



Australian Government
**Australian Pesticides and
Veterinary Medicines Authority**



**Acute reference doses (ARfD) for agricultural and veterinary
chemicals used in food producing crops or animals**

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Introduction

The Acute reference doses for agricultural and veterinary chemicals (ARfD list) provides a tabulation of acute reference doses (ARfDs; in units of mg/kg bodyweight) for each agricultural or veterinary (agvet) chemical listed.

The **'Study' column** provides information about the pivotal study, including type, the NOAEL (no-observed-adverse-effect level) and the critical toxicological endpoint. For some agvet chemicals, longer-term rather than acute dosing studies have been used to establish the ARfD. In these cases, the NOAEL was selected on the basis of toxicological effects observed after the first dose.

The **'Comments' column** may:

1. provide additional information about its applicability to the general population
2. advise that an ARfD is not necessary
3. indicate that the ARfD has been adopted from that established by the FAO/WHO Joint Meeting on Pesticide Residues (JMPR).

The **'Date' column** indicates when particular ARfDs were established.

ARfD list

Table 1: ARfD list

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---|-----------------|------------------|---------------|---|---|
| A | | | | | |
| Abamectin (sum of abamectin + 8,9-Z Isomer) | 0.002 | 0.25 | 6 August 2018 | Based on the overall NOAEL of 0.25 mg/kg bw per day for clinical signs in dogs (mydriasis) observed in the first week of treatment at 0.5 mg/kg bw per day. | <p>A total uncertainty factor of 100 has been applied. The ARfD also applies to the 8,9-Z isomer of avermectin B_{1a} and 24-hydroxymethyl abamectin.</p> <p>The 24-hydroxymethyl metabolite of abamectin is regarded as having no greater toxicity than the parent molecule.</p> |
| Acephate | 0.1 | ≥ 1.2 | 2005 | Single dose study in humans. No inhibition of erythrocyte acetylcholinesterase activity was reported in either sex at any dose. No clinically significant changes were seen in vital signs or on electrocardiography, haematology, clinical chemistry, urine analysis or physical examination. The NOAEL was 1.2 mg/kg bw per day, the highest dose tested. | <p>The critical toxicological effect of acephate is the inhibition of acetylcholinesterase activity in the nervous system, an effect that is dependent on C_{max} rather than on the area under the curve (AUC).</p> <p>Data on inhibition in vitro indicate that human brain acetylcholinesterase is slightly less sensitive to inhibition by acephate than is rat brain acetylcholinesterase. Well conducted toxicokinetics studies, available for both rats and humans, show that there is no significant difference between the two species; in particular, C_{max} values have the same relationship to administered dose in the two species, and acephate is rapidly absorbed and eliminated in both species.</p> |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------|-----------------|------------------|-----------------|---|--|
| | | | | | <p>Data for rats in vivo indicate that inhibition of brain acetylcholinesterase activity occurs at lower doses than those required for a similar level of inhibition of erythrocyte acetylcholinesterase activity.</p> <p>Data for dogs and monkeys in vivo indicate that brain and erythrocyte acetylcholinesterase activities are nearly equally inhibited at any given dose, and do not show the difference seen in rats, which might thus be rat-specific.</p> <p>Well-conducted single – and repeated-dose studies in humans clearly demonstrated a dose where no inhibition of blood cholinesterase activities occurred. Data from animals in vivo do not show sex differences in inhibition of acetylcholinesterase activity or clinical signs.</p> <p>Since there is no interspecies extrapolation, an overall safety factor of 10 was used.</p> |
| Acequinocyl | 0.08 | 8 | 13 January 2021 | Rat mechanistic studies; single oral dose produced effects on blood coagulation (increases in prothrombin and activated partial thromboplastin time) at higher doses. | |
| Acetamiprid | 0.1 | 10 | 27 July 2001 | Single-dose gavage neurotoxicity rat study; a NOAEL of 10 mg/kg bw was based on reductions in | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|------------------|--|---|
| | | | | locomotor activity at the next higher dose. | |
| Acibenzolar-S-methyl | 0.01 | 10 [LOAEL] | 23 April 2002 | Developmental rat study; based on haemorrhagic discharge in dams at LOAEL of 10 mg/kg bw/d. | |
| Afidopyropen | 0.3 | 30 | 27 November 2017 | Developmental rabbit studies; an overall NOAEL of 30 to 32 mg/kg bw/d was based on inappetence observed at the next higher dose. | ARfD for afidopyropen applies to the general population. |
| Aldicarb | 0.001 | 0.01 | 15 December 1999 | Human acute study; a NOAEL of 0.01 mg/kg bw was based on significant and dose-related RBC AChE inhibition at the next higher dose. | |
| Ametoctradin | | | 1 February 2012 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Amicarbazone | 0.1 | 10 | 9 June 2006 | Acute neurotoxicity study; a NOAEL of 10 mg/kg bw was based on clinical signs of neurotoxicity at the next higher dose. | |
| Aminopyralid | | | 10 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------------|-----------------|------------------|------------------|--|---|
| Amisulbrom | | | 14 June 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Atrazine | | | 5 December 2000 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Aureobasidium pullulans | | | 21 February 2017 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Azafenidin | 0.016 | 16 | 4 July 2001 | Developmental rat study; a NOAEL of 16 mg/kg bw/d was based on increased incidence of resorptions (predominantly early) at the next higher dose. | ARfD for azafenidin only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Azimsulfuron | | | 10 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Azinphos-methyl | 0.075 | 0.75 | 5 December 2000 | Acute human study; a NOAEL of 0.75 mg/kg bw was based on the absence of RBC ChE inhibition or clinical signs. | |
| Azoxystrobin | | | 21 April 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|--|-----------------|------------------|------------------|-------|---|
| B | | | | | |
| Bacillus amyloliquefaciens | | | 9 May 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Bacillus licheniformis | | | 9 May 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Bacillus sphaericus strain 2362 | | | 9 May 2003 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Bacillus subtilis (see Bacillus amyloliquefaciens) | | | | | |
| Bacillus thuringiensis | | | 6 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Bacillus thuringiensis subsp. thuringiensis serotype 1 (strain MPPL 002) | | | 28 August 2003 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Beauveria bassiana | | | 8 August 2017 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------------------|-----------------|------------------|-----------------|--|--|
| | | | | | to be distinguishable from naturally occurring background levels of the organism. |
| Bentazone | | | 21 April 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Benzovindiflupyr | 0.1 | 10 | 23 July 2018 | Clinical observations, (decreased locomotor activity at 1 hour post-dosing and reduced forelimb grip strength in females at 1 hour post-dosing). | |
| Benzylpenicillin procaine | | | 10 October 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Bicyclopyrone | 0.01 | 1 | 10 January 2017 | Developmental rabbit study; a NOAEL of 1 mg/kg bw/d was based on increased incidence of urogenital malformations along with skeletal variations at the next higher dose. | ARfD for bicyclopyrone only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Bifenazate | | | 10 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Bitertanol | | | 21 April 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------|-----------------|------------------|------------------|---|--|
| Bixafen | 0.2 | 20 | 18 January 2016 | Developmental rat study; a NOAEL of 20 mg/kg bw/d was based on reduced body weight gain in dams and foetuses at the next higher dose. | |
| Boscalid | | | 10 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Bromide | | | 10 October 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Bupivacaine | | | 17 February 2017 | | There was insufficient information to establish an ARfD, however, based on its proposed pattern of use the dietary intake is likely to be low. |
| Buprofezin | 0.5 | 50 | 31 October 2006 | Developmental rabbit study; a NOAEL of 50 mg/kg bw/d was based on bodyweight loss at the next higher dose. | |
| Butafenacil | | | 19 November 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------|-----------------|------------------|------------------|--|---|
| C | | | | | |
| Captan | 0.1 | 10 | 18 May 2007 | Developmental rabbit study; a NOAEL of 10 mg/kg bw/d was based on reduced maternal body weight and increased skeletal variations in foetuses at the next higher dose. | ARfD for captan only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Carbaryl | 0.01 | 1 | 13 December 2002 | Subchronic neurotoxicity rat study; a NOAEL of 1 mg/kg bw/d was based on behavioural indications of autonomic neurotoxicity and reduced brain, plasma and RBC ChE activity at the next higher dose. | |
| Carbendazim | 0.05 | 50 [LOAEL] | 15 February 2011 | Special acute study in male rats; based on significant testicular and efferent ductal alterations at 50 mg/kg bw, the lowest dose tested. | The ARfD is also supported by an acute in vivo genotoxicity study, with increased frequencies of micronuclei were observed in spermatids at a LOAEL of 50 mg/kg bw. |
| Carbetamide | 0.3 | 30 | 1 October 2020 | 90-day and 1-year dog studies; a NOAEL of 30 mg/kg bw/d was based on the observation of clinical signs of neurotoxicity including unsteady gait, drowsiness and tremor which were manifest early in the studies and may occur after acute exposures. | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------------------------|-----------------|------------------|------------------|---|---|
| Ceftiofur (as free acids and salts) | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cephalexin | | | 22 November 2000 | | ARfD is considered to be unnecessary; therapeutic dose for adults ranges between 1 to 4 g/day. |
| Cetrimide | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Chlorantraniliprole | | | 9 May 2008 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Chlorfenvinphos | 0.02 | 1.9 | 5 December 2000 | 14-day mouse study; a NOAEL of 1.9 mg/kg bw/d was based on inhibition of RBC ChE activity at the next higher dose. | |
| Chlormequat | 0.07 | 7.5 | 23 June 2005 | 2-year dietary dog study; a NOAEL of 7.5 mg/kg bw/d was based on excessive salivation and muscle weakness observed after a single dose. | |
| Chloropicrin | | | 16 January 2014 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------|-----------------|------------------|------------------|--|---|
| Chlorpyrifos | 0.1 | 1 | 5 December 2000 | Single dose human study; a NOAEL of 1 mg/kg bw/d was based on inhibition of RBC ChE activity at the next higher dose. | |
| Cinmethylin | 0.3 | 30 | 20 August 2003 | Developmental rat study; a NOAEL of 30 mg/kg bw/d was based on clinical signs (excess salivation and urine stained abdominal fur) at the next higher dose. | |
| Clethodim | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Clofentezine | | | 31 December 2019 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Clitoria ternatea | | | 23 November 2015 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| d-Cloprostenol | | | 21 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cloquintocet acid | | | 5 July 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------------------|-----------------|------------------|------------------|---|---|
| Clothianidin | 0.2 | 25 | 1 August 2003 | Acute neurotoxicity mouse study; a NOAEL of 25 mg/kg bw was based on clinical signs (reduced spontaneous activity) at the next higher dose. | |
| Codling Moth Granulosis Virus | | | 25 November 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Cyantraniliprole | | | 21 January 2013 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cyazofamid | | | 6 June 2013 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cyclaniliprole | | | 29 February 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cyflufenamid | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Cyhalofop-butyl | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------|-----------------|------------------|------------------|--|---|
| gamma-Cyhalothrin | 0.005 | 0.5 | 12 August 2003 | Developmental rat study; a NOAEL of 0.5 mg/kg bw/d was based on clinical signs of toxicity, reduced body weight gains and food consumption observed in dams at the next higher dose. | |
| beta-Cypermethrin | 0.05 | 4.7 | 19 March 2002 | 3-month feeding dog study; a NOAEL of 4.7 mg/kg bw/d was based on clinical signs (whole body tremors, head nodding, 'lip-licking', subduedness, ataxia, agitation and a high-stepping gait) at the next higher dose. | |
| D | | | | | |
| Decoquatate | | | 4 June 2013 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Derquantel | 0.01 | 1 | 27 May 2011 | Acute neurotoxicity dog study; a NOAEL of 1 mg/kg bw was based on clinical signs (mydriasis, ptosis, dry eyes) at the next higher dose. | |
| Dexamethasone | | | 10 October 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Diazinon | 0.01 | 0.2 | 20 December 2002 | Acute dose human volunteer study; a NOAEL of 0.2 mg/kg bw was | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|--|-----------------|------------------|-------------------|--|---|
| | | | | based on RBC ChE inhibition at the next higher dose. | |
| 2,6 dichlorobenzamide (BAM) | 0.6 | 60 | 26 November 2015 | Developmental rat study; a NOAEL of 60 mg/kg bw/d was based on increased incidence of skeletal defects of the vertebrae and sternbrae at the next higher dose. | ARfD for 2,6 dichlorobenzamide (BAM) applies to the general population. |
| 2,4-dichlorophenoxyacetic acid (2,4-D) | 0.8 | 75 | 12 September 2006 | Acute neurotoxicity rat study; a NOAEL of 75 mg/kg bw was based on gait/coordination effects and decreased motor activity at the next higher dose. | |
| Dichlorprop-P | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Dichlorvos | 0.1 | 1 | 6 April 2004 | Single oral dose human volunteer study; a NOAEL of 1 mg/kg bw was based on the absence of any reduction in RBC ChE activity at 1 mg/kg bw, the only dose tested. | |
| Difethialone | 0.0005 | 0.48 [LOAEL] | 17 April 2007 | Acute oral rat study; a LOAEL of 0.48 mg/kg bw was based on death. | |
| Diflufenican | | | May 2020 | | ARfD considered to be unnecessary due to its low oral toxicity or the absence of any developmental toxicity after a single dose |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------|-----------------|------------------|------------------|--|--|
| Dimethenamid-P | 0.25 | 25 | 12 August 03 | Developmental rat study; a NOAEL of 25 mg/kg bw/d was based on signs of toxicity in the foetus (reduced bodyweight and incomplete ossification) at the next higher dose. | ARfD for dimethenamid-P only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. Note: Dimethenamid-P, the S-isomer, and its racemic mixture have equivalent toxicity at similar dose levels. |
| Dimethoate | 0.02 | 0.2 | 23 November 2010 | Human volunteer study; a NOAEL of 0.2 mg/kg bw/d was based on ChE inhibition in whole blood at the next higher dose. | |
| Dimethomorph | | | 17 April 2020 | | ARfD considered unnecessary due to its low oral toxicity and the absence of any neurological effects or developmental toxicity after a single dose |
| Dinotefuran | 1.25 | 125 | 10 August 2015 | Developmental rabbit study; a NOAEL of 125 mg/kg bw/d was based on reduced body weight gain at the next higher dose. | |
| Diphenylamine | | | 21 April 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. (JMPR-98). |
| Diquat | 0.8 | 75 | 8 February 2018 | Acute neurotoxicity rat study; a NOAEL of 75 mg/kg bw was based on clinical signs, inappetence and | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|------------------|--|---|
| | | | | reduced bodyweight gain at the next higher dose. | |
| Diuron | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Doramectin | 0.02 | 1.5 | 14 October 2002 | Developmental rabbit study; a NOAEL of 1.5 mg/kg bw/d was based on maternal toxicity with major malformations (cleft palate, phocomelia, syndactyly and coelosomia) observed in fetuses at 3 mg/kg bw/d and delayed ossification observed at 1.5 and 3 mg/kg bw/d. | ARfD for doramectin only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| E | | | | | |
| Emamectin benzoate | 0.03 | 5 | 11 December 2018 | Based on acute neurotoxicity in rats (tremors, irritability) at 10 mg/kg bw. Neurobehavioral effects were accompanied by serious histopathological observations of neuronal degeneration in brain and spinal cord as well as effects on sciatic nerves at 25 mg/kg bw. | JMPR 2011. Uncertainty factors applied were 10 for interspecies uncertainties, 10 for intraspecies uncertainties and 2 for severity of effect due to the serious neuropathological effects at 25 mg/kg bw. |
| Enterococcus faecium | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|------------------------|-----------------|------------------|------------------|--|--|
| Epoxiconazole | 0.2 | 20 | 16 April 2002 | Developmental rabbit study; a NOAEL of 20 mg/kg bw/d was based on increased incidence of resorptions at the next higher dose. | ARfD for epoxiconazole only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Eprinomectin | 0.2 | 1.5 | 31 January 2018 | Human clinical trial; absence of any effects at the highest tested dose of 1.5 mg/kg bw. | ARfD was based on a clinical trial with ivermectin using a 'read across' approach due to the structural similarity and pharmacokinetic similarities of the two avermectin analogues. |
| Esfenvalerate | 0.02 | 1.75 | 31 January 2018 | Acute neurotoxicity rat study; a NOAEL of 1.75 mg/kg bw was based on clinical signs of neurotoxicity (tremors) at the next higher dose. | |
| Ethametsulfuron-methyl | | | 17 January 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Ethoxyquin | 0.5 | 50 | 21 February 2000 | Acute oral (capsule) dog study; a NOAEL of 50 mg/kg bw for effects on the hepatic biliary system and clinical signs at the next higher dose. | ARfD for ethoxyquin is based on JMPR evaluation (2005). The ARfD which is applicable for the general population includes three residues (MEQ, DHMEQ and DHEQ). |
| Ethoxysulfuron | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------|-----------------|------------------|------------------|---|---|
| Ethyl formate | | | 26 November 2003 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Etofenprox | 1 | 100 | 4 December 2017 | Developmental rabbit studies; an overall NOAEL of 100 mg/kg bw/d in two studies was based on reduced maternal bodyweight and food consumption immediately after dosing and an increased incidence of post-implantation loss at the next higher dose. (JMPR 2011, EFSA 2009) | ARfD for etofenprox only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Etoxazole | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Eugenol | | | 19 August 2020 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| F | | | | | |
| Fenamiphos | 0.003 | 0.25 | 7 November 2005 | Acute oral dog study; a NOAEL of 0.25 mg/kg bw was based on inhibition of RBC ChE activity at the next higher dose. | |
| Fenbuconazole | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------|-----------------|------------------|-------------------|---|---|
| Fenhexamid | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Fenitrothion | 0.03 | 0.33 | 5 December 2000 | Acute single dose human volunteer study; a NOAEL of 0.33 mg/kg bw was based on the absence of any inhibition of plasma and RBC ChE activity at the highest tested dose. | |
| Fenpyrazamine | 0.8 | 80 | 15 February 2017 | Acute neurotoxicity rat study; a NOAEL of 80 mg/kg bw was based on a reduction in motor activity and number of rearings at the next higher dose. | |
| Fipronil | 0.02 | 2.5 | 19 June 2006 | Two acute oral neurotoxicity rat studies; a NOAEL of 2.5 mg/kg bw was based on reduced footsplay at the next higher dose. | This is a group ARfD value which includes fipronil, desulfinyl fipronil, fipronil sulphide and fipronil sulphone. |
| Flazasulfuron | | | 26 September 2011 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Flonicamid | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Florasulam | | | 26 May 2009 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-----------------------|-----------------|------------------|------------------|--|---|
| Florfenicol | | | 4 January 2001 | | ARfD considered unnecessary due to its low oral toxicity after a single dose; structural analogs of florfenicol have a long history of therapeutic use without acute effects. |
| Florpyrauxifen-benzyl | | | 8 August 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Flubendiamide | | | 14 December 2007 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Fludioxonil | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Fluensulfone | 0.15 | 16.2 | 12 June 2014 | 2-Gen reproduction study; a NOAEL of 16.2 mg/kg bw/d based on post-natal loss of pups at the next higher dose. | ARfD for fluensulfone applies to the general population. |
| Flufenoxuron | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Flumethrin | | | 4 September 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|--------------------|-----------------|------------------|------------------|---|---|
| Flumiclorac pentyl | | | 8 December 2004 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Flumioxazin | 0.03 | 3 | 12 December 2002 | Developmental rat study; a NOAEL of 3 mg/kg bw/d was based on embryo/foetal developmental toxicity with increased incidences of cardiovascular abnormalities at the next higher dose. | ARfD for flumioxazin only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Flunixin meglumine | 0.02 | 2 | 1 August 2002 | 6-week rat study; a NOAEL of 2 mg/kg bw/d was based clinical signs (reduced activity) at the next higher dose. | |
| Fluopicolide | 0.6 | 60 | 26 November 2015 | Developmental rat study; a NOAEL of 60 mg/kg bw/d was based on increased incidence of skeletal defects of the vertebrae and sternbrae at the next higher dose. | ARfD for fluopicolide only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Fluopyram | 0.5 | 50 | 6 July 2015 | Acute neurotoxicity rat study; a NOAEL of 50 mg/kg bw/d was based on slightly lower motor and locomotor activity at the next higher dose. | |
| Flupyradifurone | 0.35 | 35 | 11 August 2015 | Acute neurotoxicity rat study; a NOAEL of 35 mg/kg bw was based on increased incidences of piloerection and increased | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|----------------|---|---|
| | | | | incidences of pupil dilation at the next higher dose. | |
| Fluralaner | | | 31 May 2018 | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. | |
| Flutolanil | | | 28 August 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Fluxapyroxad | | | 20 March 2020 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| G | | | | | |
| Geraniol | | | 19 August 2020 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Glufosinate ammonium | | | 28 August 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Glyphosate | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

23 Acute reference doses for agricultural and veterinary chemicals

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------|-----------------|------------------|-------------------|--|---|
| H | | | | | |
| Halauxifen-methyl | | | 17 September 2014 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Halofuginone | 0.0003 | 0.025 | 16 June 2006 | Developmental rabbit study; a NOAEL of 0.025 mg/kg bw/d was based on reduced body weight gain and food consumption, mortality and abortions at the next higher dose. | ARfD for halofuginone only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Hexaflumuron | | | 31 August 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Hexythiazox | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| I | | | | | |
| Imazalil | 0.05 | 5 | 29 January 2007 | Developmental rabbit study; a NOAEL of 0.05 mg/kg bw/d was based on increased number of resorptions and a reduced number of live pups at the next higher dose. | ARfD for imazalil only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------------------|-----------------|------------------|-----------------|--|---|
| Imazapic | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Imazapyr | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Imazethapyr | | | 2 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Indoxacarb (S-Isomer) + R-Isomer | 0.1 | 12.5 | 30 May 2008 | Acute neurotoxicity rat study; a NOAEL of 12.5 mg/kg bw was based on reduced bodyweight gain and food consumption at the next higher dose. | |
| Ipconazole | | | 18 January 2010 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Isofetamid | 3 | 300 | 9 March 2017 | Developmental rabbit study; a NOAEL of 300 mg/kg bw/d is based on reduced maternal bodyweight gain early in gestation at the next higher dose. | |
| Isopyrazam | 0.3 | 30 | 24 May 2016 | Rat acute neurotoxicity study; a NOAEL of 30 mg/kg bw was based on clinical signs of toxicity (weak | |

25 Acute reference doses for agricultural and veterinary chemicals

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------------------|-----------------|------------------|------------------|--|---|
| | | | | appearance and decreased activity). | |
| Isoxaflutole | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Ivermectin | 0.2 | 1.5 | 31 January 2018 | Human clinical trial; absence of any effects at the highest tested dose of 1.5 mg/kg bw. | |
| K | | | | | |
| Kresoxim-methyl | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Ketoprofen | 0.001 | 0.1 | 8 December 2000 | Acute pharmacological rabbit study; a NOAEL of 0.1 mg/kg bw was based on inhibition of platelet aggregation at the next higher dose. | |
| L | | | | | |
| Lactobacillus acidophilus | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------------|-----------------|------------------|------------------|---|---|
| Lactobacillus brevis | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – from naturally occurring background levels of the organism. |
| Lactobacillus casei | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Lactobacillus plantarum | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Lignocaine | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Lufenuron | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| M | | | | | |
| Maldison | 1.5 | 15 | 12 April 2005 | Acute oral human study; a NOAEL of 15 mg/kg bw was based on inhibition of RBC and plasma ChE activity at the higher dose. | |
| Mandestrobin | | | 30 March 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

27 Acute reference doses for agricultural and veterinary chemicals

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------------|-----------------|------------------|------------------|---|---|
| Mandipropamid | | | 9 April 2010 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Mecoprop | 0.5 | 50 | 17 January 2001 | Developmental rat study; a NOAEL of 50 mg/kg bw/d was based on embryoletality and foetotoxicity (lower bodyweight and shorter CR length) at the next higher dose. | ARfD for mecoprop only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Mecoprop-p | 0.5 | 50 | 17 January 2001 | Developmental rat study; a NOAEL of 50 mg/kg bw/d was based on embryoletality and foetotoxicity (lower bodyweight and shorter CR length) at the next higher dose. | ARfD for mecoprop-p only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Mefentrifluconazole | | | 27 November 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Melaleuca Oil | 10 | 1000 | 12 August 2010 | Based on an in vivo micronucleus study in mice using a default safety factor of 100. | |
| Meloxicam | 0.004 | 0.04 | 4 August 2004 | Human clinical trial; a pharmacological NOAEL of 0.04 mg/kg bw/d was based on increased blood pressure, pulse rate and ECG at higher doses. | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------------|-----------------|------------------|-----------------|--|---|
| Mesosulfuron-methyl | | | 18 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Mesotrione | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Metalaxyl | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Metamitron | 0.1 | 10 | 4 December 2017 | Developmental rat study; a NOAEL of 10 mg/kg bw/d was based on the observation that acute CNS effects, in particular sedation and lower transient body temperature, occurred at doses in excess of 10 mg/kg bw. The only identified NOAEL of 10 mg/kg bw/d in the toxicological database was observed in a rat developmental study for reduced bodyweight gain. This NOAEL was selected as the basis of the numerical ARfD (EFSA, 2008). | ARfD for metmitron applies to the general population. |
| Metazachlor | | | 15 July 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------|-----------------|------------------|-----------------|---|---|
| Metcamifen | 0.3 | 30 | 21 July 2020 | Developmental rabbit study; a NOAEL of 30 mg/kg bw/d was based on increased incidence of skeletal and cartilage variants of the vertebrae and ribs, which might be attributable to a single exposure to metcamifen at higher doses. | ARfD for metcamifen only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Methamidophos | 0.003 | 0.3 | 30 January 2004 | Acute neurotoxicity rat study; a NOAEL of 0.3 mg/kg bw was based on plasma, RBC and brain ChE inhibition at the next higher dose. | |
| Methidathion | 0.01 | 1 | 31 May 2004 | Acute neurotoxicity rat study; a NOAEL of 1 mg/kg bw was based on RBC and brain ChE inhibition at the next higher dose. | |
| Methiocarb | 0.005 | 0.5 | 4 December 2017 | Developmental rat study; a NOAEL of 0.5 mg/kg bw/d was based on clinical signs (muscle fasciculation's) at the next higher dose. | ARfD for methiocarb applies to the general population. |
| Methomyl | 0.02 | 0.1(H) | 5 March 2007 | Acute (capsule) human toxicity study; a NOAEL 0.1 mg/kg bw was based on erythrocyte ChE inhibition at the next higher dose. | Source; JMPR 2001. |
| Methoprene | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|-----------------|---|--|
| Methoxyfenozide | | | 12 January 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| 1-Methylcyclopropene | | | 10 October 2003 | | There was insufficient information to establish an ARfD, however, based on its proposed pattern of use the dietary intake is likely to be low. |
| Metrafenone | | | 13 April 2010 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Metribuzin | | | 18 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Mevinphos | 0.003 | 0.025 | 5 December 2000 | 28-day human volunteer study; a NOAEL of 0.025 mg/kg bw/d was based on inhibition of RBC ChE activity and clinical signs at the next higher dose. | |
| Milbemectin | 0.06 | 6 | 29 April 2005 | Developmental rat study; a NOAEL of 6 mg/kg bw/d was based on reduced maternal bodyweight gain at the next higher dose. | ARfD for milbemectin only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Monepantel | | | 31 August 2009 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|--|-----------------|------------------|-------------------|--|---|
| Moxidectin | 0.01 | 1 | 28 March 2002 | 28-day dietary dog study and developmental rabbit study; a NOAEL of 1 mg/kg bw/d was based on neurotoxicity at the next higher dose (in dogs); and maternal toxicity (reduced weight gain) at the next higher dose (in rabbits). | |
| N | | | | | |
| Niclosamide | | | 20 September 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Novaluron | | | 17 January 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Nuclear polyhedrosis virus of <i>helicoverpa armigera</i> occlusion bodies | | | 17 December 2003 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| O | | | | | |
| Omethoate | 0.003 | 0.25 | 20 October 2005 | Acute neurotoxicity rat study; a NOAEL of 0.25 mg/kg bw was based on plasma ChE inhibition at the next higher dose. | |
| O-phenylphenol (see 2-phenylphenol) | | | | | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-----------------|-----------------|------------------|-----------------|--|--|
| Oxathiapiprolin | | | 30 July 2015 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Oxytetracycline | | | 10 October.2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| P | | | | | |
| Paraquat | 0.004 | 0.45 | 27 June 2003 | 1-year chronic feeding dog study; a NOAEL of 0.45 mg/kg bw/d was based on the likelihood that the observed pulmonary lesions would also occur after an acute exposure at the next higher dose. | |
| Penflufen | 0.5 | 50 | 10 October 2012 | Acute neurotoxicity rat study; a NOAEL of 50 mg/kg bw was based on decreased motor and locomotor activity at the next higher dose. | |
| Phenmedipham | | | 13 April 2011 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| 2-Phenylphenol | | | 31 July 2003 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. (JMPR'99). |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|------------------------|-----------------|------------------|------------------|--|--|
| Penthiopyrad | 1 | 125 | 10 February 17 | Acute oral neurotoxicity rat study; a NOAEL of 125 mg/kg bw was based on clinical signs (decreased motor activity, decreased body temp, hunched position and unsteady gait) at the next higher dose. | |
| Pinoxaden | 0.3 | 30 | 29 August 2005 | Developmental toxicity rabbit study; a NOAEL of 30 mg/kg bw/d was based on early resorption, implantation loss, lower number of live births and reduced foetal weight at the next higher dose. | ARfD for pinoxaden only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Piperonyl butoxide | | | 17 February 2020 | | ARfD considered unnecessary, due to its low oral toxicity and the absence of any neurological effects or developmental toxicity after a single dose. |
| Porcine gonadotrophins | | | 25 June 2002 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Procymidone | 0.1 | 12.5 | 10 May 2017 | Developmental toxicity rat study; a NOAEL of 12.5 mg/kg bw/d was based on an increased incidence of hypospadias at the next higher dose. | ARfD for procymidone only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|------------------|---|---|
| Profoxydim | | | 29 November 2006 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Prohexadione-calcium | | | 18 January 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Propamocarb | 2 | 200 | 26 November 2015 | Acute neurotoxicity rat study; a NOAEL of 200 mg/kg bw was based on a reduced activity 1 h after dosing at the next higher dose. | |
| Propargite | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Propiconazole | 0.3 | 30 | 30 August 2018 | An ARfD of 0.3mg/kg bw was established based on a NOAEL of 30mg/kg bw per day in a developmental toxicity study in rats and a 100-fold safety factor. The NOAEL was identified on the basis of slight increases in rudimentary ribs and unossified sternbrae at 90mg/kg bw per day. This provides an adequate margin over the maternal toxicity and cleft palate seen at 300mg/kg bw per day. The NOAEL is also adequately protective against any acute local effects on the gastrointestinal tract | |

35 Acute reference doses for agricultural and veterinary chemicals

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|--------------------------|-----------------|------------------|------------------|---|--|
| | | | | based on the available data in dogs. Ataxia has also been noted in pregnant rats dosed at 360 mg/kg body weight/day. | |
| Propineb | 0.003 | 0.32 | 22 February 2017 | Developmental rat study; a NOAEL of 0.32 mg/kg bw/d was based on skeletal variations at the next higher dose. | This group ARfD value which includes propineb and propylene thiourea (PTU) only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Propylene oxide | 0.4 | 205 | 21 April 2006 | Inhalation developmental toxicity rat study; a NOAEC of 300 ppm (equivalent to NOAEL of 205 mg/kg bw/d) was based on increased incidence of 7th cervical rib at the next higher dose. | ARfD for propylene oxide only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Propylene thiourea (PTU) | 0.003 | 0.32 | 22 February 2017 | | See group ARfD for Propineb. |
| Propyzamide | 0.13 | 40 [LOAEL] | 11 December 2018 | Based on a LOAEL of 40 mg/kg bw due to acute, reversible neurotoxicity (increased landing foot splay and decreased motor activity; without detectable neuropathology) in rats at this dose. | The total uncertainty factor applied is 3 for LOAEL to NOAEL extrapolation uncertainties, 10 for interspecies uncertainties and 10 for intraspecies uncertainties. |
| Proquinazid | 1 | 100 | 10 February 2017 | Acute neurotoxicity rat study; a NOAEL of 100 mg/kg bw was based on reduced motor activity at the next higher dose. | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|------------------|-----------------|------------------|------------------|--|--|
| Prosulfocarb | 0.4 | 40 | 30 July 2007 | Acute neurotoxicity rat study; a NOAEL of 40 mg/kg bw was based on reduced motor activity at the next higher dose. | |
| Prothioconazole | 0.03 | 3 | 28 May 2008 | Developmental rat study; a NOAEL of 3 mg/kg bw/d was based on increased incidence of 14th rib, increased resorptions and cleft palate at the next higher dose. | ARfD for prothioconazole only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. Since the residue definition for risk assessment in all commodities is expressed as prothioconazole-desthio and this metabolite is of higher toxicity than the parent, a group ARfD was established to include prothioconazole-desthio. |
| Pydiflumetofen | | | 21 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Pyraclostrobin | 0.05 | 5 | 26 June 2008 | Developmental rabbit study; a NOAEL of 5 mg/kg bw/d was based on early resorptions at the next higher dose. | ARfD for pyraclostrobin only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |
| Pyraflufen-ethyl | 0.2 | 20 | 17 December 2004 | Developmental rabbit study; a NOAEL of 20 mg/kg bw/d was based on increased maternal mortality and morbidity at the next higher dose. | |
| Pyrasulfotole | 0.2 | 200 [LOAEL] | 20 August 2008 | Acute neurotoxicity rat study; based on decreased motor and | |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------|-----------------|------------------|------------------|--|---|
| | | | | locomotor activity at a LOAEL of 200 mg/kg bw. | |
| Pyrethrins | 0.2 | 20 | 31 July 2003 | Acute neurotoxicity rat study; a NOAEL of 20 mg/kg bw was based on neurotoxicity observed at the next higher dose. | Adopted from JMPR '99. |
| Pyridalyl | | | 29 April 2004 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Pyridate | 2 | 177 | 12 June 2020 | Based on an acute neurotoxicity study in rats. Death occurred within 1 day after dosing at the next higher dose of 500 mg/kg bw. | The ARfD applies to pyridate, pyridafol and pyridafol-N-glucoside expressed as pyridate. Adopted from JMPR (2019). |
| Pyrimethanil | | | 10 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Pyriofenone | | | 26 November 2014 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Pyroxasulfone | | | 27 June 2013 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Pyroxulam | | | 14 April 2008 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|---------------------------|-----------------|------------------|-------------------|---|---|
| Q | | | | | |
| Quinlorac | 2 | 200 | 13 September 2004 | Acute oral toxicity gavage mouse study; a NOAEL of 200 mg/kg bw was based on clinical signs at the next higher dose. | |
| Quinoxifen | | | 15 January 2002 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| R | | | | | |
| Ractopamine hydrochloride | 0.001 | 0.13 | 30 July 2002 | Human study; a NOAEL of 0.13 mg/kg bw was based on increased heart rate at the next higher dose. | |
| S | | | | | |
| Saccharomyces cerevisiae | | | 4 September 2002 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Saflufenacil | 0.05 | 5 | 13 February 2017 | Developmental rat study; a NOAEL of 5 mg/kg bw/d was based on an increased incidence of bent scapula and wavy ribs in the absence of maternal toxicity at the next higher dose. | ARfD for saflufenacil only applies to women of child-bearing age. An ARfD for the general population is considered to be unnecessary. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------------|-----------------|------------------|---------------|--|---|
| Sedaxane | | | 24 April 2011 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Spinetoram | | | 5 May 2008 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Spinosad | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Spirotetramat | 1 | 100 | 26 May 2008 | Acute neurotoxicity rat study; a NOAEL of 100 mg/kg bw was based on clinical signs and decreased motor activity at the next higher dose. | |
| Spiroxamine | 0.2 | 20 | 2 July 2001 | Acute neurotoxicity rat study; a NOAEL of 20 mg/kg bw was based on decrease in landing footsplay at the next higher dose. | |
| Streptomyces lydicus | | | 7 June 2016 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Sulfoxaflor | 0.25 | 25 | 27 June 2013 | Acute oral neurotoxicity rat study; a NOAEL of 25 mg/kg bw was based on decreased motor activity at the next higher dose. | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-------------------|-----------------|------------------|------------------|---|---|
| Sulfuryl Fluoride | 0.3 | 31 | 24 August 2006 | Acute inhalational neurotoxicity rat study; a NOAEL of 31 mg/kg bw (300 ppm) was based on the absence of any observed effects at the highest tested concentration of 300 ppm. | |
| T | | | | | |
| Tebuconazole | 0.3 | 30 | 11 December 2018 | Based on a maternal and developmental toxicity NOAEL of 30 mg/kg bw/day in rats and rabbits. Maternotoxicity manifested as decreased body weight gain. Visceral and skeletal developmental anomalies occurred at higher doses. This is supported by a NOAEL of 30 mg/kg bw/day in the 28-day oral (gavage) toxicity study in rats based on changes in haematological parameters detected at the next highest dose. The haematological changes could potentially be caused by a single dose. | Total uncertainty factor applied was 100. |
| Tepraloxydim | | | 13 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|----------------|-----------------|------------------|------------------|---|---|
| Terbutylazine | | | 4 May 2001 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Tetraconazole | 0.2 | 16 | 12 December 2002 | 4-week dietary rat study; a NOAEL of 16 mg/kg bw/d was based on clinical signs at the next higher dose. | |
| Tetraniliprole | | | 17 July 2019 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Thiacloprid | 0.03 | 3.1 | 20 July 2001 | Acute oral neurotoxicity rat study; a NOAEL of 3.1 mg/kg bw was based on reduced motor and locomotor activity at the next higher dose. | |
| Thiram | 0.1 | 10 | 2 July 2010 | Acute neurotoxicity rat study; a NOAEL of 10 mg/kg bw was based on reduced locomotor activity at the next higher dose. | |
| Thymol | | | 19 August 2020 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Tiafenacil | 0.006 | 0.6 | 22 December 2020 | One-generation rat reproductive study. A NOAEL of 0.6 mg/kg bw/d was based on increased total liver porphyrins at the next higher dose. | |
| Tilmicosin | 0.4 | 36 | 29 August 2002 | 7-day oral dosing (capsule) dog study; a NOAEL of 10 mg/kg bw/d | |

| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|------------------|-----------------|------------------|------------------|---|---|
| | | | | was based on the absence of clinical signs (ataxia, dyspnoea, bilateral mydriasis) during the first 4 days of dosing. | |
| Tolfenamic acid | 0.005 | [0.5] | 16 January 2001 | Lowest effective therapeutic dose (as a single dose) for treatment of pyresis in children. | |
| Topramezone | | | 16 June 2016 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Trifloxystrobin | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Trifloxysulfuron | | | 13 February 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Trinexapac-ethyl | | | 10 May 2017 | | ARfD considered to be unnecessary due to its low oral toxicity and the absence of any developmental toxicity after a single dose. |
| Tulathromycin | 0.1 | 100 | 16 August 2006 | Acute tolerance dog study; a LOAEL of 100 mg/kg bw was based on the occurrence of emesis and loose stools. | |

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| Chemical | ARfD (mg/kg bw) | NOAEL (mg/kg bw) | Date | Study | Comments |
|-----------------------|-----------------|------------------|------------------|---|---|
| U | | | | | |
| Ulocladium oudemansii | | | 12 December 2003 | | ARfD unnecessary. Naturally occurring organism – residues from its use are unlikely to be distinguishable from naturally occurring background levels of the organism. |
| Z | | | | | |
| Zilpaterol | 0.00004 | 0.00076 [LOAEL] | 24 October 2016 | Single dose human study; a LOAEL of 0.05 mg/person (equal to 0.00076 mg/kg bw) was based on the observation of tremors at the lowest tested dose. | |