Response to public submissions on draft default guideline values for metsulfuron-methyl in freshwater

July 2021

Draft default guideline values (DGVs) for metsulfuron-methyl in freshwater were published on the Water Quality Guidelines website for a 4-month public consultation period. During this period, comments for the draft DGVs for metsulfuron-methyl in freshwater were received via public submission.

Responses to comments and any associated edits to the draft DGV technical brief are outlined in this report, de-identified for public record. The responses and revisions have been approved by the jurisdictional technical and policy oversight groups and noted by the National Water Reform Committee.

The default guideline values for metsulfuron-methyl in freshwater are now published as final. For additional information on the publication process, please refer to the pathway for toxicant default guideline value publication.

The Water Quality Guidelines Improvement Program thanks all submissions for their valuable contribution to the development of default guideline values for the protection of aquatic ecosystems.

Comment	Response	Action taken
Technical Brief for metsulfuron-methyl DGV does not cover all registered uses of this herbicide, which includes uses near or within waterways. The summary page of ANZG (2020) does not refer to all registered uses of metsulfuron-methyl, which is much wider than controlling broadleaf weeds and annual grasses. A search of the national pesticide regulator, Australian Pesticides and Veterinary Medicines Authority PUBCRIS database lists the 75 products registered for use in Australia at Public Chemical Registration Information System Search. Metsulfuron-methyl also controls brush and woody plants and can be used across rights of way, commercial and industrial areas in addition to agricultural areas. There are also 47 current APVMA permits at Agricultural and Veterinary Permits Search for use of metsulfuron-methyl for various weeds and situations, including aquatic situations, floodplains and open natural ecosystems.	The Summary represents a brief snapshot of the DGV technical brief and, thus, is not meant to provide exhaustive information on chemical uses. The Introduction provides more information on registered uses of metsulfuron-methyl in Australia. However, some additional Australia- and New Zealand-specific information on approved uses has been added. Note, however, that the additional information represents *examples* of registered uses, not all uses. Readers can access the relevant source references for complete information.	Additional text on approved uses in Australia and New Zealand has been added to the Summary and Introduction sections, as follows: *Revised text in Summary:* "In Australia and New Zealand, metsulfuron-methyl is typically used in agriculture to control broadleaf and other weeds in pastures, cereals, forestry and/or for other non-agricultural purposes (ACVM 2020, APVMA 2020)." *Revised text in Introduction:* "In Australia, metsulfuron-methyl has been approved for brush and broadleaf weed control on a range of crops including cereals (e.g. wheat, barley, canola, rye, triticale), linseed, chickpeas, mung beans and pastures, and also in other activities such as forestry, commercial and industrial areas, and for *Mimosa pigra* control on floodplains (APVMA 2020). In New Zealand, it is approved for weed control on pastures, and in forestry (radiata pine) and non-cropland areas (ACVM 2020)."
If the DGV methodology only tests pure form technical grade active constituents of pesticide formulations, what method will distinguish amending toxicity value due to the adjuvant or carrier?	The methodology for this is provided in Warne et al. (2018). Moreover, a draft update to Warne et al. (2018) includes updated guidance for accounting for formulations. This should be available within the next six months.	No action taken for DGVs technical brief.

Comment	Response	Action taken
How can these DGV's for freshwater be legally used when a product is safe enough to be registered for use within or adjacent to waterways? For example, metsulfuron-methyl with a non-ionic surfactant can be used safely beside waterways to control ox-eye daisy in NSW National Parks (permits.apvma.gov.au/PER13056.PDF), alligator weed in aquatic situations and including potable water near Port Stephens NSW (permits.apvma.gov.au/PER14200.PDF) or kidney-leaf mud plantain in Qld non-potable waterways (permits.apvma.gov.au/PER14122.PDF).	The DGVs represent concentrations of a chemical that, if exceeded, indicate a potential unacceptable hazard to the aquatic environment, independent of whether or not they are approved for use near or within waterways. It is important to note that the DGVs should be applied within the context of the Water Quality Management Framework (WQMF), which represents a process that allows for consideration and decisions on, amongst other things, key stressors, community values and management goals (i.e., what is to be protected and to what extent). This process can include decisions on whether certain stressors represent a greater risk and, accordingly, how the system should be managed. Such considerations would need to be discussed and agreed with your local jurisdiction.	No action taken for DGVs technical brief.
Water Quality Australia should consider the national ecotoxicity guidelines used by the national pesticide regulator, Australian Pesticides and Veterinary Medicines Authority (APVMA), before progressing any further with DGV methods to revise water quality trigger values. APVMA has an extremely rigorous registration process for all agricultural and veterinary chemicals used in Australia. Toxicology and Environment are two required elements for registration of active constituents, see Toxicology (APVMA). Toxicity studies must comply with international guidelines established by the Organisation for Economic Co-operation and Development OECD and in accord with the principles of Good Laboratory Practice. Toxicity studies are required on the active constituent, the formulation and any degradation products. Toxicology data includes acute, short-term and long-term chronic toxicity, development studies, no-observed adverse effect level NOAEL and many other criteria. Environmental impacts consider expected exposure and fate of active constituents and potential effects on vertebrates, invertebrates, fish, algae, higher plants and soil microbes. The methodology for	The APVMA registration process is indeed comprehensive. However, it serves a different, albeit partially overlapping, purpose to the ANZG (2018) DGVs. The APVMA process represents a prospective (before use) risk assessment often using limited amounts of actual data and instead relying heavily on modelling. Notably, the APVMA registration process risk assessment typically follows a tiered approach, whereby initial less detailed assessments determine a level of risk and the need or otherwise to undertake a more detailed assessment, including a more detailed effects/hazard assessment (EFSA 2013). This effects/hazard assessment can include the use of a species sensitivity distribution (SSD) approach similar to that used by ANZG (2018), as per the Warne et al. (2018) DGV derivation method. There is no specific requirement to use an SSD approach; however, it is the preferred approach when there are sufficient available laboratory toxicity data. It is noteworthy that EFSA (2013) recommends dividing the HC5 from the SSD (which is analogous to the ANZG (2018) 95% species protection DGV typically applied to slightly to moderately disturbed systems) by a	No action taken for DGVs technical brief.

Comment	Response	Action taken
environmental risk assessment assesses risk of runoff or spray drift by considering scale and situations of use and fate in the environment. Other assessed factors include degradation, bioaccumulation and mobility of the active constituent and major metabolites. Ecotoxicity data for at least four algal species, one aquatic plant species and binding to sediment are all included in the registration process. None of these factors are considered for calculating DGV's for Water Quality Australia.	safety factor to derive a Regulatory Acceptable Concentration (RAC) that aims to be protective for edge of the field surface water bodies. The use of a safety factor means that this approach is most likely more conservative than that used for DGVs under ANZG (2018). As noted earlier, the DGVs represent an estimate of *hazard* of chronic toxicity effects to the aquatic environment based on as much publicly available acceptable quality toxicity data as can be obtained*. As DGVs are based on publicly available acceptable quality toxicity data, they are often based on data for more species than RACs derived as part of the pesticide registration process (depending on the tier of risk assessment undertaken). It would be ideal if toxicity data generated as part of pesticide registration processes could also be incorporated into datasets for DGV derivation. However, the data that is supplied to the APVMA is done so under "commercial-in-confidence" arrangements and, typically, the data are not available for use to derive DGVs. As DGVs represent the hazard, they only represent one half of a risk assessment (the other half being exposure). The risk assessment process for assessing water and/or sediment quality compares the DGVs with actual *measured* environmental exposure estimates as part of one of several lines of evidence, and is undertaken in step 6 of the WQMF. This is done to assess water quality and determine if any impacts have occurred (i.e., retrospective risk/impact assessment), which is different to the objective of registering a pesticide. It is important to note that factors such as runoff, spray drift and degradation are accounted for in the measured environmental concentrations that are compared with the DGVs (i.e., because how much of a chemical is present in water is a direct result of factors such as spray-drift, run-off and degradation). In contrast, the pesticide registration process needs to model different runoff	

Comment	Response	Action taken
	and spray drift scenarios, and incorporate degradation, in order to predict potential environmental concentrations, because actual environmental data are often lacking. Depending on the toxicant, factors such as bioaccumulation, formulations and degradation are considered when determining how the DGVs should be applied. Such issues are discussed in Warne et al. (2018) and also on the ANZG (2018) website at accounting for local conditions * Acceptability criteria for toxicity data and minimum data requirements for DGV derivation are specified in Warne et al. (2018). The criteria are rigorous and generally consistent with, if not the same as, similar schemes overseas.	
Submitter does not support the concept of lowest reported chronic toxicity as a basis for determining a DGV trigger value. Freshwater volume is not considered in the calculations. The registered rate of application for a product containing metsulfuron-methyl ranges from 0.05grams per litre to 0.15grams per litre of water plus a non-ionic surfactant, depending on which weed species is being controlled. The product contains 600g/kg of the active constituent metsulfuron-methyl. Therefore, these registered application rates equate to 0.03g to 0.09g of active constituent (which equals 30, 000 to 90,000 micrograms). The highest Potential Environmental Risk PER is generally considered to be 10 per cent runoff of applied rate. If 9000 micrograms did end up in a freshwater system, the final toxicity value depends on the volume of freshwater. Even when applying metsulfuron-methyl at the highest rate on the label for managing woody *Mimosa pigra* weed across floodplains in the Northern Territory (60g product /ha which equates to 36g active constituent/ha), the concentration washed off into the floodplain depends on area and depth of the freshwater body.	The Aus/NZ approach for deriving DGVs is consistent with international practice (e.g., in North America and Europe), and these practices have been used for many years. This includes the EFSA (2013) process used by APVMA. A transparent process is undertaken to determine how toxicity data for each species are to be treated. The approach involves selection of a single toxicity value for each species (or genus in the U.S. method). In some cases, the lowest value for a species is selected, and in other cases a geometric mean of multiple values for a species is selected. Decisions depend on the amount and type of data. The aim is to select a toxicity value that is believed to be protective for that species. All the single toxicity values are combined and used in a species sensitivity distribution, from which concentrations that are believed to be protective of a specified percentage of species are estimated (e.g., 99%, 95%, 90%). Volume is implicitly accounted for in DGVs because they are expressed as a concentration, which takes into account volume (i.e., a unit mass of chemical per unit volume of water). And the DGVs are compared to an actual measured concentration of the	No action taken for DGVs technical brief.

<table>
<tr><th>Comment</th><th>Response</th><th>Action taken</th></tr>
<tr><td>If 10 per cent of metsulfuron-methyl ended up in nearby freshwater, the volume of the freshwater body determines runoff concentration.

For example:
<table>
<tr><th>Water body Width (m)</th><th>Length (m)</th><th>Depth (m)</th><th>Water volume (m³)</th><th>Volume (L)</th><th>Conc of Metsulfuron-methyl (µg/L)</th></tr>
<tr><td>3</td><td>3</td><td>0.1</td><td>0.9</td><td>900</td><td>4000</td></tr>
<tr><td>10</td><td>5</td><td>0.1</td><td>5</td><td>5000</td><td>720</td></tr>
<tr><td>10</td><td>5</td><td>0.2</td><td>10</td><td>10000</td><td>360</td></tr>
<tr><td>10</td><td>5</td><td>0.3</td><td>15</td><td>15000</td><td>240</td></tr>
<tr><td>10</td><td>5</td><td>0.5</td><td>25</td><td>25000</td><td>144</td></tr>
<tr><td>10</td><td>5</td><td>0.6</td><td>30</td><td>30000</td><td>120</td></tr>
<tr><td>10</td><td>5</td><td>0.7</td><td>35</td><td>35000</td><td>103</td></tr>
<tr><td>10</td><td>5</td><td>0.8</td><td>40</td><td>40000</td><td>90</td></tr>
</table>
Herbicide impacts on macrophytes such as reduced growth rate can re-establish back to normal, once duration of herbicide exposure ceases. There is no clarification if duration of exposure has been considered for DGV's.</td>
<td>chemical in the waterbody. The Mimosa pigra example that is provided relates to the size of the receiving waterbody. The DGV would still be relevant for this example, but there are other factors that would need to be considered by stakeholders in terms of assessing impacts, including the community values, other stressors, management goals (what is to be protected and to what level of protection) and related issues such as mixing zones and even ecosystem recovery. The WQMF provides the vehicle for considering these types of issues. Ultimately, the derivation of DGVs is independent of such issues.

The DGVs are relevant to chronic exposure situations. Thus, in general, they are not applicable to short-term (acute) exposures of up to three or four days. At present, there is no ability to quantitatively incorporate duration of exposure into DGVs. Such an approach would be useful but would take significant additional effort to develop and implement and, regardless, for many toxicants, the necessary toxicity data to enable this would not exist. Where short-term exposures or other duration-based issues (e.g., multiple pulse exposures) are relevant for a toxicant, then site-specific GVs may be required.</td>
<td></td></tr>
<tr><td>Query regarding the method used to determine fish mortality, as metsulfuron-methyl Mode of Action MOA is only toxic to plants, not fish.

The default DGV for metsulfuron-methyl (ANZG 2020) correctly states the mode of action inhibits acetolactate synthase (ALS) enzyme which forms amino acids in macrophytes (plants). The methodology used for the final toxicity value of 4,500 micrograms/L for mortality of fish after 90 days exposure (ANZG 2020, Table 2) is questioned. Fish do not have this enzyme. How has the fish been exposed to the technical grade active constituent? Where is a congruent control experiment where the fish were exposed to the same conditions without including the technical grade active constituent? Or did this experiment expose fish to</td>
<td>Many chemicals, particularly those with specific modes of action such as metsulfuron-methyl also have other modes of action in non-target organisms. All chemicals, in addition to their specific mode of action, will also exert some toxicity by the narcotic (i.e., non-specific) mode of action. Examples of pesticides having multiple modes of action include the triazines: that have a photosystem II inhibiting mode of action to plants, and they also lead to increased concentrations of reactive oxygen species by a different mode of action; in amphibians they have an endocrine disruptor mode of action and finally, together with every organic chemical, a non-specifically acting baseline toxicity. Thus, herbicides can be toxic to fish and other animals, although</td>
<td>No action taken for DGVs technical brief.</td></tr>
</table>

Comment	Response	Action taken
metsulfuron-methyl product, surfactants or other compounds which contributed to the mortality?	animals are often less sensitive than plants and algae. Therefore, the toxicity data for metsulfuron-methyl are what is expected. The toxicity values to the target organisms (plants and algae) are generally very low (0.054 to 95.4 µg/L) while the toxicity values for one non-target organism is considerably higher (4500 µg/L). The toxicity value for the fish was obtained from the US EPA Office of Pesticides Program which uses US EPA approved methods for its toxicity testing. The fish were exposed to technical grade metsulfuron-methyl (with a purity of greater than 80%) and all the USEPA methods have appropriate controls.	
Conclusion In summary, the submitter is concerned with the new novel DGV methodology and draft guideline values for metsulfuron-methyl. Methodologies to assess environmental risk should be nationally consistent. There needs to be improved communication with affected industries and further technical discussion about this new DGV system, before national adoption.	The current methodology for deriving DGVs (Warne et al. 2018) is similar to the method that was approved and used for the ANZECC/ARMCANZ (2000) trigger values. Indeed, the method has been improved in numerous ways, which are outlined in Warne et al. (2018) and Batley et al. (2018). Also, as mentioned earlier, the method is consistent with other GV derivation methods that have been employed in North America and Europe for well over a decade. The metsulfuron-methyl DGVs have been derived in accordance with the approved method, and clearly state that they should be used in conjunction with the guidance provided on the ANZG (2018) website, which provides an overarching framework and extensive supporting technical guidance for assessing water and sediment quality. It is agreed that methods for assessing environmental risk should be as nationally consistent as possible, noting that there will be differences between requirements for prospective and retrospective risk assessments. Nevertheless, further alignment in the future is a desirable outcome.	No action taken for DGVs technical brief.

References

ANZECC/ARMCANZ 2000. Australian and New Zealand guidelines for fresh and marine water quality. Canberra (AU). National Water Quality Management Strategy Paper No 4.

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia.

Batley, GE, van Dam, RA, Warne, MStJ, Chapman, JC, Fox, DR, Hickey, CW and Stauber, JL 2018. Technical rationale for changes to the Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, 49 pp.

EFSA 2013. Guidance on tiered risk assessment for plant protection products for aquatic organisms in edge-of-field surface waters. EFSA Journal 11(7), 3290.

Warne MStJ, Batley GE, van Dam RA, Chapman JC, Fox DR, Hickey CW & Stauber JL 2018. Revised Method for Deriving Australian and New Zealand Water Quality Guideline Values for Toxicants – update of 2015 version. Prepared for the revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, 48 pp.