Propylene glycol dinitrate		
Propylene glycol monomethyl ether (1-Methoxypropan-2-ol)		
Propylene imine (2-methylaziridine)		
Propylene oxide (1,2-Epoxypropane; Oxirane, methyl-)	Yes	