Australian Government

Australian Pesticides and Veterinary Medicines Authority

2,4-D (2,4-dichlorophenoxyacetic acid)

Review Technical Report

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PREFACE

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an independent statutory authority with responsibility for the regulation of agricultural and veterinary chemicals in Australia. Its statutory powers are provided in the Agvet Codes scheduled to the *Agricultural and Veterinary Chemicals Code Act 1994*.

The APVMA has legislated powers to reconsider the approval of an active constituent, registration of a chemical product or approval of a label at any time after it has been registered. The reconsideration process is outlined in sections 29 to 34 of Part 2, Division 4 of the Agvet Codes.

A reconsideration may be initiated when new research or evidence has raised concerns about the use or safety of a particular chemical, a product containing that chemical, or its label. The scope of each reconsideration can cover a range of areas including human health (toxicology, public health, work health and safety), the environment (environmental fate and ecotoxicology), residues and trade, chemistry, efficacy or target crop or animal safety. However, the scope of each reconsideration is determined on a case-by-case basis reflecting the specific issues raised by the new research or evidence.

The reconsideration process includes a call for data from a variety of sources, a scientific evaluation of that data and, following public consultation, a regulatory decision about the ongoing use of the chemical or product. The data required by the APVMA must be generated according to scientific principles. The APVMA conducts scientific and evidence-based risk analysis with respect to the matters of concern by analysing all the relevant information and data available.

About this document

This Technical Report is intended to provide an overview of the assessments that have been conducted by the APVMA. It has been deliberately presented in a manner that is likely to be informative to the widest possible audience, thereby encouraging public comment.

This document contains a summary of the assessment reports generated in the course of the chemical review of an active ingredient, including the registered product and approved labels. The document provides a summary of the APVMA's assessment, which may include details of:

- the toxicology of both the active constituent and product;
- the residues and trade assessment;
- occupational exposure aspects;
- environmental fate, toxicity, potential exposure and hazard; and,
- efficacy and target crop or animal safety.

Submissions from the public are invited

Information about how to make a submission to the consultation can be found on our website.

1 INTRODUCTION

2,4-D (2,4,-dichlorophenoxyacetic acid) is a selective broadleaf chlorphenoxy Group 1 herbicide that has been registered for use in Australia since the 1960s. It works by disrupting the actions of the plant growth hormone auxin. Its use causes uncontrolled growth and eventual death in susceptible plants.

In Australia, 2,4-D is currently registered for post-emergent control of broadleaf and grass weeds in pasture, stubble and fallow maintenance, cereal crops (including wheat, oats, barley, rye, triticale), grain crops (including sorghum, millet, maize) and oilseed crops (safflower, canola, rape). Other agricultural uses include cotton, citrus crops (particularly to inhibit post -harvest abscission of buttons), sugar cane, sweetcorn, peanuts and control of banana suckers. 2,4-D is also used extensively for weed control in non-cropping situations, including commercial and industrial areas, turf, forestry, aquatic areas and domestic situations.

2 PURPOSE OF REVIEW

The APVMA began its reconsideration of 2,4-D in 2003 because of concerns over toxicological, occupational health and safety and environmental issues. The adequacy of instructions and warnings on product labels was also considered. Of particular concern to APVMA have been the issues of spray drift and the environmental risks associated with the 2,4-D high volatile (short chain) esters (ethyl ester, butyl ester and isobutyl ester forms of 2,4-D).

To address concerns regarding spray drift APVMA undertook regulatory actions in 2005, 2013, 2018 and 2019 to strengthen label instructions, label restraints and label warnings in order to reduce the risk of undesirable chemical spray drift. In addition to these actions the APVMA released the 2,4-D preliminary review findings report (environment) part 1, HVE esters summary in 2006. The same year the APVMA suspended the registrations and label approvals of 24 products containing the registrations and label approvals of 24 products containing high volatile ester forms of 2,4-D and issued new instructions for use to allow further data to be generated by registrants. In 2013 the agency published an annex to this report and cancelled the active constituent approvals, registrations and associated label approvals for the 24 products containing high volatile ester forms of 2,4-D. In 2018 and 2019 the APVMA suspended the label approvals of all commercial use products containing 2,4-D and issued new instructions targeted to reduce spray drift occurrences and damage to sensitive off target crops for the 2018–19 summer spray seasons. These label changes were implemented as an immediate priority, rather than waiting to implement all of the proposed label changes at the completion of the review.

The scope of the reconsideration includes the following aspects of active constituent approvals, product registrations and label approvals for 2,4-D:

- chemistry (dioxin impurities)
- toxicology, including dioxin impurities
- workplace health and safety (WHS)
- health and safety associated with home garden and domestic pesticide control use
- environment.

3 2,4-D PRODUCT CATEGORIES CONSIDERED BY THE REVIEW

Table 1: 2,4-D Product Groups

Group	2,4-D form*	Concentration (g ae/L)	Active 2	Concentration (g ac/L)	Active 3	Concentration (g ac/L)
1	2,4-D Products containing the IPA salt at a concentration of 225 g ac/L were excluded from the review since there are no currently registered products in this category.					
2	IPA salt	300				
3	IPA salt	450				
4	TIPA	300	Picloram	75		
5	DMA salt	500				
6	DMA salt	625				
7	DMA salt	800	There are no registered products in this category			
8a	DMA salt	720				
8b	DMA/MMA or DEA salts	700				
9a	DMA/DEA salts	625				
9b	DMA/DEA salts	750				
10	DMA/DEA salts	475				
11	DEA salt	500				
12a	DEA/TEA salt	500				
12b	DEA/TEA salt	625				
13**	form not specified	300				
14a	Sodium salt	700				
14b	Sodium salt	800				
15a	Sodium salt	22.8				
15b	DMA salt	100				
16a	DMA/DEA salts Commercial products	80	Mecoprop	336	Dicamba	40
16b	DEA salt	350	Clopyralid	45	Dicamba	45
17	EHE	577	Ioxynil	100		

Group	2,4-D form*	Concentration (g ae/L)	Active 2	Concentration (g ac/L)	Active 3	Concentration (g ac/L)
18	EHE	600				
19a	EHE	680				
19b	EHE	Up to 450				
20a	EHE	421	Pyraflufen-ethyl	2.1		
20b	EHE	300	Florasulam	6.25 g/L		
21	There are two current product approvals that fall into this category (numbers 31209 [2,4-D ethyl ester] and 83795 [2,4-D isobutyl ester]). Use of these products is strictly geographically restricted to Western Australia only and subject to the State's Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979. Accordingly only the human health-associated label elements require updating. The remaining elements of the existing label approvals (approval numbers 31209/117752 and 83795/108986 are considered to be sufficient provided that the products are used in accordance with the Western Australian Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979.					
22a	Granular					0.7 g ac/kg
	Home Garden Products	10.3 g ae/kg	Mecoprop	10.3 g ac/kg	Dicamba	
22b***	DMA/DEA salts					40
	Home Garden Products	80	Mecoprop	336	Dicamba	
23	Acid/DEA salts	440				

** IPA: Isopropylamine; DMA: Dimethylamine; DEA: Diethanolamine; TEA: Triethanolamine; EHE: Ethylhexyl Ester; MMA: Monomethylamine; TIPA: Triisopropanolamine.*

*** Note: this group can only be used in aquatic use situations (control of water hyacinth and water lettuce) at rates up to 3000 g ae/ha by knapsack, handgun and sprinklers or up to 1500 g ae/ha by helicopter. This group has special restraints required to minimise risks.*

**** Cancelation of all products in this group is proposed.*

4 CHEMISTRY

The APVMA standard for 2,4-D active constituent was last updated in 2004 (APVMA 2019). This standard specifies a composition of active constituent at 960 g/kg minimum, with a maximum concentration of free phenols (calculated as 2,4-dichlorophenol) of 3 g/kg. The focus chemistry review of 2,4-D was potential dioxin content of approved 2,4-D actives. In this report dioxin is used as a collective term for the polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polybrominated dibenzo-p-dioxins (PBDDs), polybrominated dibenzofurans (PBDFs) and co-planar polychlorinated biphenyl (PCBs) chemical families. All dioxins are listed in Annex C of the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention 2017). Assessment of the toxicity of dioxin and furan congeners is based on Toxic Equivalence Factors (TEQs) to normalise effects with those of 2,3,7,9-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) (WHO 1998).

In Australia, biomass combustion (both from prescribed burning and bushfires) contributes approximately 75 per cent of total estimated dioxin emissions (Environment Australia 1998, Department of the Environment and Heritage 2004). This is followed by, in decreasing order, cement production, residential wood combustion, coal combustion, sinter production, industrial wood combustion and lime production. Together, these sources combined account for approximately 95 per cent of total emissions. In Australia, dioxin levels are much lower in remote and agricultural areas compared with those in urban/industrial areas.

4.1 Active constituent

There are currently five different chemical forms of 2,4-D approved: the acid; ethyl, isobutyl and ethylhexyl esters; and the sodium salt. The key step in the manufacture of 2,4-D is a nucleophilic substitution reaction of 2,4-dichlorophenol with chloroacetic acid in the presence of a base. Polychlorinated dibenzodioxins (PCDDs) are formed as by-products of manufacture of chlorinated phenoxy compounds such as 2,4-D. Their formation proceeds through a condensation reaction of two phenolate ions with chlorine atoms at the ortho position, with elimination of chloride ions as the leaving group. The reaction rate increases rapidly at elevated temperatures, and thus formation of dioxins during manufacture is minimised by good temperature control. Multiple dioxin congeners can be formed during the manufacture of 2,4-D. Formation of polychlorinated dibenzodifurans (PCDF) occurs via a similar reaction.

All currently approved 2,4-D active constituents except one have been tested for dioxin content using US EPA method 1613B (US EPA 1994). The approval of the single 2,4-D active constituent that has not been tested is currently suspended pending cancellation. The level of dioxins in all approved and tested 2,4-D active constituents are consistent with the proposed new dioxin condition for 2,4-D active constituents.

4.2 Proposed new dioxin condition for approval of 2,4-D active constituents

Based on concerns related to human health exposure resulting from the use of formulated products, and the re-entry into treated areas, 2,4-D active constituents must contain **no more than** one part of total dioxin/dioxin-like compound toxic equivalency per billion parts of 2,4-D acid equivalent (**no more than** 1 nanogram of total dioxin/dioxin-like compound toxic equivalency per gram of 2,4-D acid equivalent). At this level, an adequate margin of safety is maintained when the products are used according to the label instructions.

This proposed new dioxin condition will be applied to the current APVMA standards for 2,4-D, 2,4-D esters, 2,4-D dimethylamine salt, 2,4-D-isopropylamine salt and 2,4-D-sodium active constituents.

5 TOXICOLOGY

At the time of nomination of 2,4-D for Chemical Review, the human health-relevant concerns were its potential to cause human birth defects and its possible human-relevant carcinogenicity. The toxicological database for 2,4-D is extensive, and was considered adequate for the purpose of defining the toxicological hazard of 2,4-D. The assessment considered submitted studies, as well as internationally peer-reviewed monographs. Key findings of the 2,4-D human health hazard assessment include: (a) 2,4-D is not a reproductive or developmental toxicant in laboratory animals; and (b) based on weight of evidence 2,4-D does not pose a carcinogenic risk to humans.

5.1 Toxicological properties of 2,4-D

Metabolism and toxicokinetics

Following oral dosing to mice, rats and goats, 2,4-D is rapidly and extensively absorbed and distributed to tissues, with highest concentrations detected in kidney, liver and brain. There was rapid plasma clearance, with extensive urinary and faecal excretion. Except for dogs, metabolism and excretion in animals were adequate models of metabolism in humans. Compared with humans, dogs had more limited renal excretion and this species was not an adequate human-relevant model. Based on dermal absorption studies in rats, rabbits, monkeys and humans and weight of evidence assessment a dermal absorption factor of six per cent was considered appropriate for exposure assessment.

Since 2,4-D salts and esters undergo rapid hydrolysis *in vivo* their acute toxicity was considered to be a function of the 2,4-D acid equivalent (a.e.) dose. Accordingly toxicological endpoints are expressed as the equivalent dose of 2,4-D acid, and are expressed in mg/kg bw/d 2,4-D acid equivalent (a.e), with values for the salts and esters converted incorporating the molecular weights of the various salts and esters.

Acute toxicity

Following oral administration in rats, 2,4-D acid and its salts and esters were of low to moderate toxicity. 2,4-D acid and all salts, esters and products tested were of low acute dermal toxicity in rats and rabbits. 2,4-D salts and esters were of low inhalational toxicity, with the exception of 2,4-D Triisopropanolamine (TIPA), which was of moderate acute inhalational toxicity.

Following exposure to the skin for four hours, 2,4-D acid, salts and esters were not irritating to rabbit skin. However, in repeat application irritation studies, irritation was observed for the acid, Dimethylamine (DMA) and Ethylhexyl ester (EHE). 2,4-D acid, and sodium, TIPA and DMA salts were severe eye irritants, while esters were at most slight eye irritants. 2,4-D acids, its salts and esters were negative for skin sensitisation by the Buehler method.

Repeat dose toxicity

Dose-related effects on the kidney were the most common manifestation of systemic toxicity associated with 2,4-D (and related salt and esters) in short-term, subchronic and chronic studies in mice, rats and dogs. Secondary target organs included the liver and thyroid.

Short term studies: Following dermal application of 2,4-D acid, the DMA salt and EHE, progressive skin irritation was seen, and systemic toxicity NOAELs were not established. A NOAEL for local effects was established for 2,4-D DMA at 10 mg/kg bw/d 2,4-D a.e. due to skin effects. A systemic NOAEL was established for 2,4-D TIPA at 55 mg/kg bw/d 2,4-D a.e. due to altered skin cells in areas adjacent to the treated sites.

Sub-chronic studies: In sub-chronic studies, effects on eyes, kidney, adrenals, lung, liver, spleen, thyroid, testes, thymus and pituitary were observed in rats and mice, with effects on kidney generally seen at lower doses (dose-related) in all species. In mice and rats, effects on clinical chemistry and increased organ weights were seen at doses above 15 mg/kg bw/d. These effects were correlated with histopathological changes in the kidney, including increased cellular homogeneity, vacuolisation and cytoplasmic swelling. A NOAEL for sub-chronic oral exposure of 2,4-D to mice was established at 15 mg/kg bw/d. Effects of the salts and esters of 2,4-D were similar to those seen with 2,4-D, and at similar doses when adjusted for molecular weight.

Chronic studies: All long-term feeding studies were conducted using 2,4-D acid. In mice and rats, the kidney was the target organ, with dose-related histopathological effects seen at doses at or above 15 mg/kg bw/day. These effects included degeneration of proximal tubules, decreased vacuolisation, mineralisation, multifocal cortical cysts and cytoplasmic homogeneity of tubular epithelium in mice, and mineralisation of the renal pelvis in rats. In mice, no treatment-related effects on clinical chemistry or haematology was seen, while in rats, changes were observed at 15 mg/kg bw/day. Retinal degeneration was also seen in a range of dietary studies in F344 rats with 2,4-D, 2,4-D DMA and 2,4-D EHE, at doses at and above 75 mg/kg bw/day. The chronic toxicity NOAEL in mice were established at 1 and 5 mg/kg bw/day and in rats at 5 mg/kg bw/day.

Long-term feeding studies with 2,4-D in mice and rats revealed no evidence of any carcinogenic potential. No treatment-related tumours were seen in mice, with all incidences being within historical control ranges and were not dose-related nor statistically significant. In rats, increased incidences of tumours of the pituitary, brain, testes, spleen and thyroid were seen, however no dose-response relationship was observed. An increased incidence of astrocytoma of the brain was seen in one study at the highest dose tested; however, this was not replicated in another study at higher doses, and there was no evidence of pre-neoplastic lesion (eg glioma), and was not considered attributable to treatment. Overall, the weight of evidence supports the conclusion that 2,4-D is not carcinogenic to rats of mice.

Genotoxicity studies

The weight of evidence indicates that 2,4-D acid and its salts and esters are not genotoxic.

Reproductive and developmental toxicity

Some effects on reproduction and development were seen with 2,4-D and its salts and esters in rats and rabbits at maternally toxic doses. More severe effects were seen with 2,4-D TIPA than with other salts. In a two-generation study in rats, signs of maternal toxicity including decreased bodyweight and increase relative liver weight were seen at 5 mg/kg bw/day (the lowest dose tested). A reproductive and offspring NOAEL was established at 20 mg/kg bw/day, based on decreased viability and bodyweight gain of offspring at 80 mg/kg bw/day. An extended one-generation reproduction dietary study had a NOAEL for reproductive effects of 40/30 m/kg bw/day in females/males, and a systemic toxicity NOAEL of 15 mg/kg bw/day based on kidney histopathology. In the offspring, the NOAEL for systemic toxicity was 5 mg/kg bw/day.

Developmental effects were assessed in rats and rabbits using 2,4-D acid and DMA, TIPA and EHE forms. Maternal toxicity in both species was seen at doses between 60 and 130 mg/kg bw/day 2,4-D a.e., with NOAELS of between 15 and 75 mg/kg bw/day 2,4-D a.e. Developmental toxicity was observed at higher doses (110–325 mg/kg bw/day 2,4-D a.e, with NOAELs of between 45 and 110 mg/kg bw/day).

Neurotoxicity

Acute and repeat-dose neurotoxicity studies in rats and dogs were available for 2,4-D, and 2,4-D DMA. Neurotoxicity was seen at relatively high doses in adult animals and following post-natal exposure. No developmental neurotoxicity was seen in a one-generation reproductive study. Most effects were reversible in studies where recovery following cessation of exposure was assessed. A NOAEL of 75 mg/kg bw was established in an acute neurotoxicity study, based on changes in gait, coordination and decreased motor activity following dosing at 250 mg/kg bw. In a one year rat dietary study, no neurotoxic effects were seen at doses of up to 150 mg/kg bw/day (the highest dose tested). A mechanistic study for neurotoxicity indicated exposure to 70 mg/kg bw/day 2,4-D during prenatal development induced behavioural abnormalities that disappeared in adulthood. Exposure in early post-natal development resulted in effects that were not reversible, including decreased movement, excessive grooming, catalepsy and circling. No NOAEL could be established in this study as it was a limited mechanistic study. In an extended one-generation reproduction study, there were no treatment-related effects on developmental neurotoxicity in pups exposed during gestation and lactation and subsequently through the diet at doses of 40/30 (M/F) mg/kg bw/day.

Endocrine effects

2,4-D causes suppression of thyroid hormone levels in rodents, increases in thyroid gland weight, histopathological changes in the thyroid and decreases in weights of ovaries and testes. The lowest LOAEL for thyroid effects was seen in rats at 1 mg/kg bw/day.

Human toxicity

Assessment of epidemiological studies have concluded that while it is possible that 2,4-D may be associated with certain chronic adverse effects in humans, there is insufficient evidence to support a causal relationship to any specific chemical. Case-control studies have provided little evidence of an association between 2,4-D and soft tissue sarcomas, and while some studies have shown a relationship with non-Hodgkins lymphoma, others have been inconsistent. The International Agency for Research on Cancer (IARC) has classified 2,4- D as ‘possibly carcinogenic to humans (group 2B). In taking this decision, they considered that there was inadequate evidence in humans for the carcinogenicity from 2,4-D exposure and in animal studies there was limited evidence for carcinogenicity, however mechanistic studies indicated strong evidence that 2,4-D induces oxidative stress, and moderate evidence that 2,4-D causes immunosuppression. The proposed human health based guidance values (shown below) are considered to be adequately protective in relation to these effects.

Other studies

Mechanistic studies: The potential to induce peroxisome proliferation in rats following gavage dosing was investigated, and it was concluded that 2,4-D enhanced hepatic peroxisome proliferation via increased oxidation of fatty acids. In a study to investigate thyroid effects, it was concluded that exposure to 2,4-D altered thyroid function

in male and female rats, which supports the findings in other evaluated studies which observed effects on thyroid function. 2,4-D, 2,4-D DMA and 2,4-D iso-octyl ester (IOE) (reagent grade) did not induce receptor-mediated oestrogenic effects. In this assay, commercial grade herbicides were positive for these effects, and it was concluded that additives or contaminants in commercial-grade herbicides were responsible for the oestrogen-like effects.

Impurities of toxicological concern

Dioxins

Dioxins are a well-characterised impurity in 2,4-D technical. Dioxins are persistent environmental pollutants that are found throughout the world in the environment, and accumulate in the food chain, mainly in the fatty tissue of animals. Dioxins are generally present as complex mixture of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) congeners, as well as other dioxin-like compounds such a polychlorinated biphenyls (PCS). Of the 75 dioxin congeners, and 135 furan congeners, only 17 (with chlorine in the 2,3,7 and 8 positions) show toxic effects, with the most toxic being 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). These 17 congeners have been the main focus of academic and regulatory studies, and the World Health Organisation has determined Toxic Equivalence Factors (TEFs) which allow the calculation of an effective concentration of dioxins from a toxicological perspective, known as Toxic Equivalents (TEQs). The toxicity of dioxins are well characterised and documented. The proposed new dioxin condition for approval of 2,4-D active constituents (shown above) is considered to be sufficiently human health protective.

2,4-Dichlorophenol (2,4-DCP)

2,4-DCP is a chemical intermediate used principally in the manufacture of 2,4-D (OCS 1991). It can be present as an impurity in 2,4-D technical. On this basis, the specification established for 2,4-D includes a maximum permitted level of 2,4-DCP as an impurity in 2,4-D at 3 g/kg.

In genotoxicity tests carried out by the US National Toxicology Program, there were equivocal effects. In a number of repeat-dose and carcinogenicity studies, a range of effects, including clinical signs and reduced bodyweight were seen. There was treatment-related bone marrow atrophy at high doses in rats. Liver damage, which was not dose-related, was seen in mice. Kidney effects were also observed in mice at the highest dose. In two-year studies in rats, non-cancer effects were seen in a range of organ systems, however no neoplastic lesions were reported. In treated mice, non-neoplastic effects were alterations of liver cells, with neoplastic effects included malignant lymphomas of the spleen and heart, cancers in the forestomach in males and subcutaneous fibromas. Due to inadequate monitoring in these studies, including a lack of any clinical chemistry evaluation, they were not suitable to establish NOAELS.

In a developmental study, decreased maternal bodyweight gain was seen at all doses. Clinical signs of toxicity were seen in high-dose dams, how no significant abnormalities were seen on pathology examination. In the high-dose group, there was a slight increase in post-implantation loss with a decrease in viable litter size. An increase in foetal effects related to delayed development was seen at the high dose. There was no NOAEL for maternal toxicity, with effects seen at 200 mg/kg bw/day. The NOAEL for developmental toxicity was 375 mg/kg bw/day. 2,4-DCP is also immunotoxic in rodents.

No Acceptable Daily Intake or Acute Reference dose have been established for 2,4-DCP since human health-relevant exposures via food are not currently anticipated.

Diethanolamine salts

Diethanolamine is used as a counter-ion in 2,4-D formulations. It has also been used as a component of cosmetics and toiletries, however, these uses are prohibited in the European Union and Canada. Occupational exposure to DEA can occur through industrial uses. It is well absorbed following oral administration and is dermally absorbed. DEA concentrates in the blood, liver and kidney following repeat administration, with a half-life of approximately six days, primarily with urinary excretion.

DEA has moderate to low acute oral toxicity, moderate dermal toxicity, and low inhalational toxicity. It is a moderate skin and severe eye irritant, and has also caused upper respiratory tract irritation in rats. It is not a skin sensitiser. In mice, effects were seen in the liver, while in rats the main effects were anaemia and kidney toxicity. In both species, dermal application resulted in ulcerative skin lesions at high doses.

Based on the weight of evidence, DEA was not considered to be genotoxic and is not carcinogenic in rats. No NOAEL could be established in rats due to local and systemic effects at the lowest dose tested in females. In mice, liver neoplasms were seen after long-term dermal exposure, with adenomas and carcinomas from 40 mg/kg bw/day, and hepatoblastomas in males from 80 mg/kg bw/day. Renal tubule adenomas were also seen in males at all doses tested. It has been hypothesised that DEA-induced hepato-carcinogenicity is due to S-adenosyl methionine and choline deficiency, leading to altered gene expression. In mice, chronic stimulation of liver cells can induce spontaneous liver tumours, by a mechanism not relevant to humans. On this basis, the OECD concluded that the liver tumours were related to choline depletion and disturbance of its metabolism, and that a similar mode of action could be responsible for renal tubular adenomas. A recent IARC consideration raised concerns about this argument, based on data gaps on choline levels in mice kidneys as well as the lack of observed effects in rats, which are highly sensitive to choline deficiency. Further, fatty liver is noted as an effect associated with choline deficiency, however this was not seen in rat or mouse carcinogenicity studies. At this time the outcomes of the mouse carcinogenesis studies are of uncertain human relevance and, given the negative genotoxicity findings, are likely to be mediated by a threshold mode of action. The DEA margin of exposure associated with the occupational exposure associated use of 2,4-D DEA containing products is considered to human health-protective of these effects (see the below).

No specific reproduction toxicity and fertility study was available. In rats and mice, developmental toxicity was seen at maternotoxic doses, with effects on pup bodyweight gain and delayed development. In rabbits, no evidence of embryo-foetal toxicity or developmental malformations was seen at maternotoxic doses.

5.2 Health-based guidance values and poisons scheduling

Acceptable Daily Intake (ADI)

The acceptable daily intake (ADI) for humans is considered to be the level of intake of a chemical that can be ingested daily over an entire lifetime without any appreciable risk to health. It is calculated by dividing the overall point of departure from a suitable study (typically an animal study) by an appropriate uncertainty factor. The current Australian ADI for 2,4-D as the free acid is 0.01 mg/kg bw/day. This was derived by applying a 100-fold

uncertainty factor to the NOAEL of 1 mg/kg bw/d in a two-year rat study, based on abnormal renal morphology at the next highest dose.

The current re-evaluation of this data concluded that the effects seen at 1 mg/kg bw/day were unrelated to treatment. Accordingly, the NOAEL was revised to 5 mg/kg bw/day. This point of departure is supported by a NOAEL of 5 mg/kg bw/day in a second two-year rat study and the offspring NOAEL of 5 mg/kg bw/day in the rat extended one generation reproduction study. On this basis, a proposed new ADI can be established at 0.05 mg/kg bw/d (2,4-D a.e.), based on a point of departure of 5 mg/kg bw/d from the two year rat studies using an uncertainty factor of 100 (10× for intraspecies variability, 10× for interspecies uncertainty).

In 2005 the US FDA established a dietary exposure chronic reference dose of 0.005 mg/kg bw/day based on the two year rat studies but applying a 1000 fold uncertainty factor (100 fold for inter- and intra-species uncertainty with an additional 10-fold safety factor due to toxicological database deficiencies stemming from a lack of a developmental neurotoxicity study and a reproduction study considering endocrine disruption). In the 2019 re-evaluation the APVMA regards the current toxicological database to be sufficient and has thus not used an additional ten-fold safety factor to account for database deficiencies.

While the European Food Safety Authority (EFSA) had established an ADI of 0.05 mg/kg bw/day in 2013 on the same basis as the APVMA, they have recently amended their ADI to 0.02 mg/kg bw/day, based on kidney toxicity in the dog seen in studies on 2,4-DB with a NOAEL of 2.04 mg/kg bw/day. This endpoint was not considered appropriate by the APVMA since the dog is not regarded as a sufficiently human-relevant animal model due toxicokinetic differences.

Acute reference dose (ARfD)

The acute reference dose (ARfD) is the estimate of the amount of a substance in food and/or drinking water, normally expressed on milligram per kilogram bodyweight basis, that can be ingested in a period of 24 hr or less, without appreciable health risk to the consumer, on the basis of all the known facts at the time of the evaluation. No ARfD has previously been established for 2,4-D.

The current review proposes establishing a new ARfD for 2,4-D based on acute neurotoxicological effects (gait/coordination effects and decreased motor activity) in rats (Mattsson et al 1994). The NOAEL for these effects (67 mg/kg bw) was regarded as an appropriate point of departure. Total uncertainty factor of 100 was then applied resulting in the new proposed ARfD 0.7 mg/kg bw/d (2,4-D a.e.).

In 2005 the US EPA established a dietary exposure ARfD for the general population of 0.067 mg/kg bw. This was based on the same study and point of departure as the proposed new APVMA ARfD. The US EPA applied a total uncertainty factor of 1000 (100 fold for inter- and intra-species uncertainty with an additional 10-fold safety factor due to toxicological database deficiencies stemming from a lack of a developmental neurotoxicity study and a reproduction study considering endocrine disruption). As noted above, in the current 2019 re-evaluation the APVMA regards the current toxicological database to be sufficient and thus has not used an additional ten-fold safety factor to account for database deficiencies.

EFSA has established an ARfD of 0.3 mg/kg bw, based on development toxicity in rats with a NOAEL of 31.25 mg/kg bw/day, as recommended in the conclusions on 2,4-DB, and applying an uncertainty factor of 100.

Tolerable monthly intake of dioxins

An Australian Tolerable Monthly Intake (TMI) of 70 pg dioxin TEQ/kg bw/month was recommended in 2002 and confirmed as appropriate by the National Dioxins Programme in 2004. This value is essentially the same as the Estimated Human Monthly Intake (EHMI) of 74 pg dioxin TEQ/kg bw/month set by the WHO/FAO Joint Expert Committee on Food Additives and Contaminants (JECFA) (FAO/WHO, 2002). The TMI of 70 pg dioxin TEQ/kg bw/month is considered to be adequately protective of the general population with respect to the effects of dioxin-like compounds.

The establishment of the proposed new dioxin condition for approval of 2,4-D active constituents will limit potential exposure to dioxins resulting from exposure to 2,4-D at the ADI to 1.5 pg TEQ/kg bw/month which is about ten-fold lower than the overall estimated background exposure to dioxins for adults of 16 pg TEQ/kg bw/month and about twenty-five fold lower than the overall estimated background exposure to dioxins for children of 38 pg TEQ/kg bw/month.

Poisons scheduling

2,4-D was originally placed in Schedule 5 in 1972, and confirmed in 1988. In 2006, it was agreed to include 2,4-D in Schedule 6 of the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) with a cut-off to Schedule 5 for 2,4-D in preparations containing 20 per cent or less of 2,4-D (ie including 2,4-D and all its salts and esters), after reconsideration of available acute studies data. This Schedule remains appropriate.

Halogenated dibenzodioxins and dibenzofurans are in Schedule 7 of the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) with an Appendix J rider. However, “a reference to a substance in [the SUSMP] does not include … any substance present as an impurity in a pesticide, at a concentration at or below the maximum content for that substance, specified for the pesticide in the Standards for Active Constituents, as published by the Australian Pesticides and Veterinary Medicines Authority.” Therefore, dioxins as an impurity in 2,4-D are unscheduled. Given that the establishment of the proposed new dioxin condition for approval of 2,4-D active constituents will adequately limit human exposure to these impurities does not recommend any changes to the SUSMP.

5.3 Recommendations

The toxicological component of the Review Technical Report considered the hazards identified in acute, short-term, chronic, reproduction and developmental toxicity studies, genotoxicity, carcinogenicity and neurotoxicity studies of 2,4-D.

The 2,4-D toxicology component of the Review Technical Report concluded that the active constituents and registration of products containing 2,4-D, its salts and esters:

- would not be an undue health hazard to the safety of people exposed to it during its handling or people using anything containing its residues
- would not be likely to have an effect that is harmful to human beings

- the toxicological profiles of the 2,4-D salts and esters evaluated were similar to the free acid. This is most likely due to their bioconversion to the free acid. As such, it was concluded that doses in animal studies could be directly compared using the 2,4-D acid equivalent dose
- the acceptable daily intake (ADI) for 2,4-D should be revised to 0.05 milligrams of 2,4-D acid equivalent per kilogram body weight per day based on a no observed adverse effect level of 5 mg of 2,4-D acid equivalent per kilogram body weight per day for renal toxicity occurring at higher doses in two, two year rat toxicity/carcinogenicity studies and an extended one generation rat reproduction study. The ADI incorporates a 100-fold uncertainty factor to account for inter- and intra-species variation in sensitivity
- the acute reference dose (ARfD) for 2,4-D should be revised to 0.8 milligrams of 2,4-D acid equivalent per kg body weight based on a no observed adverse effect level of 75 mg per kilogram body weight for acute (single dose) neurotoxicological effects. The ARfD incorporates a 100-fold uncertainty factor to account for inter- and intra-species variation in sensitivity
- that 2,4-D should remain in Schedule 6 of the Standard for the Uniform Scheduling of Medicines and Poisons.

6 OCCUPATIONAL HEALTH AND SAFETY

6.1 Application methods

Most 2,4-D products are diluted with water and applied by spray equipment (either aerial or groundboom). Restrictions on droplet size are needed to limit spray drift. For spot spraying, and application in non-agricultural settings, hand-held spraying equipment, including low- or high-pressure handguns/wands and backpack sprayers may be utilised.

6.2 Exposure during use

Users of 2,4-D can be exposed during mixing, loading and application of the product. Exposure modelling has been undertaken to determine potential systemic exposure during use. For each method of application, 'worst-case' operator exposure has been estimated, assuming the 2,4-D is applied at the maximum registered label application rates to the largest area that could be covered in one workday. Based on these estimates, the highest masses that could be applied range from 182 g to 4500 kg 2,4-D acid equivalent per day, depending on the situation of use and application equipment. Once exposure had been assessed using the worst-case scenario, consideration was given the risk posed, and whether this could be mitigated either by the use of personal protective equipment, or through other use restrictions (such as limitations on maximum use rates, or the use of engineering controls).

For mixing/loading for all formulations, the maximum exposure related to use in aerial spray applications, which resulted in a total mass of 4500 kg 2,4-D a.e. handled per day. For liquid sprays, the mass of 2,4-D a.e. handled per day was 4500 kg for aerial application (fixed wing), 750 kg for aerial rotary wing (waterways only), 450 kg for groundboom, 6.5 kg for airblast, 13.9 kg for handwand and 4.5 kg for backpack application. For granular formulations used on lawns a maximum use rate of 0.185 kg 2,4-D a.e. was handled per day.

Dermal and inhalational exposure was estimated using the Pesticide Handlers Exposure Database (US EPA). Risk characterisation was based on calculation of the margins of exposure (MOE) for a 70 kg worker, taking into account the relevant absorption factors (100 per cent for inhalation exposure, 6 per cent for dermal exposure). The MOEs are shown in Table 2.

For 2,4-D products, except those with 2,4-D DEA, acceptable margins of exposure are attained or exceeded for persons mixing/loading and applying 2,4-D products by aircraft, helicopter, groundboom and hand-held equipment, with the provision of appropriate protective equipment, with the exception of those mixing and loading conventionally packaged soluble powder formulations, where the maximum work rates resulted in unacceptable levels of exposure. For these formulations, either a reduction in work rate or engineering controls are required. In addition, when exposure to dioxins at the maximum level under the proposed condition for approval of 2,4-D active constituents, backpack application produces an unacceptable level of exposure at the maximum work rate of 4.5 kg a.e./d. Acceptable exposures are found when the work rate is limited to 4.0 kg a.e./day.

On the basis of these modelled exposures, as well as consideration of the acute hazards associated with the formulation, suitable safety directions have been recommended for all approved formulations, and are available in the model labels, published along with the statement of reasons for the decisions on 2,4-D.

Table 2: Margins of Exposure for mixing, loading and application of 2,4-D products (except for 2,4-D DEA salts)

Activity	Mass handled (kg ae/d)	PPE	Dermal MOE	RPE	Inhalation MOE	Aggregate MOE
Open M/L, dry flowable	4500	G O HFC	141	HFR	1376	127
Open M/L Liquid	4500	G O	307	HFR	882	**227**
Closed M/L Liquid	4500	G O	820	Nil	1275	**499**
Open M/L Powder	4500	G O HFC	72	FFR	244	**56**
Open M/L Powder	4500	G O A HFC	280	FFR	244	**130**
Open M/L Powder in WSP	4500	O	336	Nil	441	**191**
APP Aircraft Closed Cockpit	4500	O	1410	Nil	1556	**739**
APP Helicopter Closed Cockpit	750	O	22 282	Nil	352 798	**20 958**
APP Airblast Open Cab	6.6	O	13 364	Nil	16 036	**7289**
APP Groundboom Open Cab	450	G O	5040	Nil	1430	**1113**
APP LP Handwand	13.5	O	196	HFR	375	**128**
APP HP Handwand	13.5	O	1307	Nil	447	**333**
APP Backpack	4.5	G O	104	HFR	3205	**100**
APP Manual dispersal GR*	0.185	G O	2145	Nil	5574	**1676**
APP GR Belly grinder*	0.185	G O	18 450	Nil	41 551	**12 777**
APP GR Push spreader*	0.185	G O	134 953	Nil	408 719	**101 454**

A = Apron APP = Application FFR = Full facepiece respirator G = Chemical resistant gloves HP = High pressure HFC = Head and facial covering equivalent to hat and face shield HFR = Half facepiece respirator LP = Low pressure M/L = Mixing / Loading

MOE = Margin of exposure relative to the NOAEL O = Overalls

PPE = Personal protective equipment RPE = Respiratory protective equipment

**GR = Granular formulation intended for home garden lawn treatment*

For products containing 2,4-D DEA salts, additional concerns were identified, both in relation to acute hazards and for the modelled exposures. These concerns have resulted in additional label requirements for products containing 2,4-D DEA, including decreases in the rate of product application in some crops and situations of use, and to revise product label safety directions to include the use of personal and respiratory protective equipment when preparing and applying 2,4-D DEA products. A major restriction on use is that backpack spraying of 2,4-D DEA formulation is not supported due to occupational safety concerns. Concerns over systemic exposure limit the quantity of 2,4-D DEA which can be handled on a daily basis. Details of the recommendations for amended use restrictions are included in the recommended label statements are which available in the model labels, published along with the statement of reasons for the decisions on 2,4-D.

Worker exposure resulting from the use of combination products containing 2,4-D along with other actives, except for Group 22b products, were also considered, and suitable first aid and safety directions have been recommended.

Group 22b products are home and garden products containing 80 g 2,4-D/L as the DMA/DEA salt, 336 g/L mecoprop and 40 g/L dicamba. In order to mitigate the human health hazards and risks associated with opening the container and preparing the product for use the following personal protective equipment would be required: protective waterproof clothing, elbow-length chemical resistant gloves, impervious footwear, goggles and half facepiece respirator with organic vapour/gas cartridge or canister. When using the product the following personal protective equipment would be required to mitigate the human health hazards and risks: cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. Due to concerns regarding effectiveness and compliance, this level of personal protective equipment is not regarded as a reliable risk management approach for non-professional, home and garden product use. Accordingly, the APVMA proposed to cancel the registration of these products and to cancel the associated label approvals.

All updated first aid and safety directions will be published in the FAISD Handbook[1].

6.3 Exposure during re-entry

Agricultural workers may also be exposed to pesticide residues when re-entering treated crops to undertake activities such as harvesting, thinning, irrigation or scouting for pests. The main route of exposure is via the skin, through direct contact with treated foliage. Estimate of exposure relies on the use of transfer coefficients, which describe the ratio of re-entry worker exposure to the duration of exposure and the concentration of dislodgeable pesticide residue on foliage contacted by the worker. These values vary depending on the type of activity, the crop species and the stage of crop growth. Dermal exposure of re-entry worker has been estimated using US EPA Re-Entry Interval (REI) calculator, with the following assumptions. It was assumed that there had been a single application of 2,4-D at the maximum approved rate. Default values for dislodgeable foliar residue levels and for initial transferable turf residues were used. The duration of activity was assumed to be eight hours per day for all work activities.

Acceptable margins of exposure for workers performing the most exposure-intensive activities were found for most situations and application rates for all forms of 2,4-D. For hand-harvesting of sugar cane, exposure on the day of application resulted in unacceptable exposure to dioxins at the upper limit of acceptable standards. For this

[1] Available at apvma.gov.au/node/26586

situation, a one day re-entry period would result in acceptable exposure levels, while for all other uses of 2,4-D, acceptable exposure levels are obtained after the spray has dried.

6.4 Public exposure

It is possible that members of the public could be exposed to 2,4-D residues by spray drift. This would be most likely to involve dermal contact with residues deposited on vegetation, soil and other surfaces. Under these circumstances, infants and children are potentially the most heavily exposure sector, due to their play behaviour at ground level, patterns of 'hand to mouth' play behaviour, and their high surface area: bodyweight ratio. The risks of exposure were estimated using the US EPA Bystander Exposure Model. For aerial application, it was assumed that a play area was adjacent to a pasture treated once at 9000 g ae/ha, and the child entered the play area on the day of application after the spray had dried. For airblast, it was assumed that the area was adjacent to an orchard treated once with 2,4-D at 200 g ae/ha. The distance between the application site and play area was assumed to be three metres. The dermal transfer coefficient was based on a transfer coefficient of 49 000 cm^2/h, consistent with the model used. Oral exposure was based on default values of 400 cm^2/h. The post application exposure, including via dermal and oral exposures (based on hand to mouth activities) of a child resulted in acceptable MOEs as set out in the following table. There are no significant concerns of toxicological grounds with respect to the incidental exposure of bystanders resulting from agricultural uses of 2,4-D at the highest current label rate.

Table 3: Post application exposure (mg/kg bw) of a child to 2,4-D foliar residues on turf near to pasture treated by aerial or groundboom spray, or a citrus orchard treated by airblast

Exposure Route	Dermal	Oral	Aggregate
Exposure (Groundboom application)	0.107	0.000438	-
MOE	**9346**	**11 416**	**5139**
Exposure (Aerial application)	0.894	0.00365	-
MOE	**1119**	**1370**	**616**
Exposure (Airblast application)	0.0315	0.00013	-
MOE	**31 746**	**38 462**	**17 391**

Public exposure is also possible from recreational use of treated lawns and turf. While adults, infants and children may all be exposed, infants and children have the greatest potential for exposure. Three scenarios were investigated: adults performing recreational activities on treated turf (dermal exposure only), one to two year old children playing on turf following spray application (dermal and oral exposure), and oral exposure of one to two year old children to granular 2,4-D. Estimates were made for exposure on the day of treatment, after spray had dried or after application of the granules. For exposure to turf treated with liquid spray, acceptable margins of exposure were obtained for both adults and children, as set out in the following table.

Table 4: Post-application exposure to 2,4-D foliar residues on turf treated at 2500 g/ha

Life stage	Exposure Route	Dermal	Oral	Aggregate
Adult	Exposure (mg/kg bw)	0.844	NC	-
	MOE	**1185**	**NC**	**NC**
Child	Exposure (mg/kg bw)	1.61	0.0332	-
	MOE	**621**	**151**	**121**

For children potentially ingesting granule material after application, it was estimated that the likelihood of ingestion would be minimised by the label instructions for use, which specify that granules are to be watered into the lawn after application. Ingestion is considered to be an accidental event, rather than the result of routine behaviour. It was estimated that ingestion of 300 mg of granule material would result in 2,4-D exposure of around 34 per cent of the Acute Reference Dose, which would not be expected to cause any acute systemic toxicity.

6.5 Recommendations

The worker health and safety component of the Review Technical Report concluded that the APVMA is satisfied that the use of 2,4-D does not pose an unacceptable risk to human health provided the following are ensured:

- label recommendations for suitable combinations of clothing, personal and/or respiratory protective equipment will limit the exposure of workers preparing spray mixture from 2,4-D products or applying 2,4-D by aerial or groundboom spray, orchard airblast and hand-held spray equipment to levels which will pose negligible risks of adverse effects on their health and safety
- additional limitations are required on formulations with 2,4-D DEA, including restrictions on use rates and certain equipment, in particular the elimination of use by backpack spray
- the use of 2,4-D products by backpack spray must be limited to a maximum work rate of 4.0 kg a.e./day to limit potential exposure to dioxins
- the current uses of 2,4-D (except 2,4-D DEA) on most agricultural crops and in non-agricultural situations do not pose unacceptable exposures or risks of toxicity to workers re-entering and performing inspection, harvesting or maintenance activities in treated areas after the spray has dried. If re-entering treated areas before the spray has dried, workers should wear overalls, elbow-length gloves and water-resistant footwear
- For hand-harvesting of sugar cane, a re-entry period of one day is required to provide an adequate margin of safety in relation to dioxin exposures
- when applied by liquid spray at up to the current maximum registered label rate, 2,4-D will not cause adverse effects on the health of bystanders exposed via foliar residues deposited by spray-drift within areas adjacent to application sites
- when applied to turf in locations such as sports facilities, parks or home gardens at up to the currently registered maximum label rate, 2,4-D poses negligible risk of adverse effects on the health of members of the public during recreational activities

- the human health risks associated with spray drift exposures are considered to be negligible. Risk mitigation is not required for these exposures
- taking into consideration the potential toxicological hazard, the first aid instructions and safety directions on 2,4-D product labels require updating.

Overall, 2,4-D products when used according to the proposed new required label elements shown in section 9 (below) will not cause unacceptable exposures, hazards or risks associated with 2,4-D active constituents. This conclusion also applies to hazards or risks associated with exposure to impurities present in 2,4-D active constituents.

7 ENVIRONMENT

The APVMA published a Preliminary Review Finding (Environment) (Part 1) document in 2006. This PRF contained a preliminary assessment of all forms of 2,4-D (acid, salts and esters) and a refined risk assessment for the high volatile esters. A further report was published in 2013, an annex to the Part 1 PRF, and as result of the PRF and Annex, most of the high volatile ester products were cancelled. This report focuses on the low and non-volatile forms of 2,4-D (acid, salts and EHE).

Following a data call-in in July 2015, 53 new studies were provided on the environmental fate, behaviour and ecotoxicity of 2,4-D acid, salts and EHE. The majority of these were assessed by the European Union and the remainder by the APVMA. This assessment considers the outcomes of the new data to determine whether the information adds to or changes the 2006 conclusions in relation to 2,4-D acid, salts and EHE. In this regard, no new data were provided with respect to high volatile esters (HVEs) so no changes are required for previous assessment relating to these forms of 2,4-D. Since the 2006 assessment of 2,4-D salts and low volatile esters, there have been significant advancements in methodology for aspects of risk assessment.

The environmental assessment characterised the environmental fate and behaviour of 2,4-D, and its effects and associated risks to non-target species associated with 2,4-D product use. The assessment considered dietary exposure of terrestrial vertebrates, direct and indirect exposure of aquatic species, contact and/or oral exposure of non-target arthropods including bees, exposure of soil organisms within the treatment area, and spray drift exposure of non-target terrestrial plants.

7.1 Fate and behaviour

In support of the assessment for the review of 2,4-D, registrants submitted a full range of laboratory environmental fate data for 2,4-D acid and some bridging laboratory data for the EHE and DMA forms of 2,4-D. In addition, a full suite of field dissipation studies were provided for 2,4-D 2-EHE and 2,4-D DMA. No field data were provided for any other ester or amine salt form of 2,4-D. The 2006 PRF and its appendices contain detailed information characterising the environmental fate properties for 2,4-D acid, salts and esters.

In summary, 2,4-D amine salts and 2,4-D esters are not persistent under most environmental conditions including those associated with typical agricultural conditions. 2,4-D amine salt dissociation is expected to be instantaneous (<3 minutes) under most environmental conditions. While the data reviewed tend to show de-esterification of 2,4-D EHE to 2,4-D acid under all conditions is not instantaneous, they do tend to demonstrate that 2,4-D esters in normal agriculture soil and natural water conditions are short-lived compounds (<1 week). Under these conditions, the environmental exposure from 2,4-D esters and 2,4-D amines is expected to be minimal in both terrestrial and aquatic environments. 2,4-D is more persistent than its esters and amine salts but is still considered not persistent with a geometric mean DT_{50} value of 4.8 days under field conditions. Maximum DT_{50} values for the soil metabolites, 2,4-DCP and 2,4-DCA respectively were 7.3 days and 16 days, respectively.

2,4-D has very high to medium mobility in soil with a mean Kf value of 1.2 L/kg; however, modelling has indicated a low risk of migration to groundwater at rates up to 9000 g ae/ha. The major metabolites had mean Kf values of 15 L/kg (2,4-DCP) and 19 L/kg (2,4-DCA), which indicate they are not as mobile as the parent acid in the soil environment. In the aquatic environment, 2,4-D remains largely in the water phase.

7.2 Effects and associated risks to non-target species

Terrestrial vertebrates

2,4-D is moderately toxic to mammals (LD_{50} 485 mg ae/kg bw, *Rattus norvegicus*) and birds (geometric mean LD_{50} 530 mg ae/kg bw, three species). Following long-term dietary exposure in reproductive toxicity studies, reduced offspring viability was observed in mammals at doses as low as 144 mg ac/kg bw/d (NOEL 21 mg ae/kg bw/d, *Rattus norvegicus*), while no adverse effects were observed in birds at the maximum dose tested (NOEL 100 mg ae/kg bw/d). Applying a risk index approach, acceptable risks to terrestrial vertebrates were determined to be acceptable up to a maximum application rate of 4500 g 2,4-D acid equivalent per hectare.

Aquatic species

2,4-D has low toxicity to fish (lowest LC_{50} 100 mg ae/L, *Pimephales promelas*), moderate toxicity to aquatic invertebrates (lowest EC_{50} 25 mg ae/L, *Daphnia magna*) and algae (lowest EC_{50} 3.9 mg ae/L, *Navicula pelliculosa*), and high toxicity to aquatic plants (lowest EC_{50} 0.011 mg ae/L, *Myriophyllum spicatum*). The regulatory acceptable level (RAL) for aquatic species is based on the aquatic plant endpoint with an assessment factor of 3 (RAL 3.7 µg ae/L). A hazard statement is required on 2,4-D labels due to its high toxicity to aquatic plants.

A spray drift assessment was conducted according to APVMA's updated approach to spray drift management[2]. Based on the aquatic RAL of 3.7 µg ae/L, it was determined that spray drift risks can be adequately mitigated by the mandatory buffer zones specified in the 'Recommendations' section below.

A runoff assessment was conducted according to APVMA's method to refine estimates of pesticide runoff to waterways[3]. Surface water concentrations due to runoff were predicted for the agricultural uses using several lines of evidence. These include information on soil types, slopes in the growing regions, rainfall in the different regions and hydrology (streamflow). The consequence of this approach is that risk was not considered equally between different regions and specific restraints were determined for some regions but not others. The restraints specified in the 'Recommendations' section below are required to ensure the expected surface water concentrations do not exceed the aquatic RAL.

Predicted ground water concentrations following applications up to 4500 g ae/ha are lower than the aquatic RAL and therefore risks due to ground water exposure are considered to be acceptable without mitigation.

Group 13 products can be applied directly to aquatic weeds in natural aquatic systems at rates up to 3000 g ae/ha by knapsack sprayers, hand gun or sprinkler sprayers, and up to 1500 g ae/ha by helicopter. In order to minimise indirect effects of aquatic weed control such as deoxygenation of the water through decaying plants material, only up to 50 per cent of the total surface area should be treated at any one time and a minimum interval of seven days between applications is required. Additional precautionary measures are also required to minimise direct entry of the product into the water.

[2] apvma.gov.au/node/28071
[3] apvma.gov.au/node/15696

Bees

2,4-D has very low toxicity to bees by contact exposure (lowest LD_{50} 98 µg ae/bee) and oral exposure (lowest LD_{50} 78 µg ae/bee). Following dietary exposure of bee larvae, no adverse effects were observed up to the maximum dose tested (NOEL 265 mg ae/kg diet). Due to a low hazard, risks to bees were determined to be acceptable without mitigation.

Other non-target arthropods

Representative SL formulations of 2,4-D salts are not considered to be toxic to beneficial (predatory and parasitic) arthropods. No adverse effects were observed following exposure to fresh-dried residues in tier one (glass plate) tests for both indicator species (LR_{50} >3000 g ae/ha; *Typhlodromus pyri* and *Aphidius rhopalosiphi*). Therefore, 2,4-D acid/salt formulations are considered to be compatible with IPM programs utilising beneficial arthropods.

However, in a tier one laboratory (glass plate) test, fresh-dried residues of a representative EC formulation containing 2,4-D EHE resulted in an LR_{50} somewhere between 28 and 564 g ae/ha for *Aphidius rhopalosiphi*, which is an indicator species for parasitic arthropods. One hundred percent mortality was observed at 564 g ae/ha, while 28 g ae/ha is considered to be harmless (ie, <30 per cent mortality). In the absence of higher tier information on parasitic arthropods, use of 2,4-D EHE formulations at rates higher than 28 g a.e./ha cannot be considered compatible with IPM programs, and precautionary measures are required to minimise spray drift to off-crop habitats.

Soil organisms

2,4-D is considered to be moderately toxic to soil macro-organisms such as earthworms (LC_{50} 833 mg ae/kg dry soil, *Eisenia fetida*). Following long-term exposure, reproduction was inhibited in a dose-dependent manner (EC_{10} 21 mg ae/kg dry soil, *Eisenia fetida*). Available data indicate that 2,4-D does not adversely affect soil processes such as nitrification at exaggerated soil concentrations (NOEC 13 mg ae/kg dry soil). Based on the available information, risks to soil organisms were determined to be acceptable at the maximum registered rates without mitigation.

Non-target terrestrial plants

Post-emergent exposure is the most sensitive route for non-target terrestrial plants. Based on a sensitive species distribution (SSD) of data on acid and salt formulations and EHE formulations, the resulting HR_5 values were 18 g ae/ha (salts) and 10 g ae/ha (esters). Applying an assessment factor of 3.1 to account for more sensitive endpoints that were not measured, the RAL for assessing spray drift to non-target terrestrial plants was set at 5.8 g ae/ha for salt formulations and 3.2 g ae/ha for EHE formulations. A spray drift assessment was conducted according to APVMA's updated approach to spray drift management[4]. Based on the RAL values, it was determined that risks to non-target terrestrial plants can be adequately mitigated by the specified mandatory buffer zones in the 'Recommendations' section below.

[4] apvma.gov.au/node/28071

7.3 Recommendations

The environmental assessment concluded that risks to non-target species associated with the use of registered 2,4-D products in Australia at rates up to 4500 g ae/ha are considered to be acceptable, provided 2,4-D products are used in accordance with the proposed new required label elements shown section 9 (below). Risks to the environment associated with impurities derived from 2,4-D active constituents are considered to be acceptable.

8 RESIDUES

Because of the proposed changes to the 2,4-D health based guidance values a dietary exposure assessment was performed. Publicly available data relevant to animal feeds and animal transfer has been considered to allow for an assessment of appropriate Maximum Residue Limits (MRLs) for animal feeds and animal food commodities. A contemporary dietary exposure and spray drift assessment has also been performed.

Risks to consumer safety associated with dioxin and/or dioxin-like impurities are considered to be acceptable based on negligible exposure from 2,4-D relative to background levels of dioxins in the environment and in food[5].

8.1 Animal feed MRLs

There are currently no Table 4 entries in the APVMA MRL standard for 2,4-D to cover the uses on pasture or other forage crops. The maximum 2,4-D considered was 4500 g ai/ha to pasture and a seven day grazing withholding period applies to this use.

Data from the USA for pastures have been considered by the 1998 JMPR[6]. The data for 2,4-D applied (as the free acid, DMA salt or EHE) two times at 2200 g ai/ha on pasture seven PHI days recorded residues of 19, 20, 20, 23, 32, 32, 34, 39, 41, 41, 41, 45, 46, 49, 61, 74, 82, 87, 93, 103, 103, 107, 117, 120, 122, 125, 170 mg/kg (fresh weight basis). On a dry weight basis the high residue is 680 mg/kg (assuming a dry matter content of 25 per cent).

The highest application rate for an animal feed is for pasture (4500 g ai/ha). When the high residue is scaled for this application rate then the residue is equivalent to 1388 mg/kg. An MRL of 1500 mg/kg is considered to be appropriate for 2,4-D on Primary feed commodities.

Cereal forage and fodder are animal feeds and oaten hay is considered to be a major export commodity. The highest application rate for cereals is 1160 g ai/ha (harvest aid or salvage spray). When the high residue is scaled for this application rate then the residue is equivalent to 360 mg/kg. An MRL of 400 mg/kg is considered to be appropriate for Forage and fodder of cereal grains.

8.2 Animal commodity MRLs

A dairy cattle transfer study was evaluated by the 1998 JMPR and involved dosing at 1446 ppm for 28 to 30 days. Highest residues observed in tissues and milk in the study together with estimated residues from feeding cattle on pasture with a HR of 1388 mg/kg are summarised below:

[5] Food Standards Australia New Zealand, Dioxins in food, Dietary Exposure Assessment and Risk Characterisation foodstandards.gov.au/publications/documents/FINAL%20DEA-RC%20Report%20Dioxin%2024May04final.pdf

[6] Joint Meeting of Pesticide Residues, 1998 evaluation, fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/JMPR/Evaluation98/24deval.pdf

Table 5: Results of the cattle transfer study

Feeding level (ppm)	Milk	Muscle	Liver	Kidney	Fat
	2,4-D residue (mg/kg)				
1446–observed	0.07	0.24	0.20	6.5	0.51
1388–estimated burden	0.07	0.23	0.19	6.2	0.49
Established MRLs	*0.05 (milks)	0.2 (meat)		2 (offal)	–
Recommended MRLs	0.1	0.7 (in fat)		7	–

An increase to the established MRLs for 2,4-D in mammalian meat (in the fat), offal and milk is required to support currently registered uses.

8.3 Estimated dietary intake

As discussed in Section 3.2, the Acceptable Daily Intake (ADI) for 2,4-D has been increased from 0.01 mg/kg bw/d to 0.05 mg/kg bw/d. An Acute Reference Dose (ARfD) for 2,4-D has been established at 0.7 mg/kg bw/d.

The chronic dietary exposure to 2,4-D is estimated by the National Estimated Daily Intake (NEDI) calculation encompassing all registered/temporary uses of the chemical and the mean daily dietary consumption data derived primarily from the 2011–12 National Nutritional and Physical Activity Survey. The NEDI calculation is made in accordance with WHO Guidelines and is a conservative estimate of dietary exposure to chemical residues in food. Considering the revised ADI of 0.05 mg/kg bw/d, the NEDI for 2,4-D is equivalent to <15% of the ADI. It is concluded that the chronic dietary exposure of 2,4-D is acceptable.

The acute dietary exposure is estimated by the National Estimated Short Term Intake (NESTI) calculation. The NESTI calculations are made in accordance with the deterministic method used by the JMPR with 97.5th percentile food consumption data derived primarily from the 2011–12 National Nutritional and Physical Activity Survey. NESTI calculations are conservative estimates of short-term exposure (24 hour period) to chemical residues in food. Considering the ARfD of 0.8 mg/kg, the highest acute dietary intake was estimated at <35 per cent of the ARfD (citrus for the two to six year old population). It is concluded that the acute dietary exposure for 2,4-D is acceptable.

8.4 Maximum Residue Limits

Maximum Residue Limits (MRLs) are currently established in the APVMA MRL Standard for approved uses[7]. The following changes are recommended to Tables 1 and 4 of the APVMA MRL Standard. The Lupin MRL is to be deleted as there is a pulse crop group MRL established at the same level:

[7] Agricultural and Veterinary Chemicals Code (MRL Standard) Instrument 2019: legislation.gov.au/Series/F2019L01105

Table 6: MRLs Food

Compound	Food	MRL (mg/kg)
2,4-D		
DELETE:		
MO 0105	Edible offal (mammalian)	2
VD 0545	Lupin (dry)	*0.05
MM 0095	Meat (mammalian)	0.2
ML 0106	Milks	*0.05
ADD		
MO 0105	Edible offal (Mammalian)	7
MM 0095	Meat [mammalian][in the fat]	0.7
ML 0106	Milks	0.1

Table 7: MRLs Animal Feed Commodity

Compound	Animal Feed Commodity	MRL (mg/kg)
2,4-D		
ADD		
	Forage and fodder of cereal grains	400
	Primary feed commodities {forage and fodder of cereal grains}	1500

8.5 Spray drift

For the spray drift assessment for the protection of international trade for livestock commodities, the Codex MRL of 5 mg/kg for Edible offal (Mammalian) was considered to determine the Regulatory Acceptable Level (RAL) for 2,4-D residues in pasture of 1112 ppm. Based on the spray drift assessment using this RAL, the knowledge that 2,4-D residues deplete quickly from livestock tissues and that no 2,4-D related trade issues with animal commodities have been identified in the past, it has been determined that mandatory no-spray zones for protection of international trade are not required on 2,4-D product labels.

8.6 Trade

While the maximum use rate of 2,4-D is not increasing, the review of available relevant residues data supports the increase in MRL for mammalian meat (in the fat), offal and milk. No changes are proposed to any other MRLs for food commodities and the risk to international trade remains unchanged. A consideration of MRLs established for animal commodities overseas is given below:

Table 8: International 2,4-D MRLs for Animal Commodities

Commodity	MRL (mg/kg)						
	Australia	Codex	EU	Japan	Korea	Taiwan	USA
Edible offal (mammalian)	2 (current) 7 (proposed)	5	5	5	–	–	4 (kidney) 0.3 (meat by-products except kidney)
Meat (mammalian)	0.2 (current) 0.7 (in fat proposed)	0.2	0.2 (muscle) 0.2 (fat)	0.2 (muscle) 0.2 (fat)	0.05 (mammalian meat)	0.05 (muscle)	0.3 (meat) 0.3 (fat)
Milks	*0.05 (current) 0.1 (proposed)	0.01	*0.01	0.01	0.01	0.05	0.05

The proposed Australian MRLs for animal commodities are higher than those established overseas and by Codex. The highest predicted residue from approved uses is 6.2 mg/kg in kidney. In the feeding study summarised by the JMPR an average residue of 24 mg/kg in kidney declined to 0.06 mg/kg after three days on clean feed to give an estimated half-life of 0.35 days. It would take less than one day for the estimated HR of 6.2 mg/kg in kidney to decline to the Codex Edible offal (mammalian) MRL of 5 mg/kg based on a half-life of 0.35 days (for other tissues the initial half-life for 2,4-D is 1.1 days in liver, and less than one day for muscle and fat). Given this rapid depuration and because no 2,4-D trade issues with animal commodities have been identified in the past, it is considered unnecessary to recommend an Export Slaughter Interval (ESI) for registered uses of current 2,4-D products.

Oaten hay is currently considered to be a major export commodity and MRL is being proposed at 400 mg/kg for the currently approved use. The proposed MRL is equivalent to the established Codex MRL for Hay or fodder (dry) of grasses at 400 mg/kg[8].

8.7 Recommendations

Continued approval of the label use patterns do not pose an undue hazard to the safety of people consuming anything containing foods containing 2,4-D residues, nor are they an undue risk to international trade.

Amendments to the APVMA MRL standard for animal feeds and animal commodities are recommended to align the MRLs with residues expected from current use patterns.

Risks to consumer safety associated with impurities derived from 2,4-D active constituents are considered to be acceptable.

[8] Codex MRLs for 2,4-D: fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/pesticide-detail/en/?p_id=20

9 PROPOSED REQUIRED LABEL ELEMENTS

9.1 Instructions

To determine which new label elements are required for a given 2,4-D product:

1. take note that the mandatory general label elements are required for all 2,4-D products and labels

then

2. determine the correct Product Group for the product as per Table 1

then

3. refer to the list of specific required label elements for the relevant product category.

9.2 Mandatory General elements required for all labels

Signal Heading:	POISON KEEP OUT OF REACH OF CHILDREN READ SAFETY DIRECTIONS BEFORE OPENING OR USING
Product Name:	[INSERT HERE]
Constituent Statement:	[INSERT HERE]g/L 2,4-D present as [INSERT HERE] [Applicants if your product contains other scheduled excipients please include these here or delete this text]
Mode of Action:	GROUP I HERBICIDE [INSERT SECOND GROUP HERE IF REQUIRED]
Statement of Claims:	[INSERT HERE] [THE FOLLOWING STATEMENT IS A NEW REQUIREMENT FOR ALL 2,4-D PRODUCT LABELS] THIS IS A PHENOXY HERBICIDE THAT CAN CAUSE SEVERE DAMAGE TO NATIVE VEGETATION AND SUSCEPTIBLE CROPS SUCH AS COTTON, GRAPES, TOMATOES, OILSEED CROPS AND ORNAMENTALS.
Net Contents:	[INSERT HERE]
Restraints:	See 'SPRAY DRIFT RESTRAINTS' and 'GENERAL RESTRAINTS' sections. This can be uploaded as an attachment when submitting a label
Directions For Use:	See 'DIRECTIONS FOR USE' section. This can be uploaded as an attachment when submitting a label
Other Limitations:	[INSERT HERE]
Withholding Period:	PASTURE, CEREAL CROPS: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 7 DAYS AFTER APPLICATION CROP HARVEST WITHOLDING PERIOD: NOT REQUIRED WHEN USED AS DIRECTED. [INSERT ADDITIONAL WITHHOLDING PERIOD AS REQUIRED]
Trade Advice:	[INSERT HERE]
General Instructions:	[INSERT HERE]
Resistance Warning:	Resistant Weeds Warning [INSERT PRODUCT NAME] herbicide is a member of the PHENOXY group of herbicides. The product has the disruptors of plant cell growth mode of action. For weed resistance management [INSERT PRODUCT NAME] is a Group I herbicide. Some naturally-occurring weed biotypes resistant to [INSERT PRODUCT NAME] and other Group I herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used

	repeatedly. These resistant weeds will not be controlled by [INSERT PRODUCT NAME] or other Group I herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use, [INSERTCOMPANY NAME] accepts no liability for any losses that may result from the failure of [INSERT PRODUCT NAME] to control resistant weeds. [INSERT SECOND GROUP HERE IF REQUIRED]

Precautions:	RE-ENTRY PERIOD DO NOT hand harvest sugar cane for at least 1 day after application If re-entering treated areas before the spray has dried, workers should wear overalls, elbow-length gloves and water-resistant footwear. [INSERT ADDITIONAL PRECAUTIONS AS REQUIRED]
Protection Statements:	PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers.

Storage and Disposal:	[Applicants, please chose from the relevant statements below.] STORAGE AND DISPOSAL: General Containers: Store in the closed, original container in a cool, well-ventilated area. Do not store for prolonged periods in direct sunlight. Triple-rinse containers before disposal. Add rinsings to spray tank. Do not dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush, or puncture and deliver empty packaging to an approved waste management facility. If an approved waste management facility is not available, bury the empty packaging 500 mm below the surface in a disposal pit specifically marked and set up for this purpose, clear of waterways, desirable vegetation and tree roots, in compliance with relevant local, state or territory government regulations. Do not burn empty containers or product. DrumMUSTER containers: This container can be recycled if it is clean, dry, free of visible residues and has the drumMUSTER logo visible. Triple-rinse container for disposal. Dispose of rinsate by adding it to the spray tank. Do not dispose of undiluted chemical on site. Wash outside of the container and the cap. Store cleaned container in a sheltered place with cap removed. It will then be acceptable for recycling at any drumMUSTER collection or similar container management program site. The cap should not be replaced, but may be taken separately. Returnable containers: With Micro Matic Valve [INSERT VOLUME HERE]: DO NOT tamper with the Micro Matic valve or the security seal. DO NOT contaminate the container with water or any foreign matter. After each use of the product, please ensure that the Micro Matic coupler delivery system and hoses are disconnected, triple rinsed with clean water and drained accordingly. When the contents of the container have been used, please return the container to the point of purchase. The container remains the property of [COMPANY] Bulk [INSERT VOLUME HERE]: Empty contents fully into application equipment. Close all valves and return to the point of supply for refill or storage.

Safety Directions:	[INSERT SPECIFIC SAFETY DIRECTIONS AS REQUIRED] HAZARDS & PRECAUTIONS MIXING OR USING AFTER USE

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

RESTRAINTS

DO NOT apply if heavy rains or storms are forecast within 3 days.
DO NOT irrigate to the point of runoff for at least 3 days after application.
DO NOT apply if crop or weeds are stressed due to dry or excessively moist conditions.
DO NOT exceed maximum application rate of (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3 4 and 5.
DO NOT exceed the maximum daily application rate by backpack spraying of XX L/day (4000 g ae/day).
Category specific restraints must also be applied.

SPRAY DRIFT RESTRAINTS

Spray restraints and instructions must be consistent with the APVMA spray drift policies and procedures.
apvma.gov.au/spraydrift

Specific definitions for terms used in this section of the label can be found at apvma.gov.au/spraydrift

DO NOT apply by a vertical sprayer.

DO NOT allow bystanders to come into contact with the spray cloud.

DO NOT apply in a manner that may cause an unacceptable impact to native vegetation, agricultural crops, landscaped gardens and aquaculture production, or cause contamination of plant or livestock commodities, outside the application site from spray drift. The buffer zones in the relevant buffer zone table/s below provide guidance but may not be sufficient in all situations. Wherever possible, correctly use application equipment designed to reduce spray drift and apply when the wind direction is away from these sensitive areas.

DO NOT apply unless the wind speed is between 3 and 20 kilometres per hour at the application site during the time of application.

DO NOT apply if there are hazardous surface temperature inversion conditions present at the application site during the time of application. Surface temperature inversion conditions exist most evenings one to two hours before sunset and persist until one to two hours after sunrise.

DO NOT apply by a boom sprayer unless the following requirements are met:
Spray droplets are not smaller than a VERY COARSE spray droplet size category
Minimum distances between the application site and downwind sensitive areas (see ‘Mandatory buffer zones’ section of the following table titled ‘Buffer zones for boom sprayers’) are observed.

Buffer zones for boom sprayers

Application rate	Boom height above the target canopy	Mandatory downwind buffer zones	
		Natural aquatic areas	Vegetation areas
Up to 4500 g ae/ha	0.5 m or lower	75 metres	70 metres
	1.0 m or lower	300 metres	275 metres
Up to 3300 g ae/ha	0.5 m or lower	55 metres	50 metres
	1.0 m or lower	160 metres	160 metres
Up to 3000 g ae/ha	0.5 m or lower	50 metres	45 metres
	1.0 m or lower	150 metres	140 metres
Up to 2710 g ae/ha	0.5 m or lower	45 metres	40 metres
	1.0 m or lower	130 metres	130 metres
Up to 2750 g ae/ha	0.5 m or lower	45 metres	45 metres
	1.0 m or lower	130 metres	130 metres
Up to 2250 g ae/ha	0.5 m or lower	40 metres	35 metres
	1.0 m or lower	110 metres	110 metres
Up to 1890 g ae/ha	0.5 m or lower	35 metres	35 metres
	1.0 m or lower	90 metres	90 metres
Up to 1575 g ae/ha	0.5 m or lower	30 metres	30 metres
	1.0 m or lower	80 metres	75 metres
Up to 1150 g ae/ha	0.5 m or lower	30 metres	25 metres
	1.0 m or lower	60 metres	60 metres
Up to 336 g ae/ha	0.5 m or lower	Not required	No required
	1.0 m or lower	30 metres	25 metres

DO NOT apply by aircraft unless the following requirements are met:

- Spray droplets are no smaller than a VERY COARSE spray droplet size category
- For maximum release heights above the target canopy of 3m or 25% of wingspan or 25% of rotor diameter whichever is the greatest, minimum distances between the application site and downwind sensitive areas (see ‘Mandatory buffer zones’ section of the following table titled ‘Buffer zones for aircraft’) are observed.

Buffer zones for aircraft

Note: Specific buffer zones apply for group 13 products (aquatic use only products).Group 13 products must only be aerially applied using rotary-wing aircraft.

Application rate	Type of aircraft	Mandatory downwind buffer zones	
		Natural aquatic areas	Vegetation areas
Up to 4500 g ae/ha	Fixed wing	725 metres	675 metres
	Helicopter	350 metres	325 metres
Up to 3640 g ae/ha	Fixed wing	550 metres	525 metres
	Helicopter	300 metres	275 metres
Up to 3300 g ae/ha	Fixed wing	475 metres	450 metres
	Helicopter	275 metres	275 metres
Up to 3000 g ae/ha	Fixed wing	425 metres	400 metres
	Helicopter	250 metres	240 metres
Up to 2250 g ae/ha	Fixed wing	325 metres	300 metres
	Helicopter	200 metres	200 metres
Up to 1120 g ae/ha	Fixed wing	190 metres	180 metres
	Helicopter	130 metres	130 metres
Up to 1080 g ae/ha	Fixed wing	180 metres	180 metres
	Helicopter	130 metres	120 metres
Up to 950 g ae/ha	Fixed wing	170 metres	160 metres
	Helicopter	120 metres	120 metres
Up to 560 g ae/ha	Fixed wing	140 metres	140 metres
	Helicopter	100 metres	100 metres
Up to 560 g ae/ha	Fixed wing	120 metres	120 metres
	Helicopter	85 metres	80 metres
Up to 325 g ae/ha	Fixed wing	80 metres	80 metres
	Helicopter	60 metres	60 metres

DIRECTIONS FOR USE: - Applicants if your product is currently approved for additional uses please add to this table, and highlight the changes made

WEED TABLE: Applicants to add a weed table as required.

PLANTBACK DAYS: Applicants to add a plantback days table as required.

9.3 Group 1 (225 g 2,4-D/L as the IPA salt)

2,4-D Products containing the IPA salt at a concentration of 225 g ac/L were excluded from the review since there are no currently registered products in this category. Required label elements are not required.

9.4 Group 2 (300 g 2,4-D/L as the IPA salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, goggles and half facepiece respirator with organic vapour/gas cartridge or canister. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 15L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 13.3L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 2.9L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 3.6L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**

FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 3.7L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 7.5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (prior to sowing, conservation tillage)	Queensland	11	11	11	11
	New South Wales	11	11	11	11
	Victoria	1.2	3.5	11	3.5
	Tasmania	1.2	2.6	7.4	3.5
	South Australia	2.4	3.5	11	7.4
	Western Australia	3.5	7.4	11	7.4
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	15	15	15	15
	New South Wales	15	15	15	15
	Victoria	2.0	4.0	15	7.5
	Tasmania	1.4	3.5	11	6.6
	South Australia	3.0	6.6	15	11
	Western Australia	7.5	10.6	15	1

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	**Region**	**Timing Restriction**
		DO NOT APPLY DURING THE MONTHS
Up to **3.6L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November

	Northern NSW	No timing restriction
Up to **7.4L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	6.7
	New South Wales	6.7
	Victoria	5.3
	Tasmania	5.3
	South Australia	5.3
	Western Australia	8.3

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.5 Group 3 (450 g 2,4-D/L as the IPA salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if absorbed by skin contact or swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 10 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 8.9 L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.9L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 2.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**

FALLOW BAND SPRAY PRIOR TO SOWING Peanuts	Up to 2.5L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	7.1	7.1	7.1	7.1
	New South Wales	7.1	7.1	7.1	7.1
	Victoria	0.8	2.3	7.1	2.3
	Tasmania	0.8	1.7	4.9	2.3
	South Australia	1.6	2.3	7.1	4.9
	Western Australia	2.3	4.9	7.1	4.9
Pastures (established)	**State**	**Summer**	**Autumn**	**Winter**	**Spring**
	Queensland	10	10	10	10
	New South Wales	10	10	10	10
	Victoria	1.3	2.7	10	5
	Tasmania	0.9	2.3	7.1	4.4
	South Australia	2	4.4	10	7.1
	Western Australia	5	7.1	10	7.1

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	Region	Timing Restriction
		DO NOT APPLY DURING THE MONTHS
Up to **2.4L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November

	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **4.9L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Rate (L/ha)**
Turf	Queensland	4.4
	New South Wales	4.4
	Victoria	3.5
	Tasmania	3.5
	South Australia	3.5
	Western Australia	5.6

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.6 Group 4 (300 g 2,4-D/L as the IPA salt and 75g/L Picloram) specific label elements

Withholding Period:	PASTURE, CEREAL CROPS: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 7 DAYS AFTER APPLICATION SUGARCANE: DO NOT HARVEST FOR 8 WEEKS AFTER APPLICATION DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 8 WEEKS AFTER APPLICATION.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will damage the eyes. Will irritate the skin. Repeated exposure may cause allergic disorders. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 15 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 13.3L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 2.9L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 3.6L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions

		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 3.7L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 7.5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	11	11	11	11
	New South Wales	11	11	11	11
	Victoria	1.2	3.5	11	3.5
	Tasmania	1.2	2.6	7.4	3.5
	South Australia	2.4	3.5	11	7.4
	Western Australia	3.5	7.4	1	7.4
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	15	15	15	15
	New South Wales	15	15	15	15
	Victoria	2.0	4.0	15	7.5
	Tasmania	1.4	3.5	10	6.6
	South Australia	3.0	6.6	15	11
	Western Australia	7.5	11	15	11

Table 3: Timing restrictions for spraying SUGARCANE

Situation	Rate (L/ha)	Region	Timing Restriction

			DO NOT APPLY DURING THE MONTHS
	Up to 3.2**L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	October to November
		Mary/Burnett	No timing restriction
		Northern NSW	No timing restriction

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Rate (L/ha)**
Turf	Queensland	6.7
	New South Wales	6.7
	Victoria	5.3
	Tasmania	5.3
	South Australia	5.3
	Western Australia	8.3

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.7 Group 5 (500 g/ L 2,4-D present as DMA (dimethylamine) salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS
	Poisonous if inhaled or swallowed. Corrosive to the eyes and skin. Avoid contact with the eyes and skin. Will irritate the nose and throat. Do not inhale vapour or spray mist.
	MIXING OR USING
	When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, elbow-length chemical resistant gloves, impervious footwear and goggles and half face piece respirator with organic vapour/gas cartridge or canister or full facepiece respirator. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water.
	AFTER USE
	After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 9 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by **backpack spraying of 8 L/day.**
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.8L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 2.1L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions

		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	Use not supported
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 2.2L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 4.5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	6.4	6.4	6.4	6.4
	New South Wales	6.4	6.4	6.4	6.4
	Victoria	0.7	2.1	6.4	2.1
	Tasmania	0.7	1.6	4.4	2.1
	South Australia	1.4	2.1	6.4	4.4
	Western Australia	2.1	4.4	6.4	4.4
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	9.0	9.0	9.0	9.0
	New South Wales	9.0	9.0	9.0	9.0
	Victoria	1.2	2.4	9.0	4.5
	Tasmania	0.8	2.1	6.4	4.0
	South Australia	1.8	4.0	9.0	6.4
	Western Australia	4.5	6.4	9.0	6.4

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	Region	Timing Restriction

		DO NOT APPLY DURING THE MONTHS
Up to **2.2L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **4.4L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	4.0
	New South Wales	4.0
	Victoria	3.2
	Tasmania	3.2
	South Australia	3.2
	Western Australia	5.0

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.8 Group 6 (625g/L 2,4-D present as the Dimethylamine salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if inhaled or swallowed. Corrosive to the eyes and skin. Avoid contact with the eyes and skin. Will irritate the nose and throat. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, elbow-length chemical resistant gloves, impervious footwear and goggles and half face piece respirator with organic vapour/gas cartridge or canister or full facepiece respirator. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 7.2 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 6.4 L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.7L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October

		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 1.8L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.6L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	5.1	5.1	5.1	5.1
	New South Wales	5.1	5.1	5.1	5.1
	Victoria	0.6	1.7	5.1	1.7
	Tasmania	0.6	1.2	3.6	1.7
	South Australia	1.2	1.7	5.1	3.6
	Western Australia	1.7	3.6	5.1	3.6
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	7.2	7.2	7.2	7.2
	New South Wales	7.2	7.2	7.2	7.2
	Victoria	1.0	1.9	7.2	3.6
	Tasmania	0.7	1.7	5.1	3.2
	South Australia	1.4	3.2	7.2	5.1
	Western Australia	3.6	5.1	7.2	5.1

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	Region	Timing Restriction

		DO NOT APPLY DURING THE MONTHS
Up to **1.8L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **3.6L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Rate (L/ha)**
Turf	Queensland	3.2
	New South Wales	3.2
	Victoria	2.5
	Tasmania	2.5
	South Australia	2.5
	Western Australia	4.0

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.9 Group 7 (800 g 2,4-D/kg as the DMA salt) specific label elements

There are no currently registered products in this category. Required label elements are not required.

9.10 Group 8a (720 g 2,4-D/L present as the DMA salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if inhaled or swallowed. Corrosive to the eyes and skin. Avoid contact with the eyes and skin. Will irritate the nose and throat. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, elbow-length chemical resistant gloves, impervious footwear and goggles and half face piece respirator with organic vapour/gas cartridge or canister or full facepiece respirator. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 6.3 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 5.6L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.2L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.5L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December

		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 1.5L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.1L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	4.4	4.4	4.4	4.4
	New South Wales	4.4	4.4	4.4	4.4
	Victoria	0.5	1.4	4.4	1.4
	Tasmania	0.5	1.1	3.1	1.4
	South Australia	1.0	1.4	4.4	3.1
	Western Australia	1.4	3.1	4.4	3.1
Pastures (established)	**State**	**Summer**	**Autumn**	**Winter**	**Spring**
	Queensland	6.3	6.3	6.3	6.3
	New South Wales	6.3	6.3	6.3	6.3
	Victoria	0.8	1.7	6.3	3.1
	Tasmania	0.6	1.5	4.4	2.8
	South Australia	1.3	2.8	6.3	4.4
	Western Australia	3.1	4.4	6.3	4.4

Table 3: Timing restrictions for spraying SUGARCANE		
Rate (L/ha)	**Region**	**Timing Restriction**
		DO NOT APPLY DURING THE MONTHS
Up to **1.5L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **3.1L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF		
DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST		
	State	**Rate (L/ha)**
Turf	Queensland	2.8
	New South Wales	2.8
	Victoria	2.2
	Tasmania	2.2
	South Australia	2.2
	Western Australia	3.5
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses	
Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.11 Group 8b (700 g 2,4-D/L present as the DMA/MMA or DEA salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if inhaled or swallowed. Corrosive to the eyes and skin. Avoid contact with the eyes and skin. Will irritate the nose and throat. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, elbow-length chemical resistant gloves, impervious footwear and goggles and half face piece respirator with organic vapour/gas cartridge or canister or full facepiece respirator. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 6.4 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 5.7L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.2L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.5L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December

		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 1.6L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.2L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (prior to sowing, conservation tillage)	Queensland	4.5	4.5	4.5	4.5
	New South Wales	4.5	4.5	4.5	4.5
	Victoria	0.5	1.5	4.5	1.5
	Tasmania	0.5	1.1	3.2	1.5
	South Australia	1.0	1.5	4.5	3.2
	Western Australia	1.5	3.2	4.5	3.2
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	6.4	6.4	6.4	6.4
	New South Wales	6.4	6.4	6.4	6.4
	Victoria	0.9	1.7	6.4	3.2
	Tasmania	0.6	1.5	4.5	2.8
	South Australia	1.3	2.8	6.4	4.5
	Western Australia	3.2	4.5	6.4	4.5

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	**Region**	**Timing Restriction**
		DO NOT APPLY DURING THE MONTHS

Up to **1.5L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **3.2L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	2.9
	New South Wales	2.9
	Victoria	2.2
	Tasmania	2.2
	South Australia	2.2
	Western Australia	3.6

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.12 Group 9a (625 g 2,4-D/L as the DMA/DEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if absorbed by skin contact, inhaled or swallowed. Corrosive to the eyes and skin. Will irritate the nose and throat. Avoid contact with the eyes and skin. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, impervious footwear and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with enclosed operator's cab and air filtration or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by boomspray equipment with open operator's cab or hand-held spray equipment wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[9].
DO NOT apply by aircraft at rates exceeding 3.6 L/ha.
DO NOT apply by hand-held spraying equipment at rates exceeding 5.3 L/ha or 530 mL/100 L.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT exceed maximum application rate of 7.2L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December

[9] Manually pressurised backpack sprayer.

		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.7L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 1.8L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.6 L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	5.1	5.1	5.1	5.1
	New South Wales	5.1	5.1	5.1	5.1
	Victoria	0.6	1.7	5.1	1.7
	Tasmania	0.6	1.2	3.6	1.7
	South Australia	1.2	1.7	5.1	3.6
	Western Australia	1.7	3.6	5.1	3.6
	State	Summer	Autumn	Winter	Spring
Pastures (established)	Queensland	7.2	7.2	7.2	7.2
	New South Wales	7.2	7.2	7.2	7.2
	Victoria	1	1.9	7.2	3.6
	Tasmania	0.7	1.7	5.1	3.2

	South Australia	1.4	3.2	7.2	5.1
	Western Australia	3.6	5.1	7.2	5.1

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	Region	Timing Restriction
		DO NOT APPLY DURING THE MONTHS
Up to 1.7L/ha	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to 3.6L/ha	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	3.2
	New South Wales	3.2
	Victoria	2.5
	Tasmania	2.5
	South Australia	2.5
	Western Australia	4.0

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.13 Group 9b (750 g 2,4-D/L as the DMA/DEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if absorbed by skin contact, inhaled or swallowed. Corrosive to the eyes and skin. Will irritate the nose and throat. Avoid contact with the eyes and skin. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, impervious footwear and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with enclosed operator's cab and air filtration or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by boomspray equipment with open operator's cab or hand-held spray equipment wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[10].
DO NOT apply by aircraft at rates exceeding 3.3 L/ha.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT exceed maximum application rate of 6 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.2L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December

[10] Manually pressurised backpack sprayer.

		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 1.5L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	4.2	4.2	4.2	4.2
	New South Wales	4.2	4.2	4.2	4.2
	Victoria	0.5	1.4	4.2	1.4
	Tasmania	0.5	1.0	3.0	1.4
	South Australia	1.0	1.4	4.2	3.0
	Western Australia	1.4	3.0	4.2	3.0
Pastures (established)	State	Summer	Autumn	Winter	Spring
	Queensland	6.0	6.0	6.0	6.0
	New South Wales	6.0	6.0	6.0	6.0
	Victoria	0.8	1.6	6.0	3.0
	Tasmania	0.6	1.4	4.2	2.6

	South Australia	1.2	2.6	6.0	4.2
	Western Australia	3.0	4.2	6.0	4.2

Table 3: Timing restrictions for spraying SUGARCANE		
Rate (L/ha)	Region	Timing Restriction
		DO NOT APPLY DURING THE MONTHS
Up to 1.4L/ha	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to 3L/ha	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF		
DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST		
	State	**Rate (L/ha)**
Turf	Queensland	2.7
	New South Wales	2.7
	Victoria	2.1
	Tasmania	2.1
	South Australia	2.1
	Western Australia	3.3
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses	
Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.14 Group 10 (475g 2,4-D/L as the DMA/DEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Corrosive to the eyes. Will damage the skin. Will irritate the nose and throat. Avoid contact with the eyes and skin. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, PVC or rubber apron, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with enclosed operator's cab and air filtration or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by hand-held spraying equipment or boomspray equipment with open operator's cab wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[11].
DO NOT apply by aircraft at rates exceeding 3.4 L/ha.
DO NOT apply by hand-held spraying equipment at rates exceeding 5.3 L/ha or 530 mL/100 L.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT exceed maximum application rate of 9.5 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.8L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October

[11] Manually pressurised backpack sprayer.

		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 2.2L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 2.3L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 4.7L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	6.7	6.7	6.7	6.7
	New South Wales	6.7	6.7	6.7	6.7
	Victoria	0.7	2.2	6.7	2.2
	Tasmania	0.7	1.6	4.7	2.2
	South Australia	1.5	2.2	6.7	4.7
	Western Australia	2.2	4.7	6.7	4.7
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	9.5	9.5	9.5	9.5
	New South Wales	9.5	9.5	9.5	9.5
	Victoria	1.3	2.5	9.5	4.7

	Tasmania	0.9	2.2	6.7	4.2
	South Australia	1.9	4.2	9.5	6.7
	Western Australia	4.7	6.7	9.5	6.7

Table 3: Timing restrictions for spraying SUGARCANE

Rate (L/ha)	**Region**	**Timing Restriction**
		DO NOT APPLY DURING THE MONTHS
Up to **2.3L/ha**	Wet Tropics	No timing restriction
	Burdekin	No timing restriction
	Mackay/Whitsunday	October to November
	Mary/Burnett	October to November
	Northern NSW	No timing restriction
Up to **4.7L/ha**	Wet Tropics	October to December
	Burdekin	September to October
	Mackay/Whitsunday	August to December
	Mary/Burnett	April to January
	Northern NSW	October to November

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Rate (L/ha)**
Turf	Queensland	4.2
	New South Wales	4.2
	Victoria	3.3
	Tasmania	3.3
	South Australia	3.3
	Western Australia	5.3

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.15 Group 11 (500 g 2,4-D/L as the DEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray, using undiluted concentrate or applying by hand-held spraying equipment or boomspray equipment with open operator's cab, wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by boomspray equipment with enclosed operator's cab and air filtration wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[12].
DO NOT apply by aircraft at rates exceeding 3.2 L/ha.
DO NOT apply by hand-held spraying equipment at rates exceeding 5 L/ha or 500 mL/100 L.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT exceed maximum application rate of 9 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.8L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May

[12] Manually pressurised backpack sprayer.

	Up to 2.1L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 2.2L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts (DO NOT EXCEED 3.2 L/ha by aerial application)	Up to 4.5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	6.4	6.4	6.4	6.4
	New South Wales	6.4	6.4	6.4	6.4
	Victoria	0.7	2.1	6.4	2.1
	Tasmania	0.7	1.6	4.4	2.1
	South Australia	1.4	2.1	6.4	4.4
	Western Australia	2.1	4.4	6.4	4.4
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	9.0	9.0	9.0	9.0
	New South Wales	9.0	9.0	9.0	9.0
	Victoria	1.2	2.4	9.0	4.5
	Tasmania	0.8	2.1	6.4	4.0
	South Australia	1.8	4.0	9.0	6.4
	Western Australia	4.5	6.4	9.0	6.4

Table 3: Timing restrictions for spraying SUGARCANE			
Situation	**Rate (L/ha)**	**Region**	**Timing Restriction**
			DO NOT APPLY DURING THE MONTHS
(DO NOT EXCEED 3.2 L/ha by aerial application)	Up to **2.2L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	October to November
		Mary/Burnett	October to November
		Northern NSW	No timing restriction
	Up to **4.4L/ha**	Wet Tropics	October to December
		Burdekin	September to October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		Northern NSW	October to November

Table 4: Application restrictions for TURF		
DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST		
Turf	**State**	**Rate (L/ha)**
	Queensland	4
	New South Wales	4
	Victoria	3.2
	Tasmania	3.2
	South Australia	3.2
	Western Australia	5
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses	
Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.16 Group 12a (500 g 2,4-D/L as the DEA/TEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if absorbed by skin contact, inhaled or swallowed. Will damage the eyes. Will irritate the skin. Repeated exposure may cause allergic disorders. MIXING OR USING When opening the container and preparing spray, using undiluted concentrate or applying by hand-held spraying equipment or boomspray equipment with open operator's cab, wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with enclosed operator's cab and air filtration or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user.
DO NOT apply by aircraft at rates exceeding 6.4 L/ha.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT exceed maximum application rate of 9 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3 and 4.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.8L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 2.1L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December

		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 2.2L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 4.5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	6.4	6.4	6.4	6.4
	New South Wales	6.4	6.4	6.4	6.4
	Victoria	0.7	2.1	6.4	2.1
	Tasmania	0.7	1.6	4.4	2.1
	South Australia	1.4	2.1	6.4	4.4
	Western Australia	2.1	4.4	6.4	4.4
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	9.0	9.0	9.0	9.0
	New South Wales	9.0	9.0	9.0	9.0
	Victoria	1.2	2.4	9.0	4.5
	Tasmania	0.8	2.1	6.4	4.0
	South Australia	1.8	4.0	9.0	6.4
	Western Australia	4.5	6.4	9.0	6.4

Table 3: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	4.0

	New South Wales	4.0
	Victoria	3.2
	Tasmania	3.2
	South Australia	3.2
	Western Australia	5.0
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 4: Risk mitigation measures for Dryland cropping, pre-emergent uses	
Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.17 Group 12b (625 g 2,4-D/L as the DEA/TEA salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if absorbed by skin contact, inhaled or swallowed. Will damage the eyes. Will irritate the skin. Repeated exposure may cause allergic disorders. MIXING OR USING When opening the container and preparing spray, using undiluted concentrate or applying by hand-held spraying equipment or boomspray equipment with open operator's cab, wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with enclosed operator's cab and air filtration or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user.[13]
DO NOT apply by aircraft at rates exceeding 5.1 L/ha.
DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.
DO NOT EXCEED application rates of 7.2 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3 and 4.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.5L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.7L/ha	Cape York	October and November
		Northern Gulf	October and November

[13] Manually pressurised backpack sprayer.

		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING **Peanuts**	Up to 1.8L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.6L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	5.1	5.1	5.1	5.1
	New South Wales	5.1	5.1	5.1	5.1
	Victoria	0.6	1.7	5.1	1.7
	Tasmania	0.6	1.2	3.6	1.7
	South Australia	1.2	1.7	5.1	3.6
	Western Australia	1.7	3.6	5.1	3.6
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	7.2	7.2	7.2	7.2
	New South Wales	7.2	7.2	7.2	7.2
	Victoria	1.0	1.9	7.2	3.6
	Tasmania	0.7	1.7	5.1	3.2
	South Australia	1.4	3.2	7.2	5.1
	Western Australia	3.6	5.1	7.2	5.1

Table 3: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST		
Turf	**State**	**Rate (L/ha)**
	Queensland	3.2
	New South Wales	3.2
	Victoria	2.5
	Tasmania	2.5
	South Australia	2.5
	Western Australia	4.0
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 4: Risk mitigation measures for Dryland cropping, pre-emergent uses	
Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.18 Group 13 (300 g 2,4-D/L form not specified) specific label elements

Note: These products can only be used for aquatic use situations (control of water hyacinth and water lettuce) at rates up to 3000 g ae/ha by knapsack, handgun and sprinklers or up to 1500 g ae/ha by helicopter. This group has special restraints required to minimise risks.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. Avoid inhaling vapour. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 15 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 13.3L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2 and 3.

For aquatic uses:
REMOVE aquatic weeds as much as possible through mechanical means.
DO NOT apply to bodies of water where weed infestations do not exist.
DO NOT treat more than 50% of the total surface area at any one time.
DO NOT treat areas of the same water body for at least 7 days after previous treatments.
DO NOT treat to the point of runoff.
DO NOT apply directly to water, direct spray onto aquatic weeds.
To the extent possible, only treat plants in water bodies greater than 1m deep.

DO NOT apply by aircraft unless the following requirements are met:

- For application by helicopter only, not for application by fixed-wing aircraft.
- Spray droplets are no smaller than a VERY COARSE spray droplet size category
- For maximum release heights above the target canopy of 3m or 25% of wingspan or 25% of rotor diameter whichever is the greatest, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for aircraft') are observed.

Buffer zones for aircraft

Application rate	Type of aircraft	Mandatory downwind buffer zones	
		Natural aquatic areas	Vegetation areas
Up to 10 L/ha	Helicopter	250 metres	240 metres
Up to 5 L/ha	Helicopter	160 metres	150 metres

Table 1: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	11	11	11	11
	New South Wales	11	11	11	11
	Victoria	1.2	3.5	11	3.5
	Tasmania	1.2	2.6	7.4	3.5
	South Australia	2.4	3.5	11	7.4
	Western Australia	3.5	7.4	11	7.4

	State	Summer	Autumn	Winter	Spring
Pastures (established)	Queensland	15	15	15	15
	New South Wales	15	15	15	15
	Victoria	2.0	4.0	15	7.5
	Tasmania	1.4	3.5	11	6.6
	South Australia	3.0	6.6	15	11
	Western Australia	7.5	11	15	11

Table 2: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	6.7
	New South Wales	6.7
	Victoria	5.3
	Tasmania	5.3
	South Australia	5.3
	Western Australia	8.3

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 3: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.19 Group 14a (700 g 2,4-D/kg as the SODIUM salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. Avoid inhaling dust. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 6.4 kg/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 5.7 kg/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (kg/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.3kg/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.5kg/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR	Up to 1.6kg/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions

TO SOWING Peanuts		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.2kg/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (kg/ha) below OR label rate, whichever is LOWEST

	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (prior to sowing, conservation tillage)	Queensland	4.5	4.5	4.5	4.5
	New South Wales	4.5	4.5	4.5	4.5
	Victoria	0.5	1.5	4.5	1.5
	Tasmania	0.5	1.1	3.2	1.5
	South Australia	1.0	1.5	4.5	3.2
	Western Australia	1.5	3.2	4.5	3.2
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	6.4	6.4	6.4	6.4
	New South Wales	6.4	6.4	6.4	6.4
	Victoria	0.9	1.7	6.4	3.2
	Tasmania	0.6	1.5	4.5	2.8
	South Australia	1.3	2.8	6.4	4.5
	Western Australia	3.2	4.5	6.4	4.5

Table 3: Timing restrictions for spraying SUGARCANE

Situation	**Rate (kg/ha)**	**Region**	**Timing Restriction**
			DO NOT APPLY DURING THE MONTHS
	Up to 1.6kg/ha	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	October to November
		Mary/Burnett	October to November
		Northern NSW	No timing restriction

	Up to **5.2kg/ha**	Wet Tropics	August to December
		Burdekin	August to November
		Mackay/Whitsunday	June to December
		Mary/Burnett	USE NOT SUPPORTED
		Northern NSW	August to January

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (kg/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	2.9
	New South Wales	2.9
	Victoria	2.3
	Tasmania	2.3
	South Australia	2.3
	Western Australia	3.6

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.20 Group 14b (800 g 2,4-D/kg as the SODIUM salts) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will damage the eyes. Avoid contact with the eyes and skin. Avoid inhaling dust. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, PVC or rubber apron, elbow-length chemical resistant gloves and full facepiece respirator with dust cartridge or canister. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear full facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 5.6kg/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 5kg/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.1kg/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.3kg/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
		Queensland dryland	No timing restrictions

FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 1.4kg/ha	Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 2.8kg/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (kg/ha) below OR label rate(kg/ha), whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	4.0	4.0	4.0	4.0
	New South Wales	4.0	4.0	4.0	4.0
	Victoria	0.4	1.3	4.0	1.3
	Tasmania	0.4	1.0	2.8	1.3
	South Australia	0.9	1.3	4.0	2.8
	Western Australia	1.3	2.8	4.0	2.8
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	5.6	5.6	5.6	5.6
	New South Wales	5.6	5.6	5.6	5.6
	Victoria	0.8	1.5	5.6	2.8
	Tasmania	0.5	1.3	4.0	2.5
	South Australia	1.1	2.5	5.6	4.0
	Western Australia	2.8	4.0	5.6	4.0

Table 3: Timing restrictions for spraying SUGARCANE

Situation	Rate (kg/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
	Up to 1.4kg**/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	October to November
		Mary/Burnett	October to November

		Northern NSW	No timing restriction
	Up to 4.6kg/ha	Wet Tropics	August to December
		Burdekin	August to November
		Mackay/Whitsunday	June to December
		Mary/Burnett	USE NOT SUPPORTED
		Northern NSW	August to January

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (kg/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	2.5
	New South Wales	2.5
	Victoria	2.0
	Tasmania	2.0
	South Australia	2.0
	Western Australia	3.1

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.21 Group 15a (22.8 g 2,4-D/L as the SODIUM salt) specific label elements

Withholding Period:	DO NOT harvest for 4 weeks after application

Safety Directions:	HAZARDS & PRECAUTIONS May irritate the eyes. Avoid contact with the eyes. Repeated exposure may cause allergic disorders. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

9.22 Group 15b (100 g 2,4-D/L as the DMA salt)

Safety Directions:	HAZARDS & PRECAUTIONS Will irritate the eyes. May irritate the skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or dip, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat. When applying by dip wear protective waterproof clothing, elbow-length chemical resistant gloves and impervious footwear. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by a vertical sprayer unless the following requirements are met:

- Spray is not directed above the target canopy
- The outside of the sprayer is turned off when turning at the end of rows and when spraying the outer row on each side of the application site.
- For dilute water rates up to the maximum listed for each type of canopy specified, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titles 'Buffer zones for vertical sprayers') are observed.

Buffer zones for vertical sprayers

Type of target canopy and dilute water rate	Mandatory no-spray zones	
	Natural aquatic areas	Vegetation areas
2 metres tall and shorter, maximum dilute water rate of 1000 L/ha	Not required	Not required
Taller than 2 metres (not fully-foliated), maximum dilute water rate of 4000 L/ha	15 metres	15 metres
Taller than 2 metres (fully-foliated), maximum dilute water rate of 4000 L/ha	10 metres	5 metres

9.23 Group 16a (80 g 2,4-D/L as the DMA/DEA salts + 336 g/L Mecoprop + 40 g/L Dicamba) (commercial product) specific label elements

Mode of Action:	GROUP I HERBICIDE
Protection Statements:	PROTECTION OF LIVESTOCK DO NOT graze treated turf/lawn; or feed turf/lawn clippings from any treated area to poultry or livestock.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Corrosive to the eyes and skin. Will irritate the nose and throat. Repeated exposure may cause allergic disorders. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear protective waterproof clothing, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, impervious footwear, goggles and half facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by hand-held spray equipment wear chemical resistant clothing buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[14].

[14] Manually pressurised backpack sprayer

9.24 Group 16b (350 g 2,4-D/L as the DEA salt + 45 g/L Clopyralid + 45 g/L Dicamba) specific label elements

Mode of Action:	GROUP	I	HERBICIDE

Precautions:	RE-ENTRY PERIOD If re-entering treated areas before the spray has dried, workers should wear overalls, elbow-length gloves and water-resistant footwear. Hand weeding and transplanting should not occur for 23 days after spray application unless workers wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves and footwear.
Protection Statements:	PROTECTION OF LIVESTOCK DO NOT graze treated turf or feed grass clippings from treated area to poultry or livestock.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will damage the eyes. Will irritate the skin. Repeated exposure may cause allergic disorders. Avoid contact with the eyes and skin. Do not inhale spray mist. MIXING OR USING When opening the container and preparing spray, wear chemical resistant clothing buttoned to the neck and wrist, cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment with open operator's cab or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by hand-held spraying equipment, wear chemical resistant clothing buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and full facepiece respirator with organic vapour/gas cartridge or canister. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[15].

DO NOT apply by aircraft at rates exceeding 3.9 L/ha.

DO NOT use open mixing/loading equipment if treating more than 50 hectares in one day.

[15] Manually pressurised backpack sprayer.

9.25 Group 17 (577 g 2,4-D as EHE + 100 g Ioxynil/L) specific label elements

Constituent Statement:	577 g/L 2,4-D present as ETHYLHEXYLESTER 100g/L IOXYNIL present as the OCTANOATE

Mode of Action:	GROUP	C I	HERBICIDE
Withholding Period:	DO NOT harvest Sugarcane for 60 days after application		

Resistance Warning:	Resistant Weeds Warning [INSERT PRODUCT NAME] herbicide is a member of the NITRIL and PHENOXY group of herbicides. The product has the inhibitors of photosynthesis at photosystem II and disruptors of plant cell growth mode of action. For weed resistance management [INSERT PRODUCT NAME] is a Group C and Group I herbicide. Some naturally-occurring weed biotypes resistant to [INSERT PRODUCT NAME] and other Group C and I herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by [INSERT PRODUCT NAME] or other Group C and I herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use, [INSERTCOMPANY NAME] accepts no liability for any losses that may result from the failure of [INSERT PRODUCT NAME] to control resistant weeds.

Protection Statements:	INTEGRATED PEST MANAGEMENT Toxic to beneficial arthropods. Not compatible with integrated pest management (IPM) programs utilising beneficial arthropods. Minimise spray drift to reduce harmful effects on beneficial arthropods in non-crop areas.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will damage the eyes. Will irritate the skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed the maximum daily application rate by backpack spraying of 6.9 L/day.
Additional USAGE restrictions apply in some states and seasons, see restriction table 1.

Table 1: Timing restrictions for spraying SUGARCANE			
Situation	**Rate (L/ha)**	**Region**	**Timing Restriction**
			DO NOT APPLY DURING THE MONTHS
	Up to **1.5L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		Northern NSW	No timing restriction
	Up to **2L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restrictions
		Mackay/Whitsunday	October to November
		Mary/Burnett	October to November
		Northern NSW	No timing restriction

9.26 Group 18 (600 g 2,4-D/L as EHE) specific label elements

Protection Statements:	PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers. INTEGRATED PEST MANAGEMENT Toxic to beneficial arthropods. Not compatible with integrated pest management (IPM) programs utilising beneficial arthropods. Minimise spray drift to reduce harmful effects on beneficial arthropods in non-crop areas.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will irritate the eyes and skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, goggles and half face piece respirator with organic vapour/gas cartridge or canister. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 7.5 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 6.7L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.5L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.8L/ha	Cape York	October and November
		Northern Gulf	October and November

		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 1.9L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.8L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate (L/ha), whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	5.3	5.3	5.3	5.3
	New South Wales	5.3	5.3	5.3	5.3
	Victoria	0.6	1.7	5.3	1.7
	Tasmania	0.6	1.3	3.7	1.7
	South Australia	1.2	1.7	5.3	3.7
	Western Australia	1.7	3.7	5.3	3.7
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	7.5	7.5	7.5	7.5
	New South Wales	7.5	7.5	7.5	7.5
	Victoria	1.0	2.0	7.5	3.8
	Tasmania	0.7	1.8	5.3	3.3
	South Australia	1.5	3.3	7.5	5.3
	Western Australia	3.8	5.3	7.5	5.3

Table 3: Timing restrictions for spraying SUGARCANE

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
	Up to **1.3L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	No timing restriction
		Mary/Burnett	No timing restriction
		Northern NSW	No timing restriction
	Up to **2.7L/ha**	Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	August to December and April to May
		Northern NSW	No timing restriction

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	3.3
	New South Wales	3.3
	Victoria	2.6
	Tasmania	2.6
	South Australia	2.6
	Western Australia	4.2

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.27 Group 19a (680 g 2,4-D/L as EHE) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will irritate the eyes and skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, goggles and half face piece respirator with organic vapour/gas cartridge or canister. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 6.6 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 5.9L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.3L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 1.6L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR	Up to 1.6L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions

TO SOWING **Peanuts**		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 3.3L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (prior to sowing, conservation tillage)	Queensland	4.7	4.7	4.7	4.7
	New South Wales	4.7	4.7	4.7	4.7
	Victoria	0.5	1.5	4.7	1.5
	Tasmania	0.5	1.1	3.3	1.5
	South Australia	1.1	1.5	4.7	3.3
	Western Australia	1.5	3.3	4.7	3.3
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	6.6	6.6	6.6	6.6
	New South Wales	6.6	6.6	6.6	6.6
	Victoria	0.9	1.8	6.6	3.3
	Tasmania	0.6	1.5	4.7	2.9
	South Australia	1.3	2.9	6.6	4.7
	Western Australia	3.3	4.7	6.6	4.7

Table 3: Timing restrictions for spraying SUGARCANE

Situation	**Rate (L/ha)**	**Region**	**Timing Restriction**
			DO NOT APPLY DURING THE MONTHS
	Up to **1.2L/ha**	Wet Tropics	No timing restriction
		Burdekin	No timing restriction
		Mackay/Whitsunday	No timing restriction
		Mary/Burnett	No timing restriction
		Northern NSW	No timing restriction

	Up to **2.4L/ha**	Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	August to December and April to May
		Northern NSW	No timing restriction

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	2.9
	New South Wales	2.9
	Victoria	2.3
	Tasmania	2.3
	South Australia	2.3
	Western Australia	3.7

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.28 Group 19b (up to 450 g 2,4-D/L as EHE) specific label elements

Protection Statements:	INTEGRATED PEST MANAGEMENT Toxic to beneficial arthropods. Not compatible with integrated pest management (IPM) programs utilising beneficial arthropods. Minimise spray drift to reduce harmful effects on beneficial arthropods in non-crop areas.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if swallowed. Will irritate the eyes and skin. Avoid contact with the eyes and skin. MIXING OR USING When opening the container and preparing spray or using undiluted concentrate, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves, goggles and half face piece respirator with organic vapour/gas cartridge or canister. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, goggles, respirator (and if rubber wash with detergent and warm water) and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT exceed maximum application rate of 10 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 8.9 L/day.
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3, 4 and 5.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 1.9L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May
	Up to 2.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December

		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 2.5L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 5L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	7.1	7.1	7.1	7.1
	New South Wales	7.1	7.1	7.1	7.1
	Victoria	0.8	2.3	7.1	2.3
	Tasmania	0.8	1.7	4.9	2.3
	South Australia	1.6	2.3	7.1	4.9
	Western Australia	2.3	4.9	7.1	4.9
Pastures (established)	**State**	**Summer**	**Autumn**	**Winter**	**Spring**
	Queensland	10	10	10	10
	New South Wales	10	10	10	10
	Victoria	1.3	2.7	10	5.0
	Tasmania	0.9	2.3	7.1	4.4
	South Australia	2.0	4.4	10	7.1
	Western Australia	5.0	7.1	10	7.1

Table 3: Timing restrictions for spraying SUGARCANE

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
		Wet Tropics	No timing restriction

	Up to **1.7L/ha**	Burdekin	No timing restriction
		Mackay/Whitsunday	No timing restriction
		Mary/Burnett	No timing restriction
		Northern NSW	No timing restriction
	Up to 3.6**L/ha**	Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	August to December and April to May
		Northern NSW	No timing restriction

Table 4: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	**Rate (L/ha)**
Turf	Queensland	4.4
	New South Wales	4.4
	Victoria	3.5
	Tasmania	3.5
	South Australia	3.5
	Western Australia	5.6

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 5: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	**Risk mitigation measures**
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.29 Group 20 (421 g 2,4-D/L as EHE + 2.1g/L Pyraflufen-ethyl) specific label elements

Constituent Statement:	421g/L 2,4 D present as Ethylhexyl ester 2.1g/L Pyraflufen

Mode of Action:	GROUP	G I	HERBICIDE

Resistance Warning:	Resistant Weeds Warning [INSERT PRODUCT NAME] herbicide is a member of the ARYL TRIAZOLINONE and PHENOXY groups of herbicides. The product has the disruptors of plant cell growth mode of action and of membrane disruption, which is initiated by the inhibition of the enzyme protoporphyrinogen oxidase. For weed resistance management [INSERT PRODUCT NAME] is a Group G and I herbicide. Some naturally-occurring weed biotypes resistant to [INSERT PRODUCT NAME] and other Group G and I herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by [INSERT PRODUCT NAME] or other Group G and I herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use, [INSERTCOMPANY NAME] accepts no liability for any losses that may result from the failure of [INSERT PRODUCT NAME] to control resistant weeds.

Protection Statements:	INTEGRATED PEST MANAGEMENT Toxic to beneficial arthropods. Not compatible with integrated pest management (IPM) programs utilising beneficial arthropods. Minimise spray drift to reduce harmful effects on beneficial arthropods in non-crop areas.

Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will irritate the eyes and skin. Avoid contact with the eyes and skin. Do not inhale vapour. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

RESTRAINTS

DO NOT exceed maximum application rate of 11 L/ha (4500 g ae/ha).
DO NOT exceed the maximum daily application rate by backpack spraying of 9.5L/day.

Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2 and 3

Table 1: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	7.6	7.6	7.6	7.6
	New South Wales	7.6	7.6	7.6	7.6
	Victoria	0.8	2.5	7.6	2.5
	Tasmania	0.8	1.9	5.3	2.5
	South Australia	1.7	2.5	7.6	5.3
	Western Australia	2.5	5.3	7.6	5.3

	State	Summer	Autumn	Winter	Spring
Pastures (established)	Queensland	11	11	11	11
	New South Wales	11	11	11	11
	Victoria	1.4	2.9	11	5.3
	Tasmania	1.0	2.5	7.6	4.7
	South Australia	2.1	4.7	11	7.6
	Western Australia	5.3	7.6	11	7.6

Table 2: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Rate (L/ha)
Turf	Queensland	4.8
	New South Wales	4.8
	Victoria	3.7
	Tasmania	3.7
	South Australia	3.7
	Western Australia	5.9

If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.

Table 3: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

9.30 Group 20b 300g/L 2,4-D (EHE) with up to 6.25g/L florasulam specific label elements.

Resistance Warning	THE PRODUCT contains members of the phenoxy and triazolopyrimidine sulfonanilide group of herbicides. The product has the disrupters of cell growth and acetolactate synthase (ALS) inhibitor modes-of-action. For herbicide resistance management, the product is a Group I + Group B herbicide. Some naturally occurring weed biotypes resistant to the product and other Group I and/or Group B herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by this product or other Group I or Group B herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use the holder accepts no liability for any losses that may result from the failure of the product to control resistant weeds. Strategies to minimise the risk of herbicide resistance are available. Contact your farm chemical supplier, consultant or local Department of Agriculture. The herbicide is a broadleaf herbicide with no grass weed activity and exerts no selection pressure on annual ryegrass
Precautions	RE-ENTRY Do not allow entry into treated areas until the spray has dried when conducting low exposure activities such as hand weeding unless wearing cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves. Clothing must be laundered after each day's use. Do not allow entry into treated areas for 13 days when conducting medium exposure activities such as scouting unless wearing cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves. Clothing must be laundered after each day's use.
Protection Statements:	INTEGRATED PEST MANAGEMENT Toxic to beneficial arthropods. Not compatible with integrated pest management (IPM) programs utilising beneficial arthropods. Minimise spray drift to reduce harmful effects on beneficial arthropods in non-crop areas.
Safety Directions:	HAZARDS & PRECAUTIONS Repeated exposure may cause allergic disorders. Sensitive workers should use protective clothing. Avoid contact with skin MIXING OR USING When opening the container and preparing the spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing). In addition, when mixing and loading, wear elbow-length chemical resistant gloves. AFTER USE Wash hands after use. After each day's use wash gloves and contaminated clothing.
First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by aerial equipment.

9.31 Group 21 800 g/L 2,4-D present as High volatility ester (Ethyl ester) specific label elements

The decision on 2,4-D products containing high volatile esters including isobutyl ester (IBE) and the ethyl ester (EE) was actioned in 2013.[16] There are two current product approvals that fall into this category (numbers 31209 [2,4-D ethyl ester] and 83795 [2,4-D isobutyl ester]). Use of these products is geographically restricted to Western Australia and subject to the State's Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979.[17] Accordingly only the human health-associated label elements require updating. The remaining elements of the existing label approvals (approval numbers 31209/117752 and 83795/108986 are considered to be sufficient provided that the products are used in accordance with the Western Australian Agriculture and Related Resources Protection (Spraying Restrictions) Regulations 1979.	
Safety Directions:	HAZARDS & PRECAUTIONS Harmful if inhaled or swallowed. Will irritate the eyes and skin. Avoid contact with the eyes and skin. Do not inhale vapour. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and face shield or goggles. When using the prepared spray, wear cotton overalls buttoned to the neck and wrist and a washable hat and elbow-length chemical resistant gloves. If applying by hand wear half facepiece respirator with organic vapour/gas cartridge or canister. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water, face shield or goggles and contaminated clothing.
First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by aircraft or ground-based misters
DO NOT apply this product:

- in aquatic situations
- to rights of way
- as a harvest aid/salvage spray

DO NOT apply more than 560g ae/ha (700mL of this product per ha) (ae=active equivalent).
DO NOT apply within 2km of potentially sensitive or susceptible aquatic areas, town sites or non-target vegetation. The latter includes commercial seedling and plant nurseries, horticultural crops, grapevines, tomato crops, intensive agricultural operations and wildflower processing crops, national parks, nature reserves, areas and aquaculture operations.
DO NOT USE in any state or territory except WA.
Product MUST BE USED in accordance with relevant WA legislation and regulations. **NOTE: Refer to Department of Agriculture and Food for state restricted spray areas** agric.wa.gov.au.

[16] apvma.gov.au/node/12351

[17] legislation.wa.gov.au/legislation/prod/filestore.nsf/FileURL/mrdoc_20784.pdf/$FILE/Agriculture%20and%20Related%20Resources%20Protection%20(Spraying%20Restrictions)%20Regulations%201979%20-%20%5B01-b0-07%5D.pdf?OpenElement

9.32 Group 22a (10.3 g 2,4-D/kg + 10.3g/kg Mecoprop + 0.7g/kg Dicamba) (Home Garden Products) specific label elements

Note: Label elements must adhere to the home garden and domestic pest control products section of the Agricultural Labelling Code.

Constituent Statement:	10.3g/kg 2,4-D as Acid 10.3 g/kg Mecoprop 0.7 g/kg Dicamba

CAUTION	DO NOT feed grass clippings from treated areas to poultry or other animals. DO NOT allow spray to contact or drift onto plants you do not want killed. DO NOT allow chemical containers or spray to get into drains, sewers, streams or ponds

STORAGE AND DISPOSAL:	Store in the closed, original container in a cool, dry place out of the reach of children. Do not store in direct sunlight. Dispose of empty container by wrapping in paper, placing in plastic bag and putting in garbage.

Safety Directions:	HAZARDS & PRECAUTIONS Will irritate the eyes. May irritate the skin, nose and throat. Avoid contact with the eyes and skin. Avoid inhaling dust. MIXING OR USING When opening the container and using the product, wear long-sleeved shirt, long pants shoes and socks, goggles or safety glasses and rubber gloves. If product in eyes, wash it out immediately with water. AFTER USE Wash hands after use. After each day's use wash gloves goggles or safety glasses and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

9.33 Group 22b (80 g 2,4-D/L as the DMA/DEA salt + 336 g/L Mecoprop + 40 g/L Dicamba) (Home Garden products)

Cancelation of all products in this group is proposed. Accordingly label elements have not been provided.

9.34 Group 23 (440 g 2,4-D/L as acid/ the DEA salt) specific label elements

Safety Directions:	HAZARDS & PRECAUTIONS Poisonous if inhaled or swallowed. Corrosive to the eyes. Will damage the skin. Repeated exposure may cause allergic disorders. Will irritate the nose and throat. Avoid contact with the eyes and skin. Do not inhale vapour or spray mist. MIXING OR USING When opening the container and preparing spray, wear cotton overalls buttoned to the neck and wrist and a washable hat, PVC or rubber apron, elbow-length chemical resistant gloves, goggles and half facepiece respirator with organic vapour/gas cartridge or canister. If applying by boomspray equipment or aerial spraying equipment, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and elbow-length chemical resistant gloves. If applying by hand-held spray equipment wear chemical resistant clothing buttoned to the neck and wrist and a washable hat, elbow-length chemical resistant gloves and half facepiece respirator with organic vapour/gas cartridge or canister. If clothing becomes contaminated with product remove clothing immediately. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. AFTER USE After use and before eating, drinking or smoking wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, respirator and if rubber wash with detergent and warm water and contaminated clothing.

First Aid Instructions:	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 13 11 26, New Zealand 0800 764 766.

GENERAL RESTRAINTS

DO NOT apply by spraying equipment carried on the back of the user[18].
DO NOT treat more than 50 hectares in one day if using open mixing/loading equipment.
DO NOT exceed maximum application rate of 10 L/ha (4500 g ae/ha).
Additional USAGE restrictions apply in some crops, states and seasons, see restriction tables 1, 2, 3 and 4.

Table 1: Timing restrictions for spraying peanuts in QLD production horticulture regions

Situation	Rate (L/ha)	Region	Timing Restriction
			DO NOT APPLY DURING THE MONTHS
FALLOW SPRAY PRIOR TO SOWING Peanuts	Up to 2.0L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	September to December
		Mary/Burnett	October to November
		SE Queensland	August to May

[18] Manually pressurised backpack sprayer

	Up to 2.4L/ha	Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	October
		Mackay/Whitsunday	August to December
		Mary/Burnett	September to November
		SE Queensland	**Use not supported**
FALLOW (BAND) SPRAY PRIOR TO SOWING Peanuts	Up to 2.5L/ha	Queensland dryland	No timing restrictions
		Cape York	No timing restrictions
		Northern Gulf	October and November
		Wet Tropics	No timing restrictions
		Burdekin	No timing restrictions
		Mackay/Whitsunday	No timing restrictions
		Mary/Burnett	No timing restrictions
		SE Queensland	October to January
OVERALL SPRAY, PRE-EMERGENCE, Peanuts	Up to 5.1L/ha	Queensland dryland	June to August
		Cape York	October and November
		Northern Gulf	October and November
		Wet Tropics	October to December
		Burdekin	September and October
		Mackay/Whitsunday	August to December
		Mary/Burnett	April to January
		SE Queensland	**Use not supported**

Table 2: Application and timing restrictions for application to pastures

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST

	State	Summer	Autumn	Winter	Spring
Pastures (prior to sowing, conservation tillage)	Queensland	7.2	7.2	7.2	7.2
	New South Wales	7.2	7.2	7.2	7.2
	Victoria	0.8	2.4	7.2	2.4
	Tasmania	0.8	1.8	5.0	2.4
	South Australia	1.6	2.4	7.2	5.0
	Western Australia	2.4	5.0	7.2	5.0
	State	**Summer**	**Autumn**	**Winter**	**Spring**
Pastures (established)	Queensland	10	10	10	10
	New South Wales	10	10	10	10
	Victoria	1.4	2.7	10	5.1
	Tasmania	1.0	2.4	7.2	4.5
	South Australia	2.0	4.5	10	7.2
	Western Australia	5.1	7.2	10	7.2

Table 3: Application restrictions for TURF

DO NOT apply above maximum rate (L/ha) below OR label rate, whichever is LOWEST		
	State	**Rate (L/ha)**
Turf	Queensland	4.5
	New South Wales	4.5
	Victoria	3.6
	Tasmania	3.6
	South Australia	3.6
	Western Australia	5.7
If applying to golf courses in Tasmania, DO NOT apply to fairways adjacent to natural water bodies.		

Table 4: Risk mitigation measures for Dryland cropping, pre-emergent uses

Situation	Risk mitigation measures
Dryland cropping, Preparatory spray	Only apply in no-till farming systems (Tasmania, South Australia)
Winter cereals, pre-emergence uses	Only apply in no-till farming systems (Tasmania, South Australia, Western Australia)
Summer cereals, pre-emergent uses	Only apply in no-till farming systems (Tasmania, South Australia)

REFERENCE

Adema D and Roza P, 1989, *The Acute Toxicity of U 46-D_Fluid (500 g 2,4-D Acid as Dimethylamine Salt/L) to Eisenia Fetida. Laboratory Project ID R 89/153.* TNO Division of Technology for Society, Delft, the Netherlands. 5 October 1989.

Agricultural and Veterinary Chemicals Code Act (1994) (Cth).

Alexander H, Gersich F, Mayes M and Applegath S, 1983b, *The Acute Toxicity of (2,4-Dichlorophenoxy) Acetic Acid Isooctyl Ester to Representative Aquatic Organisms. Laboratory Project Study ID ES-DR-0019-1208-3*. Dow Chemical USA, Midland, Michigan. 1 August 1983.

Alexander H, Mayes M and Gersich F, 1983a, *The Acute Toxicity of (2,4-Dichlorophenoxy)Acetic Acid to Representative Aquatic Organisms. Laboratory Project Study ID ES-DR-0002-2297-4*. Dow Chemical Company, Midland, Michigan. 7 March 1983.

Alexander H, Mayes M, Gersich F, Bartlett E and Applegath S, 1983c, *The Acute Toxicity of (2,4-Dichlorophenoxy) Acetic Acid Dimethylamine Salt to Representative Aquatic Organisms. Laboratory Project Study ID ES-DR-0008-3556-2*. Dow Chemical USA, Midland, Michigan. 7 March 1983.

ANZECC/ARMCANZ, 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (Chapters 1–7).* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ). Paper No. 4 – Volume 1. October 2000.

APVMA, 2019, *APVMA standards for active constituents for use in agricultural chemical products*. available at: apvma.gov.au/chemicals-and-products/active-constituents/standards, accessed October 2019.

Arbuckle TE, Savitz DA, Mery LS and Curtis KM 1999, *Exposure to phenoxy herbicides and the risk of spontaneous abortion.* Epidemiology, 10: 752–760.

Backus P and Crosby K, 1992a, *Effect of 2,4-D 2-EHE on Seed Germination/Seedling Emergence (Tier II).* Ricera Inc. Document No: 3722-90-0409-BE-001. Ricera Inc, Painesville, Ohio. 17 June 1992.

Backus P and Crosby K, 1992c, *Effect of 2,4-D DMAS on Seed Germination/Seedling Emergence (Tier II).* Ricera Inc. Document No: 3722-90-0407-BE-001. Ricera Inc, Painesville, Ohio. 17 June 1992.

Backus P, 1992a, *Effect of 2,4-D Acid on Seed Germination/Seedling Emergence (Tier II)*. Ricera Inc. Document No: 5097-91-0389-BE-001. Ricera Inc, Painesville, Ohio. 7 July 1992.

Backus P, 1992b, *Effect of 2,4-D Acid on vegetative vigour of plants (tier II)*, document no. 5097-91-0390-BE-001.

Backus P, 1995, *Supplemental Test. Effect of 2,4-D 2-Ethylhexyl Ester on Seedling Emergence (Tier II)*. Ricera Inc. Document No: 6128-94-0140-BE-001. Ricera Inc, Painesville, Ohio. 26 January 1995.

Backus P, Crosby K, 1992b, *Effect of 2,4-D 2-EHE on vegetative vigour of plants (tier II)*, document no. 3722-90-0410-BE-001

Bailey R and Hopkins D, 1987*, 2,4-Dichlorophenoxyacetic Acid: Determination of Octanol/Water Partition Coefficient.* Laboratory Project ID ES-DR-0002-2297-9. Dow Chemical Company, Midland, Michigan. 14 December 1987.

Banks YB, Birnbaum LS. 1991, *Absorption of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) after low dose dermal exposure*. Toxicology and Applied Pharmacology 107:302-310.

Barney W, 1994, *Aquatic Field Dissipation Study of 2,4-DMA in Louisiana. Study Number 2001RI* - Louisiana. Environmental Technologies Institute, Inc, Durham, North Carolina. 16 December 1994.

Barney W, 1995a, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Pasture in Texas. Study Number 2000PA04*. Environmental Technologies Institute, Inc, Durham, North Carolina. 22 June 1995.

Barney W, 1995b, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Wheat in North Carolina. Study Number 2000WH08*. Environmental Technologies Institute, Inc, Durham, North Carolina. 1 May 1995.

Barney W, 1995c, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Turf in North Carolina. Study Number 2000TF04*. Environmental Technologies Institute, Inc, Durham, North Carolina. 9 August 1995.

Barney W, 1995d, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Bare Soil in North Carolina Conducted According to a Turf Use Pattern. Study Number 2000BS04*. Environmental Technologies Institute, Inc, Durham, North Carolina. 9 August 1995.

Barney W, 1995e, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Bare Soil in North Carolina Conducted According to a Wheat Use Pattern. Study Number 2000WH04*. Environmental Technologies Institute, Inc, Durham, North Carolina. 16 March 1995.

Barney W, 1995f, *Forest Field Dissipation Study of 2,4-Dichlorophenoxyacetic Acid, Dimethylamine Salt in Oregon. Study Number 2002FO01*. Environmental Technologies Institute, Inc, Durham, North Carolina. 20 December 1995.

Barney W, 1995g, *Terrestrial Field Dissipation Study of 2,4-D DMA on Pasture in Texas. Study Number 2000PA02*. Environmental Technologies Institute, Inc, Durham, North Carolina. 2 June 1995.

Barney W, 1995h, *Terrestrial Field Dissipation Study of 2,4-D DMA on Wheat in North Carolina. Study Number 2000WH06*. Environmental Technologies Institute, Inc, Durham, North Carolina. 10 March 1995.

Barney W, 1995i, *Terrestrial Field Dissipation Study of 2,4-D DMA on Turf in North Carolina. Study Number 2000TF02*. Environmental Technologies Institute, Inc, Durham, North Carolina. 20 September 1995.

Barney W, 1995j, *Terrestrial Field Dissipation Study of 2,4-D DMA on Bare Soil in North Carolina Conducted According to a Turf Use Pattern. Study Number 2000BS02.* Environmental Technologies Institute, Inc, Durham, North Carolina. 20 September 1995.

Barney W, 1995k, *Terrestrial Field Dissipation Study of 2,4-D DMA on Bare Soil in North Carolina Conducted According to a Wheat Use Pattern*. Study Number 2000WH02. Environmental Technologies Institute, Inc, Durham, North Carolina. 10 March 1995.

Barney W, 1996, *Forest Field Dissipation Study of 2,4-Dichlorophenoxyacetic Acid, Isooctyl (2-Ethylhexyl) Ester in Georgia. Study Number 2002FO02*. Environmental Technologies Institute, Inc, Durham, North Carolina. 2 February 1996.

Beattie, H. 2011, *2,4-Dichlorophenol: Algal Growth Inhibition Test with 2,4-Dichlorophenol to the alga Pseudokirchneriella subcapitata over a 72 hour exposure period.* European Union 2,4-D Task Force 2012.

Beattie, H. 2011, *The acute toxicity of 2,4-Dichlorophenol to Daphnia magna over a 48 hour exposure period.* European Union 2,4-D Task Force 2012.

Beavers J, 1984a, *(2,4-Dichlorophenoxy) Acetic Acid Isooctyl Ester: An Acute Oral Toxicity Study with the Mallard. Project Number 103-229.* Wildlife International, Maryland. 21 August 1984.

Beavers J, 1984b, *(2,4-Dichlorophenoxy) Acetic Acid Isooctyl Ester: A Dietary LC50 Study with the Mallard. Project Number 103-228*. Wildlife International, Maryland. 30 July 1984.

Beavers J, 1984c, *(2,4-Dichlorophenoxy) Acetic Acid Isooctyl Ester: A Dietary LC50 Study with the Bobwhite Quail. Project Number 103-227*. Wildlife International, Maryland. 30 July 1984.

Benson BW 1981a, *2,4-Dichlorophenoxyacetic acid, dimethylamine salt (2,4-D DMA); determination of the acute oral LD50 in Fischer 344 rats. Report Study No. 490-003*. International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 19 of 96].

Benson, BW, 1981b, *2,4-Dichlorophenoxyacetic acid, dimethylamine salt (2,4-D DMA); determination of the acute dermal LD50 in rabbits. Report Study No. 490-006*. International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 18 of 96].

Bentley, R, 1974, *Acute Toxicity of DMA-4 to Blueguill (Lepomis macrochirus) and Rainbow Trout (Salmo Gairdneri). Laboratory Project Study ID 256940*. Bionomics–EG&G Environmental Consultants, Wareham, Massachusetts. September 1974.

Berdasco, NM, 1989c, *2,4-D Triisopropanolamine Salt: Dermal Sensitisation potential in the Hartley Albino Guinea Pig. Study ID K-00886600-002E* Unpublished. 6 September 1989.

Berdasco, NM and Mizell, MJ, 1989d, *2,4-Dicholorphenoxyacetic acid triisopropanolamine salt: Primary Eye Irritation Study in New Zealand White Rabbits. Laboratory Project Study ID K-008866-002C* The Toxicology Research Laboratory, Dow Chemical Company, Midland MI USA. 7 September 1989

Berdasco, NM, Schuetz, DJ, Jersey, GC, Mizell, MJ, 1989a, *2,4-Dichlorophenoxyacetic acid triisopropylamine salt: Acute oral toxicity study in Fischer 344 rats, Laboratory Project Study ID K-008866-002A*, The Toxicology Research Laboratory Health and Environmental Sciences the Dow Chemical Company Midland Michigan 48674, 28 November 1989.

Berdasco, NM, Schuetz, DJ, Jersey, GC, Mizell, MJ, 1989b, *2,4-Dichlorophenoxyacetic acid triisopropylamine salt: Acute dermal toxicity study in New Zealand White Rabbits, Laboratory Project Study ID K-008866-002D*, The

Toxicology Research Laboratory Health and Environmental Sciences the Dow Chemical Company Midland Michigan 48674, 14 September1989.

Beyer, A, and Matthies, M, 2002, *Criteria for Atmospheric Long-Range Transport Potential and Persistence of Pesticides and Industrial Chemicals*. Umwelt Bundes Amt für Mensch und Umwelt. Erich Schmidt Verlag GmbH & Co. Berlin. ISBN 3-503-06685-3

Birkved, M, and Hauschild, M, *PESTLCI - A Pesticide Distribution Model for LCA. Development of a Pesticide Distribution Model for use in Lifecycle Inventory Analysis. Institute for Product Development*. Technical University of Denmark. Lyngby, April 2003.

Bond, GG, Wetterstroem, NH, Roush, GJ, McLaren, EA, Lipps, T, Cook, RR, 1988, *Cause specific mortality among employees engaged in the manufacture, formulation, or packaging of 2,4-dichlorophenoxyacetic acid and related salts*. British Journal of Industrial Medicine; 45:98105.

Bortolozzi, AA, Duffard, RO, and Evangelista de Duffard, 1998, *Behavioural alterations induced in rats by a pre and postnatal exposure to 2,4-Dichlorophenoxyacetic acid. Neurotoxicology and Teratology*. 2(4): 451–465.

Bowmer, K, Korth, W, Scott, A, McCorkelle, G, and Thomas, M, 1998, *Pesticide Monitoring in the Irrigation Areas of South-Western NSW 1990–1995*. CSIRO Land and Water. Technical Report 17/98. April 1998.

Brockmann, A, 2011, *Evaluation of the phytotoxicity of LAF-74 (2,4-D dimethylammonium 600 g ae/l, SL) GLP Seedling Emergence and Seedling Growth Test Terrestrial Non Target Plants.* (Based on OECD Guideline 208) – Europe 2011. European Union 2,4-D Task Force 2012.

Brockmann, A, 2011, *Evaluation of the phytotoxicity of LAF-74 (2,4-Ddimethylammonium 600 g ae/l, SL) GLP Vegetative Vigour Test Terrestrial Non Target Plants (based on OECD Guideline 227) –Europe 2011*. European Union 2,4-D Task Force 2012.

Burgener, A, 1993, *2,4-D (In Form of DMA Salt): Mobility and Degradation in Soil in Outdoor Lysimeters. Study Project Number RCC Project 272586.* R C C Umweltchemie Ag, Itingen, Switzerland. 8 April 1993.

Burgoa, B, and Wauchope, R, 1995, *Pesticides in run-off and surface waters (Chapter 5).* In Environmental Behaviour of Agrochemicals. John Wiley and Sons Ltd.

Burns, CJ, and Swaen, GM, 2012, *Review of 2,4-dichlorophenoxyacetic acid (2,4-D) biomonitoring and epidemiology*. Crit Rev Toxicol. Oct 42(9): 768–786.

Burns, CJ, Beard, KK, and Cartmill, JB, 2001, *Mortality in chemical workers potentially exposed to 2,4-D, 1945–94: An update.* Occup Environ Med. 58(1): 24–30

Chakrabarti and Gennrich, 1987a, *Vapour Pressure of 2,4-Dichlorophenoxyacetic Acid. Laboratory Project ID ML-AL 87-40047*. Dow Chemical Company. Midland, Michigan. 25 November 1987.

Chakrabarti and Gennrich, 1987b, *Vapour Pressure of 2,4-Dichlorophenoxyacetic Acid-Ethylhexyl Ester. Laboratory Project ID ML-AL 87-40048*. Dow Chemical Company. Midland, Michigan. 25 November 1987.

Chakrabarti, 1989, *Vapour Pressure of the Butoxyethyl Ester of (2,4-Diclorophenoxy) Acetic Acid Measured by the Knudsen-Effusion/Weight Loss Method. Laboratory Project ID ML-AL 89-020197*. September 11, 1989.

Chandrasehar, G, 2001, *Effect of 2,4-D Acid Technical on the Growth of Green Alga (Chlorella Vulgaris). Project No. PP-35-2001*. Report No. 9794. Frederick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Charles, JM, Cunny HC, Wilson RD, Bus, JS, Lawlor, TE, Cifone, MA, Fellows, M, and Gollapudi, B, 1999a, *Ames assays and unscheduled DNA synthesis assays on 2,4-dichlorophenoxyacetic acid and its derivatives*. Sponsor: Industry Task Force II, USA. Mutation Research 444, 207–216.

Charles, JM, Cunny, HC, Wilson, RD, Ivett, JL, Murli, H, Bus, JS, and Gollapudi, B, 1999b, *In vivo micronucleus assays on 2,4-dichlorophenoxyacetic acid and its derivatives*. Sponsor: Industry Task Force II, USA. Mutation Research 444, 227–234.

Charles, JM, Hanley, RT, Wilson, RD, Van Ravenzwaay, B, and Bus, JS, 2001, *Developmental toxicity studies in rats and rabbits on 2,4-dichlorophenoxyacetic acid and its forms*. Toxicological Sciences, 60 121–131.

Chhimwal, R, 2013a, *Acute oral toxicity study of 2,4-D acid technical in rats. Study No. 401-1-01-6786*. Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 5 August, 2013

Chhimwal, R, 2013b, *Acute dermal toxicity study of 2,4-D acid technical in rats. Study No. 403-1-01-6787*. Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 5 August, 2013

Chhimwal, R, 2013c, *Acute dermal irritation study of 2,4-D acid technical in rabbits. Study No. 406-1-01-6789.* Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 6 August, 2013

Chhimwal, R, 2013d, *Acute eye irritation study of 2,4-D acid technical in rabbits. Study No. 407-1-01-6790.* Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 7 August, 2013

Chhimwal, R, 2013e, *Skin sensitisation study of 2,4-D acid technical in Guinea pigs. Study No. 408-1-01-6791.* Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 5 August, 2013

Chittibabu, R, 2002a, *Acute Oral Toxicity Study with 2,4-D Acid Technical in Chicken. Project No. 05-684-2001. Report No. 9652*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002b, *Acute Oral Toxicity Study with 2,4-D Acid Technical in Pigeon. Project No. 05-685-2001. Report No. 9653*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002c, *Acute Oral Toxicity Study with 2,4-D Ethyl Ester 38% W/W EC in Chicken. Project No. 05-737-2001. Report No. 9735*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002d, *Acute Oral Toxicity Study with 2,4-D Ethyl Ester 38% W/W EC in Pigeon. Project No. 05-738-2001. Report No. 9736*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002e, *Acute Oral Toxicity Study with 2,4-D Dimethylamine SL Salt in Chicken. Project No. 05-734-2001. Report No. 9732.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002f, *Acute Oral Toxicity Study with 2,4-D Dimethylamine SL Salt in Pigeon. Project No. 05-735-2001. Report No. 9733*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002g, *Acute Oral Toxicity Study with 2,4-D Sodium 80% WP in Chicken. Project No. 05-846-2001. Report No. 9920.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002h, *Acute Oral Toxicity Study with 2,4-D Sodium 80% WP in Pigeon. Project No. 05-847-2001. Report No. 9921*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002i, *Dietary Toxicity Study with 2,4-D Acid Technical in Japanese Quail. Project No. 05-687-2001. Report No. 9655.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002j, *Neurotoxicity Toxicity Study with 2,4-D Acid Technical in Chicken. Project No. 05-692-2001. Report No. 9660*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002k, *Acute Toxicity Study of 2,4-D Acid Technical in Freshwater Fish, Poecillia Reticulata and Brachydanio Rerio. Project No. 05-686-2001. Report No. 9654.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002l, *Acute Toxicity Study of 2,4-D Acid Technical in Freshwater Fish, Tilapia Mossambica. Project No. 05-683-2001. Report No. 9651*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002m, *Acute Toxicity Study of 2,4-D Ethyl Ester 38% W/W EC in Freshwater Fish, Tilapia Mossambica. Project No. 05-736-2001. Report No. 9734*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002n, *Acute Toxicity Study of 2,4-D Dimethylamine SL Salt in Freshwater Fish, Tilapia Mossambica. Project No. 05-733-2001. Report No. 9731*. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002o, *Acute Toxicity Study of 2,4-D Sodium 80% WP in Freshwater Fish, Tilapia Mossambica. Project No. 05-845-2001. Report No. 9919.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Chittibabu, R, 2002p*, Acute Immobilisation Test with 2,4-D Acid Technical in Daphnia magna. Project No. 05-688-2001. Report No. 9656.* Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Ciesziak, FS, 1992, *2,4-Dichlorophenoxyacetic acid, 2-ethylhexyl ester (2,4-D EHE): Acute aerosol inhalation toxicity study with Fischer 344 rats. Report Study No. K-020054-015.* Lab: The Toxicology Research Laboratory Health and Environmental Sciences, Dow Chemical Company, Midland, MI, USA. Sponsor: Industry Task Force II on 2,4-D Research Data, USA. Unpublished [sub: CR 105-1, Vol 69 of 96].

Cifone, MA, 1990a, *Mutagenicity test on 2,4-Dichlorophenoxyacetic acid (2,4-D) in the in vitro rat primary hepatocyte unscheduled DNA synthesis assay. Revised Final Report Study No. 10979-0-447.* Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Cifone, MA, 1990b, *Mutagenicity test on 2,4-D 2-ethylhexyl ester (2,4-D EHE) in the in vitro rat primary hepatocyte unscheduled DNA synthesis assay. Revised Final Report Study No. 10980-0-447*. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Cifone, MA, 1990c, *Mutagenicity test on 2,4-D dimethylamine salt (2,4-D DMA) in the in vitro rat primary hepatocyte unscheduled DNA synthesis assay. Revised Final Report Study No. 10981-0-447*. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 72 of 96].

Cohen, S, 1990a, *Aerobic Soil Metabolism of 2,4-Dichlorophenoxyacetic Acid. Laboratory Project ID 002/011/004/90*. Centre for Hazardous Materials, Pittsburgh, Pennsylvania. 21 December 1990.

Cohen, S, 1990b, *Anaerobic Aquatic Metabolism of 2,4-Dichlorophenoxyacetic Acid. Laboratory Project ID 002/001/007/88*. Centre for Hazardous Materials, Pittsburgh, Pennsylvania. 1 June 1990.

Cohen, S, 1990c, *Supplement to: Anaerobic Aquatic Metabolism of 2,4-Dichlorophenoxyacetic Acid. Laboratory Project ID 002/001/007/88-S1*. Centre for Hazardous Materials, Pittsburgh, Pennsylvania. 28 November 1990.

Cohen, S, 1991a, *Aerobic Aquatic Metabolism of 2,4-Dichlorophenoxyacetic Acid. Laboratory Project ID 002/011/008/89*. Centre for Hazardous Materials, Pittsburgh, Pennsylvania. 13 September 1991.

Cohen, S, 1991b, *Mobility of Unaged 2,4-Dichlorophenoxyacetic Acid Using Batch Equilibrium Technique. Laboratory Project ID 012/011/006/89*. Centre for Hazardous Materials, Pittsburgh, Pennsylvania. 24 September 1991

Concha, M, and Shepler, K, 1993a, *Aerobic Aquatic Metabolism Study of [14C]2,4-D. Laboratory Project Number 393W.* PTRL West Inc. 6 October 1993.

Concha, M, and Shepler, K, 1993b, *Photodegradation of [14C]2,4-D 2-Ethylhexyl Ester in a Buffered Aqueous Solution at pH 5 by Natural Sunlight*. Laboratory Project ID 390W. PTRL West Inc, Richmond California. 24 April 1993.

Concha, M, and Shepler, K, 1994a, *Aerobic Soil Metabolism of [14C]2,4-Dichlorophenoxyacetic Acid*. Laboratory Project Number 391W. PTRL West Inc. 7 February 1994.

Concha, M and Shepler, S, 1994b, *Anaerobic Aquatic Metabolism of [14C]2,4-D Acid*. Laboratory Project Number P394W. PTRL West Inc. 29 August 1994.

Concha, M, Shepler, K, and Erhardt-Zabik, S, 1993a, *Hydrolysis of [14C]2,4-D Ethylhexyl Ester at pH 5, 7 and 9.* Laboratory Project ID 387W. PTRL West Inc, Richmond California. 5 March 1993.

Concha, M, Shepler, K, and Erhardt-Zabik, S, 1993b, *Hydrolysis of [14C]2,4-D 2-Ethylhexyl Ester in Natural Water*. Laboratory Project ID 395W. PTRL West Inc, Richmond California. 29 March 1993.

Concha, M, Shepler, K, and Erhardt-Zabik, S, 1993c, *Hydrolysis of [14C]2,4-D Ethylhexyl Ester in Soil Slurries*. Laboratory Project ID 403W. PTRL West Inc, Richmond California. 26 April 1993.

Creeger, S, 1989a, *Hydrolysis of 2,4-D in Aqueous Solutions Buffered at pH 5, 7 and 9. Project ID Number 002/001/001/88 C8-208*. Centre for Hazardous Materials Research, Pittsburgh, Pennsylvania. 24 January 1989.

Creeger, S, 1989b, *Hydrolysis of 2,4-D in Aqueous Solutions Buffered at pH 3, 7 and 11. Project ID Number 002/001/001/88 C8-208*. Centre for Hazardous Materials Research, Pittsburgh, Pennsylvania. 24 January 1989.

Creeger, S, 1989c, *Aqueous Photodegradation of 2,4-Dichlorophenoxyacetic Acid in pH 7 Buffered Solution. Project ID Number 002/001/002/88 C8-208.* Centre for Hazardous Materials Research, Pittsburgh, Pennsylvania. 28 April 1989.

Creeger, S, 1989d, *Photodegradation of 2,4-Dichlorophenoxyacetic Acid on Soil. Project ID Number 002/001/003/88 C8-208*. Centre for Hazardous Materials Research, Pittsburgh, Pennsylvania. 28 April 1989.

Culotta, J, Foster, J, Grimes, J, Hoxter, K, Smith, G, and Jaber, M, 1990a, *2,4-D (2,4-Dichlorophenoxyacetic Acid): A Dietary LC50 Study with the Mallard. Project No.: 103-307*. Wildlife International Limited, Maryland. 5 June 1990.

Culotta, J, Hoxter, K, Foster, J, Smith, G and Jaber, M, 1990b, *2,4-D (2,4-Dichlorophenoxyacetic Acid): A Dietary LC50 Study with the Northern Bobwhite. Project No.: 103-306*. Wildlife International Limited, Maryland. 10 July 1990.

Cycoń, M, 2004, *KWAS 2,4-D: An Acute Oral Toxicity Test with Japanese Quail (Coturnix coturnix japonica)*. European Union 2,4-D Task Force 2012.

Cycon, M, Kaczynska, A, Swoboda, T, 2004, *2,4-D ACID, Earthworm reproduction test (Eisenia fetida Sav.*). European Union 2,4-D Task Force 2012.

Dalgard, DW, *1992a, 4-week exploratory range-finding study in dogs with 2,4-D. Study No. HWA 2184-121.* Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [CR 105-1, Vol 37 of 96].

Dalgard, DW, 1992b, *4-Week Exploratory range-finding study in dogs with the ethylhexyl ester of 2,4-D; Laboratory project Study ID HWA 2184-122,* Hazelton Washington Inc, Virginia, USA; Sponsor: Industry Task Force II on 2,4-D Research Data, c/o Dow Elanco, Indianapolis, USA. 15 December 1992.

Dalgard, DW, 1993a, *13-Week dietary toxicity study of 2,4-D in dogs. Study number: HWA 2184-125*; Hazelton Washington Inc, USA Argus research laboratory, USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 6 May 1993.

Dalgard, DW, 1993b, *52-Week dietary toxicity study of 2,4-D in dogs. Study number: HWA 2184-124;* Hazelton Washington Inc, USA Argus research laboratory, USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 29 November 1993.

Dalgard, DW, 1993c, *13-Week dietary toxicity study with the 2-ethylhexyl ester of 2,4-D in dogs. Study number: HWA 2184-127*; Hazelton Washington Inc, USA. Hazelton Washington Inc. USA, Sponsor: Industry Task Force II on 2,4-D Research Data c/o DowElanco. Unpublished. Dated: 5 May 1993.

Dalgard, DW, *1993d, 13-Week dietary toxicity study with the dimethylamine salt of 2,4-D in dogs. Study No. 2184-126.* Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 35 of 96].

David, BV, 1998, *Acute inhalational toxicity of 2,4-D isobutyl ester in rats. Study No: 611* Lab: Jai Research Foundation, Gujarat, India. Sponsor: Atul Ltd, Gujarat, India. Study duration: June 15 – July 1 1998 Unpublished Dated: 1 July 1998 [RA; CR 105-1; APVMA Study No: 7413; Data protection: Yes].

Davis, BNK, & Williams, CT, 1990, *Buffer zone widths for honeybees from ground and aerial spraying of insecticides.* Environmental Pollution (1990) 63:247-259. Published.

Department of Environment and Heritage, 2004, *Dioxins in Australia: A Summary of the Findings of Studies Conducted from 2001 to 2004*. National Dioxins Program, Department of the Environment and Heritage, 2004, Canberra.

Deshmukh, NS, 1999a, *Acute dermal toxicity of 2,4-D acid technical in rat* Study No: 132003 Report Number: 99.370 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 14 - 29 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7380; Data protection: Yes].

Deshmukh, NS, 1999b, *Acute inhalation toxicity of 2,4-D acid technical to rat* Study No: 132004 Report Number: 99.371 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 12 - 27 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7381; Data protection: Yes].

Deshmukh, NS, 1999c, *Acute dermal irritation / corrosion study of 2,4-D acid technical in rabbit* Study No: 132005 Report Number: 99.372 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 4 - 7 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7382; Data protection: Yes].

Deshmukh, NS, 1999d, *Acute eye irritation / corrosion study of 2,4-D acid technical in rabbit* Study No: 132006 Report Number: 99.373 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 21 June – 6 July 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7383; Data protection: Yes].

Deshmukh, NS, 1999e, *Mucous membrane irritation study of 2,4-D acid technical in rabbit* Study No: 132011 Report Number: 99.378 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 26 May – 2 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7384; Data protection: Yes].

Deshmukh, NS, 1999f, *Primary skin irritation study of 2,4-D acid technical in rabbit* Study No: 132010 Report Number: 99.377 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 4 - 7 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7385; Data protection: Yes].

Deshmukh, NS, 1999g, *Acute inhalation toxicity of 2,4-D sodium technical to rat* Study No: 132504 Report Number: 99.732 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 11 - 26 June 1999 Unpublished Dated: 16 December 1999 [RA; CR 105-1; APVMA Study No: 7389; Data protection: Yes].

Deshmukh, NS, 1999h, *Acute oral toxicity of 2,4-D dimethylamine salt to mouse* Study No: 132301 Report Number: 99.552 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 17 May - 16 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7394; Data protection: Yes].

Deshmukh, NS, 1999i, *Acute oral toxicity of 2,4-D dimethylamine salt to rat* Study No: 132302 Report Number: 99.553 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 18 May - 17 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7395; Data protection: Yes].

Deshmukh, NS, 1999j, *Acute inhalation toxicity of 2,4-D dimethylamine salt to rat* Study No: 132304 Report Number: 99.555 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 9 - 17 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7397; Data protection: Yes].

Deshmukh, NS, 1999k, *Acute oral toxicity of 2,4-D ethyl ester technical to mouse* Study No: 132401 Report Number: 99.738 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 28 June - 16 July 1999 Unpublished Dated: 21 December 1999 [RA; CR 105-1; APVMA Study No: 7402; Data protection: Yes].

Deshmukh, NS, 1999l, *Acute oral toxicity of 2,4-D ethyl ester technical to rat* Study No: 132402 Report Number: 99.739 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 1 July - 3 August 1999 Unpublished Dated: 21 December 1999 [RA; CR 105-1; APVMA Study No: 7403; Data protection: Yes].

Deshmukh, NS, 1999m, *Acute inhalation toxicity of 2,4-D ethyl ester technical to rat* Study No: 132404 Report Number: 99.740 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 10 - 25 June 1999 Unpublished Dated: 21 December 1999 [RA; CR 105-1; APVMA Study No: 7405; Data protection: Yes].

Deshmukh, NS, 1999n, *Acute oral toxicity of 2,4-D isooctyl ester technical to mouse* Study No: 131901 Report Number: 99.351 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 16 May - 15 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7416; Data protection: Yes].

Deshmukh, NS, 1999o, *Acute oral toxicity of 2,4-D isooctyl ester technical to rat* Study No: 131902 Report Number: 99.352 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 18 May - 16 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7417; Data protection: Yes].

Deshmukh, NS, 1999p, *Acute inhalation toxicity of 2,4-D isooctyl ester technical to rat* Study No: 131904 Report Number: 99.354 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study

duration: 8 - 23 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7419; Data protection: Yes].

Dill, D, Gorzinski, S, Potter, R, Richardson, C, and Stahl, D, 1990, *2,4-Dichlorophenoxyacetic Acid Dimethylamine Salt: Evaluation of the Toxicity to Early Life Stages of the Fathead Minnow, Pimephales promelas Rafinesque*. Laboratory Project Study ID ES-DR-0008-3556-4. Dow Chemical Company, Midland, Michigan. 3 October 1990.

Donald, D, Hunter, F, Sverko, E, Hill, B, and Syrgiannist, J, 2005, *Mobilisation of Pesticides on an Agricultural Landscape Flooded by a Torrential Storm*. Environmental Toxicology and Chemistry, Vol. 24, No. 1, pp 2-10. SETAC.

Douglas, B, 2004, *An Extended Laboratory Test to Determine the Effects of Fresh and Aged Residues of GF-1387 on the Green Lacewing, Chrysoperla camea*. Report No. DOW-04-12, Dow Agrosciences Australia Ltd

Doyle, R, 1991, *Laboratory Volatility of the 2-Ethylhexyl Ester of 2,4-Dichlorophenoxyacetic Acid*. Laboratory Project ID T08037T601. IIT Research Institute, Virginia. 2 October 1991.

Driscoll, R, 1997a, *Herbizid Marks D: Acute oral toxicity (Limit Test) in the rat.* Project Number. SPL 1095/001. Lab: Safepharm Labs Ltd, Derby, UK. Sponsor: Growell Ltd, Bradford, UK [AH Marks sub; CR105-1, Vol 76 of 96].

Driscoll, R, 1997b, *Herbizid Marks D: Acute dermal toxicity (Limit Test) in the rat*. Project Number. SPL 1095/002. Lab: Safepharm Labs Ltd, Derby, UK. Sponsor: Growell Ltd, Bradford, UK [AH Marks sub; CR105-1, Vol 76 of 96.

Driscoll, R, 1997d, *Herbizid Marks D: Acute dermal irritation test in the rabbit.* Project Number. SPL 1095/004. Lab: Safepharm Labs Ltd, Derby, UK. Sponsor: Growell Ltd, Bradford, UK [AH Marks sub; CR105-1, Vol 76 of 96].

Driscoll, R, 1997e, *Herbizid Marks D: Acute eye irritation test in the rabbit.* Project Number. SPL 1095/005. Lab: Safepharm Labs Ltd, Derby, UK. Sponsor: Growell Ltd, Bradford, UK [AH Marks sub; CR105-1, Vol 76 of 96].

Driscoll, R, 1997f, *Herbizid Marks D: Buehler delayed contact hypersensitivity study in the guinea pig*. Project Number. SPL 1095/006. Lab: Safepharm Labs Ltd, Derby, UK. Sponsor: Growell Ltd, Bradford, UK [AH Marks sub; CR105-1, Vol 76 of 96].

Dryzga, MD, Bornett, GA, and Nolan, RJ, 1992b, *2,4-Dichlorophenoxyacetate, Triisopropanolamine Salt: Dissociation and Metabolism in Male Fischer 344 Rats.* Laboratory project study ID K-008866-013, The Toxicology Research Laboratory, The Dow Chemical Company, Michigan, USA, 31 January 1992. Sponsor: Industry Task Force II on 2,4-D Research Data.

Dryzga, MD, Brzak, KA, and Nolan, RJ, 1992a, *2,4-Dichlorophenoxyacetate 2-Ethyl Ester: Metabolism in Fischer 344 Rats*; Laboratory project Study ID K-020054-009, The Toxicology Research Laboratory, The Dow Chemical Company, Michigan, USA; 6 March 1992; Sponsor: Industry Task Force II on 2,4-D Research Data.

Durward, R, 1994, *2,4-D Mutation of L5178Y mouse lymphoma Cells at the Thymidine Kinase TK+/-- Locus. Fluctuation Assay.* Rhone-Poulenc. Safepharm Laboratories Limited, Study No: 238/39.

Eiseman, LJ, 1984, *The Pharmacokinetic evaluation of 14C-2,4-Dichlorophenoxyacetic acid (2,4-D) in the mouse;* Project Number 2184-104; Hazelton Laboratories America Inc.; Sponsor: Industry Task Force on 2,4-D Research Data, 19 October 1984.

Elo, H, and Ylitalo, P, 1977, *Substantial increase in the levels of chlorophenoxy acetic acid in the CNS of rats as a result of severe intoxication*, Acta Pharmacol. Toxicol. 41 (3) 280.

Environment Australia, 1998, *Sources of Dioxins and Furans in Australia: Air Emissions,* Australian Government Publishing Service, Canberra.

Evangelista de Duffard, AM, Orta, C, and Duffard, R, 1990, *Behavioural Changes in rats fed a diet containing 2,4-dichlorophenoxyacetic butyl ester*. NeuroToxicology. 11, 563-572.

FAO/WHO, 2002, *Joint FAO/WHO Expert Committee on Food Additives (JECFA). Summary and Conclusions*, Fifty-seventh Meeting, Annex 4, 5-14 June 2001, pp 24-40 Rome.

Fathulla, R, 1996a, *Aerobic Aquatic Metabolism of 14C-2,4-D*. Laboratory Project Identification CHS 6397-172. Corning Hazleton Inc, Wisconsin. 5 December 1996.

Fathulla, R, 1996b, *The Adsorption and Desorption of 14C-2,4-D on Representative Agricultural Soils.* Laboratory Project Identification CHW 6397-166. Corning Hazleton Inc, Wisconsin. 12 August 1996.

Feil, N, 2009, *Ready Biodegradability of 2,4-D in a Manometric Respirometry Test*. European Union 2,4-D Task Force 2012.

Feil, N, 2011, *Effects of 2,4-dichloroanisole on the Activity of the Soil Microflora in the Laboratory.* European Union 2,4-D Task Force 2012.

Feldmann, RJ, Maibach, HI, 1973, *Percutaneous penetration of some pesticides and herbicides in man.* Toxicology and Applied Pharmacology 28: 126-132.

Fellows, M, 1998, *2,4-D (2,4-Dichlorophenoxyacetic acid): Measurement of unscheduled DNA synthesis in rat liver using an in vivo/in vitro procedure*. Final Report Study No. 198/118-D5140. Lab: Covance Laboratories Ltd, North Yorkshire, UK. Sponsor: Rhone-Poulenc Agro, France. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Fink R, 1974a, *Eight-Day Dietary LC50 – Mallard Ducks DMA-4 – Final Report*. Project Number 103-116. Wildlife International, Maryland. 20 August 1974.

Fink R, 1974b, *Eight-Day Dietary LC50 – Bobwhite Quail DMA-4 – Final Report*. Project Number 103-115. Wildlife International, Maryland. 20 August 1974.

Fochtman, P, 2003, *2,4-D ACID: Daphnia magna acute immobilization test*. European Union 2,4-D Task Force 2012.

Frantz, SW, and Kropscott, BE, 1984, *Pharmacokinetic evaluation of the 2-Ethylhexyl (isooctyl) ester of 2,4-D administered orally to Fischer-344 rats*; Toxicology Research Laboratory, Michigan, USA; February 1984.

FSANZ, 2004, *Dietary exposure assessment and risk characterisation Dioxins in food*. Food Standards Australia New Zealand, Canberra, ACT Australia. Draft report, April 2004

Fussell, S, 2004, *A Rate-Response Laboratory Test to Determine the Effects of CF-1387 on the Parasitic Wasp, Aphidius rhopalosiphi.* Report No DOW-04-10, Dow Agrosciences Australia Ltd

Fussell, S, 2004, *An Extended Laboratory Test to Determine the Effects of Fresh and Aged Residues of GF-1387 on the Parasitic Wasp, Aphidius rhopalosiphi.* Report No. DOW-04-13, Dow Agrosciences Australia Ltd

Gaikwad, SS, 2013a, *Bacterial reverse mutation test of 2,4-D acid technical using Salmonella typhimurium.* Study No. 481-1-01-6832. Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 20 July, 2013

Gaikwad, SS, 2013b, *Micronucleus test of 2,4-D acid technical in mice.* Study No. 485-1-01-6833. Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 16 September, 2013

Gallacher, AC, 1991, *Dissociation of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-D diethanolamine salt in water*. Ricerca Inc. Document number: 4102-90-0304-AS-001. Department of Analytical Services, Painesville, Ohio. Sponsor: PBI/Gordon Corporation, 14 March 1991.

Gandhi, R, Wandji, S, Snedeker, SM, 2000, *Critical evaluation of cancer risk from 2,4-D.* Rev Environ Contam Toxicol. 167:1–33.

Garabrant, DH, Philbert, MA, 2002, *Review of 2,4-dichlorophenoxyacetic acid (2,4-D) epidemiology and toxicology*. Crit Rev Toxicol. 32:233–257.

Gargus, JL, 1986, *Dermal sensitisation study in guinea pigs; 2,4-dichlorophenoxyacetic acid.* Final Report No. 2184-105 Lab: Hazleton Labs America Inc, Virginia, USA. Sponsor: Industry Task Force on 2,4-D Research Data. Unpublished [AH Marks sub: CR 105-1, Vol 76 of 96].

Gehrig, M, 2011, *LAF-74: Assessment of the Side Effects of LAF-74 on the Activity of the Soil Microflora. European* Union 2,4-D Task Force 2012.

Gerritsen-Ebben, R, (MG) et al, 2007, *Effective personal protective equipment (PPE). Default setting of PPE for registration purposes of agrochemical and biocidal pesticides*. Report V7333, TNO, Zeist, the Netherlands, 8 January 2007.

Gollapudi, BB, Samson, YE, and McClintock, ML, 1990, *Evaluation of a formulation containing 2,4-Dichlorophenoxyacetic acid triisopropanolamine salt (2,4-D TIPA) in the mouse bone marrow micronucleus test.* Laboratory Project Study ID TXT:K-008866-009. Unpublished, Report date: 24 April 1990.

Gopinth, C, Bruner, RH, 1998, *Independent pathology peer review of kidney tissues from rats and mice assigned to multiple (8) studies 'to evaluate the subchronic toxicity of 2,4-dichlorophenoxyacetic acid.* Unpublished. Submitted by Industry Task Force II on 2,4-D Research Data.

Gorzinski, SJ, Wade, CE, Morden, DC, Keyes, DG, Dittenber, OA, Kalnins, RV, Schuetz, DJ, and Kociba, RJ, 1981a, *Purified 2,4-Dichlorophenoxyacetic acid (2,4-D): Results of a 13-week subchronic dietary toxicity study in the CDF Fischer 344 rat*; Toxicology Research Laboratory, Dow Chemical Company, Michigan USA.

Gorzinski, SJ, Wade, CE, Morden, DC, Keyes, DG, Dittenber, OA, Kalnins, RV, Schuetz, DJ, and Kociba, RJ, 1981a, *Purified 2,4-Dichlorophenoxyacetic acid (2,4-D): Results of a 13-week subchronic dietary toxicity study in the CDF Fischer 344 rat*; Toxicology Research Laboratory, Dow Chemical Company, Michigan USA.

Gorzinski, SJ, Wade, CE, Morden, DC, Keyes, DG, Wolfe, EL, Dittenber, OA, Kalnins, RV, Schuetz, DJ and Kociba, RJ, 1981b, *Technical grade 2,4-Dichlorophenoxyacetic acid (2,4-D): Results of a 13-week subchronic dietary toxicity study in the CDF Fischer 344 rat*; Toxicology Research Laboratory, Dow Chemical Company, Michigan USA.

Gorzinski, SJ, Wade, CE, Morden, DC, Keyes, DG, Wolfe, EL, Dittenber, OA, Kalnins, RV, Schuetz, DJ, and Kociba, RJ, 1981b, *Technical grade 2,4-Dichlorophenoxyacetic acid (2,4-D): Results of a 13-week subchronic dietary toxicity study in the CDF Fischer 344 rat*; Toxicology Research Laboratory, Dow Chemical Company, Michigan USA.

Goβmann, A, 1997a, *Effects of Herbizid Marks D on the Predatory Mite Typhlodromus pyri Scheuten (Acari, Phytoseiidae) in the Laboratory*. Project ID 2303063. Institut fur Biologische Analytik und Consulting (IBACON), Rossdorf. 31 October 1997.

Goβmann A, 1997b, *Effects of Herbizid Marks D on the Reproduction of Rove Beetles Aleochara bilineata Gyll. (Coleoptera, Staphylinidae) in the Laboratory.* Project ID 2305070. Institut fur Biologische Analytik und Consulting (IBACON), Rossdorf. 4 November 1997.

Goβmann A, 1997c, *Acute Toxicity (14 days) of Herbizid Marks D to the Earthworm Eisenia fetida (Savigny 1826) in Artificial Soil.* Project ID 2302021. Institut fur Biologische Analytik und Consulting (IBACON), Rossdorf. 3 November 1997.

Guo, M, & Stewart, S, 1993, *Metabolism of Uniformly 14C-Ring Labelled 2,4-Dichlorophenoxyacetic acid in Lactating Goats. Industry Task Force II on 2,4-D Rep*. ABC Laboratories N0 40630.

Guth, J, Reischmann, F, Allen, R, Arnold, D, Hassink, J, Leake, C, Skinmore, M, and Reeves, G, 2004, *Volatilisation of Crop Protection Chemicals from Crop and Soil Surfaces Under Controlled Conditions – Prediction of Volatile Losses from Physico-Chemical Properties.* Chemosphere, 57 (2004), 871-887. Elsevier.

Guth, J, Reischmann, F, Allen, R, Arnold, D, Hassink, J, Leake, C, Skinmore, M, and Reeves, G, 2004, *Volatilisation of Crop Protection Chemicals from Crop and Soil Surfaces Under Controlled Conditions – Prediction of Volatile Losses from Physico-Chemical Properties*. Chemosphere, 57 (2004), 871-887. Elsevier.

Hanstveit, A.O.H., Salmon, F.G.Ch., de Vette, H.Q.M, 2006, *The route and rate of degradation of 2,4-D in an anaerobic soil.* European Union 2,4-D Task Force 2012.

Harnish, W, 1993, *2,4-D Butoxyethyl Ester Tier II Non-Target Plant Hazard Evaluation-Terrestrial Vegetative Vigor. Landis Trial No. 1231-93-43-17-25B-06*. Landis International, Inc. Georgia. 18 November 1993.

Harnish, W, 1994, *2,4-D Butoxyethyl Ester Tier II Non-Target Plant Hazard Evaluation-Terrestrial Seed Germination and Seedling Emergence*. Landis Trial No. 1231-93-43-17-25B-05. Landis International, Inc. Georgia. 14 March 1994.

Harriman, J.F, 2004, *Renal Pathology Review from a Combined Chronic Toxicity and Oncogenicity Study In Rats Treated with 2,4-Dichlorophenoxyacetic Acid*. Lab Study ID - WIL-22003. WIL Research Laboratories, Inc. Sponsor: Industry Task Force II on 2,4-D Research Data.

Harris, SA, and Solomon, KR, 1992, *Percutaneous penetration of 2,4-dichlorophenoxyacetic acid and 2,4-D dimethylamine salt in human volunteers*. J. Toxicol. Environ. Health, 36: 233-240.

Hatfield, M, 1995a, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D on Pasture in California*. Study Number AA940017. American Agricultural Services INC. North Carolina. 15 August 1995.

Hatfield, M, 1995b, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D in Turf in California*. Study Number AA940019. American Agricultural Services INC. North Carolina. 15 August 1995.

Hatfield, M, 1995c, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D Granules on Bare Ground in Ohio*. Study Number AA940025. American Agricultural Services INC. North Carolina. 30 November 1995.

Hatfield, M, 1995d, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D Granules on Turf in Ohio.* Study Number AA940024. American Agricultural Services INC. North Carolina. 18 October 1995.

Hatfield, M, 1995e, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D in Bare Ground in California.* Study Number AA940021. American Agricultural Services INC. North Carolina. 17 November 1995.

Hatfield, M, 1995f, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D in Bare Soil in a Wheat Use Pattern in North Dakota*. Study Number AA940015. American Agricultural Services INC. North Carolina. 18 October 1995.

Hatfield, M, 1995g, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D on Bare Soil in a Corn Use Pattern in Nebraska*. Study Number AA940011. American Agricultural Services INC. North Carolina. 9 November 1995.

Hatfield, M, 1995h, *Field Soil Dissipation Study of the 2-Ethylhexyl Ester of 2,4-D on Bare Soil in a Corn Use Pattern in Ohio*. Study Number AA940013. American Agricultural Services INC. North Carolina. 2 November 1995.

Hatfield, M, 1995i, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D on Pasture in California*. Study Number AA940016. American Agricultural Services INC. North Carolina. 16 November 1995.

Hatfield, M, 1995j, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D in Turf in California*. Study Number AA940018. American Agricultural Services INC. North Carolina. 18 October 1995.

Hatfield, M, 1995k, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D Granules in Bare Soil in North Dakota.* Study Number AA940023. American Agricultural Services INC. North Carolina. 29 November 1995.

Hatfield, M, 1995l, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D Granules on Turf in North Dakota*. Study Number AA940022. American Agricultural Services INC. North Carolina. 29 October 1995.

Hatfield, M, 1995m, *Field Soil Dissipation Study of the Dimethylamine salt of 2,4-D in Bare Soil in California.* Study Number AA940020. American Agricultural Services INC. North Carolina. 26 June 1995.

Hatfield, M, 1995n, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D on a Bare Soil in a Wheat Use Pattern in North Dakota*. Study Number AA940014. American Agricultural Services INC. North Carolina. 4 December1995.

Hatfield, M, 1995o, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D on Bare Soil in a Corn Use Pattern in Nebraska*. Study Number AA940010. American Agricultural Services INC. North Carolina. 21 October 1995.

Hatfield, M, 1995p, *Field Soil Dissipation Study of the Dimethylamine Salt of 2,4-D on Bare Soil in a Corn Use Pattern in Ohio.* Study Number AA940012. American Agricultural Services INC. North Carolina. 27 October 1995.

Hatfield, M, 1995q, *Aquatic Dissipation of the Dimethylamine Salt of 2,4-D in a Small Pond in North Carolina.* Study Number AA940026. American Agricultural Services INC. North Carolina. 23 December 1995.

Hatfield, M, 1995r, *Aquatic Dissipation of the Dimethylamine Salt of 2,4-D in a Small Pond in North Dakota*. Study Number AA940027. American Agricultural Services INC. North Carolina. 23 December 1995.

Health and Environmental Sciences, The Dow Chemical Company, Midland, Michigan, USA. Sponsor: The Dow Chemical Company, Midland, Michigan, USA. Unpublished. Dated: 10 January 1990.

Heitmuller, T, 1975, *Acute Toxicity of DMA-4 to Larvae of the Eastern Oyster (Crassostrea virginica), Pink Shrimp (Penaeus duorarum) and Fiddler Crabs (Uca pugilator).* Laboratory Project Study ID CH-RC 10. Bionomics – EG&G Inc., Pensacola, Florida. June 1975.

Helmer, D, 1987a, *Determination of the Water Solubility of 2,4-Dichlorophenoxy Acetic Acid, 2-Ethylhexyl Ester*. Laboratory Project ML-AL 87-70817. Dow Chemical Company, Midland, Michigan. 3 December 1987.

Helmer, D, 1987b, *Determination of the Octanol/Water Partition Coefficient for 2,4-Dichlorophenoxy Acetic Acid, 2-Ethylhexyl Ester*. Laboratory Project ML-AL 87-70819. Dow Chemical Company, Midland, Michigan. 14 December 1987.

Hilderbrand, B, and Kirsch, P, 1983, *Report on the study of the irritation to the intact and abraded dorsal skin of the white rabbit based on Draize of 2,4-D.* Study No. RZ 83/190. Lab: BASF Corporation, Dept of Toxicology, Rhein, FRG. Unpublished [AH Marks sub: CR105-1, Vol 76 of 96].

Hoberman, AM, 1990, *Developmental toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-Dichlorophenoxyacetic acid (2,4-D acid) administered orally via stomach tube to New Zealand White Rabbits;* Argus 320-003; Argus Research Laboratories Inc. Horsham, Pennsylvania, Sponsor: Industry Task Force II on 2,4-D Research Data; USA; 12 December 1990.

Hoberman, AM, 1990, *Developmental toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-Dichlorophenoxyacetic acid (2,4-D acid) administered orally via stomach tube to New Zealand White Rabbits;* Argus 320-003; Argus Research Laboratories Inc. Horsham, Pennsylvania, Sponsor: Industry Task Force II on 2,4-D Research Data; USA; 12 December 1990.

Hoffmann, K, Deierling, T, 2012, *Toxicity of 2,4-Dichloroanisole to the Aquatic Plant Myriophyllum aquaticum in a Static Growth Inhibition Test with a Prior Rooting Phase*. European Union 2,4-D Task Force 2012.

Hoffmann, K, Deierling, T, 2012, *Toxicity of 2,4-Dichlorophenol to the Aquatic Plant Myriophyllum aquaticum in a Static Growth Inhibition Test with a Prior Rooting Phase*. European Union 2,4-D Task Force 2012.

Holland, NT, Duramad, P, Rothman, N, Figgs, LW, Blair, A, Hubbard, A, and Smith, MT, 2002, *Micronucleus frequency and proliferation in human lymphocytes after exposure to herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) in vitro and in vivo*. Mutation Research. 521, 165-178.

Hopkins, 1987a, *2,4-Dichlorophenoxyacetic Acid: Determination of the Water Solubility.* Laboratory Project ID ES-DR-0002-2297-8. Dow Chemical Company, Midland, Michigan. 25 November 1987.

Hopkins, 1987b, *2,4-Dichlorophenoxyacetic Acid Dimethylamine Salt: Determination of the Water solubility.* Laboratory Project ID ES-DR-0008-3556-3. Dow Chemical Company, Midland, Michigan. 25 November 1987.

Hoxter, K, Culotta, J, and Jaber, M, 1990, *2,4-D Dimethylamine Salt: An Acute Oral Toxicity Study with the Northern Bobwhite*. Project Number 103-310. Wildlife International, Maryland. 9 May 1990.

Hoxter, K, Palmer, S, and Krueger, H, 1997a, *2,4-D 2-Ethylhexyl Ester: An Acute Oral Toxicity Study with the Honey Bee.* Project Number: 467-101A. Wildlife International Ltd, Easton, Maryland. 17 December 1997.

Hoxter, K, Palmer, S, and Krueger, H, 1997b, *2,4-D Dimethylamine Salt: An Acute Oral Toxicity Study with the Honey Bee*. Project Number: 467-101. Wildlife International Ltd, Easton, Maryland. 17 December 1997.

Hubbard et al, 2014, *2,4-D Acid: A Dietary LC50 Study with the Canary. Industry Task Force II on 2,4-D Research Data.*

Hubbard, PM, Beavers, JB, 2011, *2,4-Dichlorophenoxyacetic acid: An Acute Oral Toxicity Study with the Canary (Serinus canaria).* European Union 2,4-D Task Force 2012.

Hughes, J, 1990a, *The Toxicity of 2,4-D to Selanastrum capricornutum.* Laboratory Project ID 0460-05-1100-1. Malcolm Pirnie Inc. Elmsford, New York. 8 March 1990.

Hughes, J, 1990b, *The Toxicity of 2,4-D 2-Ethylhexyl Ester to Lemna gibba.* Laboratory Project ID B460-07-4. Malcolm Pirnie Inc. Elmsford, New York. 30 November 1990.

Hughes, J, 1990c, *The Toxicity of 2,4-D 2-Ethylhexyl Ester to Selenastrum capricornutum.* Laboratory Project ID 0460-05-1100-2. Malcolm Pirnie Inc. Elmsford, New York. 30 November 1990.

Hughes, J, 1990d, *The Toxicity of 2,4-D 2-Ethylhexyl Ester to Skeletonema costatum*. Laboratory Project ID B460-07-3. Malcolm Pirnie Inc. Elmsford, New York. 30 November 1990.

Hughes, J, 1990e, *The Toxicity of 2,4-D 2-Ethylhexyl Ester to Anabaena flos-aquae*. Laboratory Project ID B460-07-1. Malcolm Pirnie Inc. Elmsford, New York. 30 November 1990.

Hughes, J, 1990f, *The Toxicity of 2,4-D 2-Ethylhexyl Ester to Navicula pelliculosa.* Laboratory Project ID B460-07-2. Malcolm Pirnie Inc. Elmsford, New York. 30 November 1990.

Hughes, J, 1990g, *The Toxicity of 2,4-D Dimethylamine Salt to Lemna gibba.* Laboratory Project ID 0460-05-1100-7. Malcolm Pirnie Inc. Elmsford, New York. 21 May 1990.

Hughes, J, 1990h, *The Toxicity of 2,4-D Dimethylamine Salt to Selenastrum capricornutum.* Laboratory Project ID 0460-05-1100-3. Malcolm Pirnie Inc. Elmsford, New York. 8 March 1990.

Hughes, J, 1990i, *The Toxicity of 2,4-D Dimethylamine Salt to Skeletonema costatum.* Laboratory Project ID 0460-05-1100-6. Malcolm Pirnie Inc. Elmsford, New York. 21 May 1990.

Hughes, J, 1990j, *The Toxicity of 2,4-D Dimethylamine Salt to Anabaena flos-aquae*. Laboratory Project ID 0460-05-1100-4. Malcolm Pirnie Inc. Elmsford, New York. 21 May 1990.

Hughes, J, 1990k, *The Toxicity of 2,4-D Dimethylamine Salt to Navicula pelliculosa*. Laboratory Project ID 0460-05-1100-5. Malcolm Pirnie Inc. Elmsford, New York. 21 May 1990.

IARC, 2018, *Diethanolamine*. In IARC Monograph 101, International Agency for Research on Cancer, Lyon, France pp 117-140 available at: monographs.iarc.fr/wp-content/uploads/2018/06/mono101-004.pdf

Ibrahim, MA, Bond, GG, Burke, TA, Cole, P, Dost, FN, Enterline, PE, Gough, M, Greenberg, RS, Halperin, WE, McConnell, E, Munrun, IC, Swendberg, JA, Zahm, SH, and Graham, JD, 1991, *Weight of the evidence on the human carcinogenicity of 2,4-D.* Environ. Health Perspect. 96:213-222.

Ivett, JL, 1990a, *Mutagenicity test on 2,4-Dichlorophenoxyacetic acid (2,4-D) in the in vivo mouse micronucleus assay.* Revised Final Report Study No. 10979-0-455. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Ivett, JL, 1990b, *Mutagenicity test on 2,4-D-2-ethylhexyl ester (2,4-D EHE) in the in vivo mouse micronucleus assay.* Revised Final Report Study No. 10980-0-455. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Ivett, JL, 1990c, *Mutagenicity test on 2,4-D dimethylamine (2,4-D DMA) salt in the in vivo mouse micronucleus assay.* Revised Final Report Study No. 10981-0-455. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II on 2,4-D Research Data Unpublished [AH Marks; sub: CR 105-1, Vol 71/74 of 96].

Ivett, JL, 1990d, *Single acute exposure dose selection study on 2,4-dichlorophenoxy acetic acid (2,4-D).* Revised Final Report Study No. 10979-0-459-PO. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Ivett, JL, 1990e, *Single acute exposure dose selection study on 2,4-D ethylhexyl ester (2,4-D EHE).* Revised Final Report Study No. 10980-0-459-PO. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II on 2,4-D Research Data Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Ivett, JL, 1990f, *Single acute exposure dose selection study on 2,4-D dimethylamine salt (2,4-D DMA).* Revised Final Report Study No. 10981-0-459-PO. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished [CR 105-1, Vol 73 of 96].

Jeffries, TK, Yano, BL, Ormand, JR, and Battjes, 1995, *2,4-DDichlorophenoxyacetic acid: Chronic toxicity/oncogenicity study in Fischer 344 rats – Final report;* Study no. K-002372-064; The Toxicology Research Laboratory, Dow Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 28 March 1995.

Jeyalakshmi, T, 2002a, *Toxicity of 2,4-D Acid Technical to Honey Bee, Apis indica.* Project No. 03-363-2001. Report No. 9589. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Jeyalakshmi, T, 2002b, *Toxicity of 2,4-D Ethyl Ester 38% W/W EC to Honey Bee, Apis indica*. Project No. 03-389-2001. Report No. 9805. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Jeyalakshmi, T, 2002c, *Toxicity of 2,4-D Dimethyl Amine SL Salt to Honey Bee, Apis indica*. Project No. 03-390-2001. Report No. 9806. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Jeyalakshmi, T, 2002d, *Toxicity of 2,4-D Sodium 80% WP to Honey Bee, Apis indica.* Project No. 03-397-2001. Report No. 9849. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

Johnson, KA, 1997, *Dietary oncogenicity study in male B6C3F1 mice – Supplemental histopathology – Examination of spleens from low and mid-dose level mice sacrificed at two-year necropsy.* Study Nos. K-002372-063MF (Rev). Lab: The Toxicology Research Laboratory, Health & Environmental Sciences, Dow Chemical Company, Michigan, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 16 November 1995. Unpublished [AH Marks; sub: CR 105-1, Vol 9 of 96].

Kamle, MI, 2013, *Acute toxicity study of 2,4-D acid technical to earthworm, Eisenia foetida*. UPL Australia Limited.

Kamle, MK, 2014, *Acute oral toxicity of 2,4-D acid technical to the honeybee, Apis mellifera L.* UPL Australia Limited.

Kamle, MK, 2013, *Acute contact toxicity (LD50) of 2,4-D acid technical to the honeybee, Apis mellifera L*. UPL Australia Limited.

Katdare, SM, 1998a, *Mutagenicity study of 2,4-D isobutylester (2,4-D IBE) technical by using Salmonella typhimurium, reverse mutation assay.* Study No. 117306. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1998b, *In vivo micronucleus test in mouse bone marrow with 2,4-D isobutylester (2,4-D IBE) technical.* Study No. 117307. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1998c, *In vivo mammalian mouse bone cytogenetic test with 2,4-D isobutylester (2,4-D IBE) technical.* Study No. 117308. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1999a, *Mutagenicity study of 2,4-D isooctylester (2,4-D IOE) technical by using Salmonella typhimurium, reverse mutation assay*. Study No. 131907. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1999b, *In vivo micronucleus test in mouse bone marrow with 2,4-D isooctylester (2,4-D IOE) technical*. Study No. 131908. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1999c, *In vivo mammalian mouse bone cytogenetic test with 2,4-D isooctylester (2,4-D IOE) technical.* Study No. 131909. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 1999d, *Mutagenicity study of 2,4-D acid (2,4-D) technical by using Salmonella typhimurium, reverse mutation assay*. Study No. 132007. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 1999e, *In vivo micronucleus test in mouse bone marrow with 2,4-D acid (2,4-D) technical.* Study No. 132008. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 1999f, *In vivo mammalian mouse bone cytogenetic test with 2,4-D acid (2,4-D) technical.* Study No. 132009. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 1999g, *Mutagenicity study of 2,4-D Dimethylamine salt (2,4-D DMA) technical by using Salmonella typhimurium, reverse mutation assay*. Study No. 132307. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 1999h, *In vivo micronucleus test in mouse bone marrow with 2,4-D Dimethylamine salt (2,4-D DMA) technical*. Study No. 132308. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 1999i, *In vivo mammalian mouse bone cytogenetic test with 2,4-D Dimethylamine salt (2,4-D DMA) technical.* Study No. 132309. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 2000a, *Mutagenicity study of 2,4-D ethylester (2,4-D EE) technical by using Salmonella typhimurium, reverse mutation assay*. Study No. 132407. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 2000b, *In vivo mouse micronucleus test in mouse bone marrow with 2,4-D ethylester (2,4-D EE) technical*. Study No. 132408. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 2000c, *In vivo mammalian mouse bone cytogenetic test with 2,4-D ethylester (2,4-D EE) technical.* Study No. 132409. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Katdare, SM, 2000d, *Mutagenicity study of 2,4-D sodium salt (2,4-D sodium) technical by using Salmonella typhimurium, reverse mutation assay*. Study No. 132507. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 2000e, *In vivo mouse micronucleus test in mouse bone marrow with 2,4-D sodium salt (2,4-D sodium) technical.* Study No. 132508. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Katdare, SM, 2000f, *In vivo mammalian mouse bone cytogenetic test with 2,4-D sodium salt (2,4-D sodium) technical*. Study No. 132509. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Kirsch, P, 1983, *Report on the study of the irritation of the eye of white rabbit based on Draize of 2,4-D.* Study No. MRID 41125302. Report No. 83/0192. Lab: BASF Corporation, Dept of Toxicology, Rhein, FRG. Unpublished [AH Marks sub: CR105-1, Vol 76 of 96].

Klöpffer, W, 1991, *Determination of the Phototransformation in Water of 2,4-Dichlorophenoxy acetic acid According to UBA Test Guideline Direct Phototransformation.* Battelle Europe, Germany. 4 November 1991.

Knowles, S, Horth, H, Blackmore, K, Thorne, J, Wright, K, 2004, *Review of monitoring and occurrence of 2,4-D in groundwater and surface water in WRc plc,* UK. European Union 2,4-D Task Force 2012.

Kobal, S, Cebulj-Kadunc, N, and Cestnik, V, 2000, *Serum T3 and T4 concentrations in the adult rats treated with herbicide 2,4-dichlorophenoxyacetic acid.* Eur J Physiol. 440 (Suppl): R171-172.

Kohli, JD, Khanna, RN, Gupta, BN, Dhar, MM, Tandon, JS, & Sircar, KP, 1974, *Absorption and excretion of 2,4-dichlorophenoxy-acetic acid in man. Xenobiotica,* 4, 97-100.

Krueger, HO, Palmer, SJ, 1997, *2,4-D Dimethylamine salt : an acute contact toxicity study with the honey bee*

Kubitza, J, Dohmen, GP, 2003, *BAS 140 01 H: Effects of BAS 140 01 H on the Growth of the Aquatic Plant Myriophyllum aquaticum*. European Union 2,4-D Task Force 2012.

Kuhner, C, 1998a, *Esteron 60 (2,4-D 2-EHE 572 g/L ae Formulation): Acute Toxicity to the Predatory Mite, Typhlodromus pyri SCHEUTEN (Acari, Phytoseiidae) in the Laboratory*. Study ID 98132/01-NLTp. Arbeitsgemeinschaft, Niefern-Oschelbronn, Germany. 13 October 1998.

Kuhner, C, 1998b, *Esteron 60 (2,4-D 2-EHE 572 g/L ae Formulation): Acute Toxicity to the Aphid Parasitoid, Aphidius rhopalosiphi (Hymenoptera, Braconidae) in the Laboratory.* Study ID 98132/01-NLAp. Arbeitsgemeinschaft, Niefern-Oschelbronn, Germany. 13 October 1998.

Kuhner, C, 1998c, *Desormone Liquid (2,4-D DMA 600 g/L ai Formulation): Acute Toxicity to the Predatory Mite, Typhlodromus pyri SCHEUTEN (Acari, Phytoseiidae) in the Laboratory.* Study ID 98117/01-NLTp. Arbeitsgemeinschaft, Niefern-Oschelbronn, Germany.

Kuhner, C, 1998d*, Desormone Liquid (2,4-D DMA 600 g/L ai Formulation): Acute Toxicity to the Aphid Parasitoid, Aphidius rhopalosiphi (Hymenoptera, Braconidae) in the Laboratory*. Study ID 98117/01-NLAp. Arbeitsgemeinschaft, Niefern-Oschelbronn, Germany.

Kumar, R, 2001, *Toxicity Study of 2,4-D Acid Technical to Earthworm Lampito Mauritii*. Project No. 03-376-2001. Report No. 9697. Fredrick Institute of Plant Protection and Toxicology. Tamil Nadu, India.

LaFranchi, et al, 2005, *Is thyroid inadequacy during gestation a risk factor for adverse pregnancy and developmental outcomes?* Thyroid 15:60-71.

Laughlin, LA, Adelfinskaya, Y, Lehman AC, 2011, *Aerobic Aquatic Degradation of 2,4-D in Two Sediment and Pond Water Systems*. European Union 2,4-D Task Force 2012.

Lawlor, MA, & Valentine, BS, 1990a, *Mutagenicity test on 2,4-Dichlorophenoxyacetic acid (2,4-D) in the Salmonella/mammalian microsome reverse mutation assay (Ames test).* Revised Final Report Study No 10979-0-401. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Lawlor, MA, & Valentine, BS, 1990b, *Mutagenicity test on 2,4-D-2-ethylhexyl ester (2,4-D EHE) in the Salmonella/mammalian microsome reverse mutation assay (Ames test).* Revised Final Report Study No 10980-0-401. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 92 of 96].

Lawlor, MA, & Valentine, BS, 1990c, *Mutagenicity test on 2,4-D dimethylamine (2,4-D DMA) salt in the Salmonella/mammalian microsome reverse mutation assay (Ames test).* Revised Final Report Study No 10981-0-401. Lab: Hazleton Laboratories America Inc, Kensington, Maryland, USA. Sponsor: Industry Task Force II, Dow Chemical, Midland, MI, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 70 of 96].

Lewis, CJ, Fletcher, TA, 2011, *[14C] 2,4-D: Anaerobic Soil Metabolism and Degradation.* European Union 2,4-D Task Force 2012.

Lewis, CJ, Fletcher, TA, 2011, *[14C]-2,4-D: Aerobic Mineralisation in Surface Water (Pelagic Test) - Simulation Biodegradation Test*. European Union 2,4-D Task Force 2012.

Lewis, CJ, Fletcher, TA, 2011, *[14C]-2,4-D: Degradation in Water-Sediment Systems under Anaerobic Conditions*. European Union 2,4-D Task Force 2012.

Lewis, CJ, Fletcher, TA, 2011, *[14C]-2,4-D: Photodegradation and Quantum Yield in sterile pH 7 Buffer and Natural Water.* European Union 2,4-D Task Force 2012.

Lewis, CJ, Fletcher, TA, 2011, *[14C]-2,4-D: Photodegradation on Soil Surface.* European Union 2,4-D Task Force 2012.

Lezotte, FJ, Van Hoven, RL, Nixon, WB, 2002, *Determination of water solubility of 2,4-D acid by the shake flask method.* Project Number 467C-103. Lab: Wildlife International Ltd, Maryland. Sponsor: Industry Task Force II on 2,4-D Research Data, Dow Chemical, Midland, MI, USA. Unpublished.

Liberacki, AB, Yano, BL, and Breslin, WJ, 1991, *Triisopropanolamine salt of 2,4-D: Oral Gavage Teratology study in New Zealand White Rabbits.* Laboratory Project Study ID K-008866-016. Lab: The Dow Chemical Company, The Toxicology Research Laboratory, Midland, Michigan, USA. Sponsor: The Dow Chemical Company, Midland, Michigan, USA. Unpublished, Report date: 18 November, 1991.

Lin, N, and Garry, VF, 2000, *In vitro studies of cellular and molecular developmental toxicity of adjuvants, herbicides and fungicides commonly used in red river valley, Minnesota.* Journal of Toxicology and Environmental Health. Part A, 60: 423-439.

Linnainmaa, K, 1983, *Sister chromatid exchanges among workers occupationally exposed to phenoxy acid herbicides 2,4-D and MCPA*. Teratogenesis, Carcinogenesis and Mutagenesis 3, 269-279.

Linscombe, VA, and Lick, SJ, 1994a, *Evaluation of 2,4-Dichlorophenoxyacetic acid isopropylamine salt in the Chinese Hamster ovary cell/Hypoxanthine-guanine-phosphoribosyl transferase (CHO/HGPRT) Forward Mutation Assay.* Laboratory Project Study ID M-004725-017. Unpublished, Report date: May 27, 1994

Linscombe, VA, and Lick, SJ, 1994b, *Evaluation of 2,4-D Triisopropanolamine salt in an in vitro chromosomal aberration assay utilising rat lymphocytes.* Laboratory Project Study ID K-008866-017. Unpublished, Report date: 28 July 1994.

Liu, D, Adelfinskaya, YA, 2011, *Soil Degradation of 2,4-D under Aerobic Conditions.* European Union 2,4-D Task Force 2012.

Liu, W, Li, H, Tao, F, Li, S, Tian, Z and Xie, H, 2013, *Formation and contamination of PCDD/Fs, PCBs, PeCBz, HxCBz and polychlorophenols in the production of 2,4-D products*. Chemosphere. July 92(3):304-8.

Lochry, EA, 1990, *Developmental toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-D Dimethylamine salt (2,4-D-DMA) administered orally via gavage to Crl:CDBR VAF/Plus presumed pregnant rats.* Study No. 320-001. Lab: Argus Research Laboratories, Inc, Horsham, Pennsylvania, USA. Sponsor: Industry Task Force II. Unpublished [AH Marks; sub: CR 105-1, Vol 51/52 of 96] Study duration: 22nd Jan – 15th Feb 1990. Report date: 15th Nov 1990.

Long, R, Foster, J, Hoxter, K, and Smith, G, 1990a, *2,4-D Dimethylamine Salt: A Dietary LC50 Study with the Mallard.* Project No.: 103-309. Wildlife International Limited, Maryland. 6 June 1990.

Long, R, Foster, J, Hoxter, K, and Smith, G, 1990b, *2,4-D Dimethylamine Salt: A Dietary LC50 Study with the Northern Bobwhite*. Project No.: 103-308. Wildlife International Limited, Maryland. 21 December 1990.

Louis, F, and Ufer, A, 1995, *Methodical Improvements of Standard Laboratory Tests for Determining the Side-Effects of Agrochemical on Predatory Mites (Acari: Phytoseiidae).* Anz. Schadlingskde., Pflanzenschutz, Umweltschutz 68, 153-154.

Lührs, U, 2011, *2,4-dichloroanisole: Effects of 2,4-dichloroanisole on Reproduction of the Predatory Mite Hypoaspis aculeifer in Artificial Soil with 5% Peat*. European Union 2,4-D Task Force 2012.

Lührs, U, 2011, *Effects of 2,4-dichloroanisole on Reproduction of the Collembola Folsomia candida in Artificial Soil with 5% Peat*. European Union 2,4-D Task Force 2012.

Lührs, U, 2011, *Effects of 2,4-dichloroanisole on Reproduction and Growth of Earthworms Eisenia fetida in Artificial Soil with 5 % Peat*. European Union 2,4-D Task Force 2012.

Lührs, U, 2011, *Effects of 2,4-Dichlorophenol on Reproduction of the Collembola Folsomia candida in Artificial Soil with 5% Peat.* European Union 2,4-D Task Force 2012.

Lührs, U, 2011, *Effects of 2,4-Dichlorophenol on Reproduction of the Predatory mite Hypoaspis aculeifer in Artificial Soil with 5% Peat*. European Union 2,4-D Task Force 2012.

Mack, P, 2012, *LAF-74: A Semi-field Study to Investigate residues in Honeybee Products and Honeybee Larvae (Apis mellifera carnica L.; Hymenoptera, Apidae) in Phacelia tanacetifolia in Germany in 2011*. European Union 2,4-D Task Force 2012.

Madrigal-Bujaidar, E, Hernandez-Ceruelos, A, and Chamorro, G, 2001, *Induction of sister chromatid exchanges by 2,4-dichlorophenoxyacetic acid in somatic and germ cells of mice exposed in vivo.* Food Chem Toxicol, 39, 941-46.

Magnusson, J, Ramel, C, Eriksson, A, 1977, *Mutagenic Effects of Chlorinated Phenoxyacetic Acids in Drosophila melanogaster Hereditas,* 87:121-123, 1977.

Maguire, HC, 1973, *The bioassay of contact allergens in guinea pig*. J. Soc. Cosmetic Chem. 24, 151-162.

Marino, et al, 2010, *2,4-Dichlorophenoxyacetic Acid: A Fish Short-Term Reproduction Assay Using the Fathead Minnow, Pimephales promelas*. Industry Task Force II on 2,4-D Research Data.

Mark, U, and Hantink-de Rooy, E, 1989, *Prolonged Toxicity Study With Daphnia magna Under Semi-Static Conditions: Test Substance: 2,4-Dichlorophenoxy Acetic Acid (2,4-D) As DMA Salt*. Corporate Research, Analytical Chemistry Department. The Netherlands. 12 December 1989.

Martin, T, 1991, *Developmental toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-D Dimethylamine salt (2,4-D-DMA) administered orally via stomach tube to New Zealand White Rabbits*. Study No. 320-004. Lab: Argus Research Laboratories, Inc, Horsham, Pennsylvania, USA. Sponsor: Industry Task Force II. Unpublished [AH Marks; sub: CR 105-1, Vol 1,7,8,9 of 10] Study duration: May 6th 1991 – 7th June 1991. Report date: 12th Nov 1991.

Martin, T, 1992a, *Developmental Toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-D 2-ethylhexyl ester (2,4-D isooctyl ester) administered orally via gavage to Crl:CD BR VAF/Plus presumed pregnant rats;* Study number: not provided Argus research laboratory, USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 10 April 1992.

Martin, T, 1992b, *Developmental toxicity (embryo-foetal toxicity and teratogenic potential) study of 2,4-D 2-ethylhexyl ester (2,4-D isooctyl ester) administered orally (stomach tube) to New Zealand White Rabbits* Crl:CD BR VAF/Plus presumed pregnant rats Study number: not provided; Argus research laboratory, USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 10 April 1992.

Marty, MS, Zablotny, CL, Andrus, DR, Boverhoff, DR, Bus, JS, Perala, AW, and Saghir, S, 2010, *2,4-D: An Extended One Generation Dietary Toxicity Study in CRL:CD(SD) rats*. Laboratory Project Study ID: 081104. Lab: Toxicology & Environmental Research and Consulting, The Dow Chemical Company, Midland, Michigan, USA. Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Final report. Dated: 30 January 2010.

Marty, MS, Zablotny, CL, Andrus, DR, Boverhoff, DR, Bus, JS, Perala, AW, and Saghir, S, 2010, *2,4-D: An Extended One Generation Dietary Toxicity Study in CRL:CD(SD) rats.* Laboratory Project Study ID: 081104. Lab: Toxicology & Environmental Research and Consulting, The Dow Chemical Company, Midland, Michigan, USA. Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Final report. Dated: 30 January 2010.

Mattsson, JL, Albee, RR, Johnson, KA, and Quast, JF, 1986, *Neurotoxicological examination of rats dermally exposed to 2,4-D amine for three weeks.* Neurobehavioural Toxicology and Teratology, 8: 255-263.

Mattsson, JL, Albee, RR, Johnson, KA, and Quast, JF, 1986, *Neurotoxicological examination of rats dermally exposed to 2,4-D amine for three weeks.* Neurobehavioural Toxicology and Teratology, 8: 255-263.

Mattsson, JL, Charles, JM, Yano, BL, Cunny, HC, Wilson, RD, and Bus, JS, 1997, *Single-dose and chronic dietary neurotoxicity screening studies on 2,4-dichlorophenoxyacetic acid (2,4-D) in rats*. Fundam. Appl. Toxicol. 40(1): 111–119.

Mattsson, JL, Jeffries, TK, and Yano, BL, 1994b, *2,4-Dichlorophenoxyacetic acid: Chronic neurotoxicity study in Fischer 344 rats;* Study no. K-002372-064N; The Toxicology Research Laboratory, Dow Corning Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 28 June 1994.

Mattsson, JL, Jeffries, TK, and Yano, BL, 1994b, *2,4-Dichlorophenoxyacetic acid: Chronic neurotoxicity study in Fischer 344 rats*; Study no. K-002372-064N; The Toxicology Research Laboratory, Dow Corning Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 28 June 1994.

Mattsson, JL, McGuirk, RJ, and Yano, BL, 1994a, *2,4-Dichlorophenoxyacetic acid (2,4-D): Acute neurotoxicity study in Fischer 344 rats*; Study no. K-002372-066; The Toxicology Research Laboratory, Dow Corning Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 5 January 1994.

Mattsson, JL, McGuirk, RJ, and Yano, BL, 1994a, *2,4-Dichlorophenoxyacetic acid (2,4-D): Acute neurotoxicity study in Fischer 344 rats*; Study no. K-002372-066; The Toxicology Research Laboratory, Dow Corning Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 5 January 1994.

Mattsson, JL, McGuirk, RJ, and Yano, BL, 1994a, *2,4-Dichlorophenoxyacetic acid (2,4-D): Acute neurotoxicity study in Fischer 344 rats*; Study no. K-002372-066; The Toxicology Research Laboratory, Dow Corning Chemical Company, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 5 January 1994.

Mayes, M, Gorzinski, S, Potter, R, and Richardson, C, 1990a, *2,4-Dichlorophenoxyacetic Acid (2-Ethylhexyl Ester): Evaluation of the Toxicity to Early Life Stages of the Fathead Minnow*, Pimephales promelas Rafinesque.

Laboratory Project Study ID ES-DR-0019-1208-7. Dow Chemical Company, Midland, Michigan. 14 December 1990.

Mayes, M, Gorzinski, S, Potter, R, and Richardson, C, 1990b, *The Acute Toxicity of Esteron 99 Herbicide to The Rainbow Trout, Oncorhynchus mykiss Walbaum.* Laboratory Project Study ID ES-DR-0119-8216-2. Dow Chemical Company, Midland, Michigan. 13 December 1990.

Mayes, M, Gorzinski, S, Potter, R, and Richardson, C, 1990c, *2,4-Dichlorophenoxyacetic Acid: Evaluation of the Toxicity to Early Life Stages of the Fathead Minnow (Pimephales promelas)*

Rafinesque, Laboratory Project Study ID ES-DR-0002-2297-10. Dow Chemical Company, Midland, Michigan. 7 December 1990.

McCarty, W, and Batchelder, T, 1977, *Toxicity of 2,4-Dichlorophenoxyacetic Acid to Daphnids.* Laboratory Project Study ID ES-143. Dow Chemicals USA, Midland, Michigan. 29 September 1977.

McCarty, W, 1979, *Toxicity of Eleven Herbicides to Daphnids.* Laboratory Project Study ID ES-274. Dow Chemical USA, Midland, Michigan. 16 March 1979.

McCoy, K, and Lehmann, R, *Soil Adsorption Properties of 2,4-D and the 2-Ethylhexyl and Butyl Esters of 2,4-D*. Laboratory Project ID GH-C 1993. Dow Chemical U.S.A. 13 January 1988.

Meinerling, M, 2012, *Effects of 2,4-dichlorophenol on the Activity of the Soil Microflora in the Laboratory.* European Union 2,4-D Task Force 2012.

Melnick, R, 1989, *Toxicology and carcinogenesis studies of 2,4-Dichlorophenol* (CAS No 120-83-2) in F344/N rats and B6C3F1 mice. National Toxicology Program, Technical Report Series No 353-USDA.

Memmert, U, 1997a, *Acute Toxicity of Herbizid Marks D to Rainbow Trout (Oncorhyncjus mykiss) in a 96 Hour Static Test.* Study Project No.: 655918. RCC Umweltchemie Ag, Itingen, Switzerland. 6 October 1997.

Memmert, U, 1997b, *Acute Toxicity of Herbizid Marks D to Daphnia magna in a 48 Hour Immobilisation Test.* Study Project No.: 655931. RCC Umweltchemie Ag, Itingen, Switzerland. 6 October 1997.

Memmert, U, 1997c, *Acute Toxicity of Herbizid Marks D to Scenedesmus subspicatus in a 72 Hour Algal Growth Inhibition Test.* Study Project No.: 655953. RCC Umweltchemie Ag, Itingen, Switzerland. 6 October 1997.

Mitchell, L, Beavers, J, Martin, K and Jaber, M, 2000, *2,4-D Acid: A Reproduction Study with the Northern Bobwhite.* Project Number 467-106. Wildlife International, Maryland. 30 October 2000.

Mizell, MJ, 1989, *2,4-Dichlorophenoxyacetic acid triisopropanolamine salt: Primary Dermal Irritation Study in New Zealand White Rabbits.* Laboratory Project Study ID K-008866-002B, The Toxicology Research Laboratory, Dow Chemical Company, Midland MI USA. 9 October 1989

Mizell, MJ, Atkin, L, Haut, KT, and Stebbins, KE, 1989, *2,4-D Triisopropanolamine salt: 21-day Dermal Toxicity Study in New Zealand White Rabbits*. Laboratory Project Study ID K-008866-004. Unpublished, Report date: 8 December 1989.

Mizell, MJ, Atkin, L, Haut, KT, and Stebbins, KE, 1989, *2,4-D Triisopropanolamine salt: 21-day Dermal Toxicity Study in New Zealand White Rabbits*. Laboratory Project Study ID K-008866-004. Unpublished, Report date: 8 December 1989.

Monk, R, 1990, *Sublethal Toxic Effects of 2,4-D-Dimethylamine-Salt on Rainbow Trout (Salmo gairdneri RICH. = Oncorhynchus mykiss) in a Flow-through System (28 Days);* OECD 204. Project No.: 42F0882/895265. BASF Aktiengesellschaft, Germany. 30 January 1990.

Moody, RP, Wester, RC, Melendres, JL, and Maibach, HI, 1992, *Dermal absorption of the phenoxy herbicide 2,4-D dimethylamine in humans: Effect of DEET and anatomic site*. Journal of Toxicology and Environmental Health 36:241-250.

Moody, RP, Franklin, CA, Ritter, L, & Maibach, HI, 1990, *Dermal absorption of the phenoxy herbicide 2,4-D, 2,4-D amine, 2,4-D isooctyl and 2,4,5,-T in rabbits, rats, rhesus monkeys, and humans. A cross-species comparison.* J. Toxicol. Environ. Health, 29, 237-245.

Myer, JR, 1981a, *2,4-dichlorophenoxyacteic acid (2,4-D), technical; Determination of acute oral LD50 in Fisher 344 rats.* Study No. 490-001. Lab; International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 76 of 96].

Myer, JR, 1981b, *2,4-dichlorophenoxyacteic acid (2,4-D), technical; Determination of acute dermal LD50 in rabbits*. Study No. 490-004. Lab; International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 76 of 96].

Myer, JR, 1981c, *2,4-dichlorophenoxyacteic acid, isooctyl ester (2,4-D IOE); Determination of acute oral LD50 in Fischer 344 rats.* Study No. 490-002. Lab; International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 76 of 96].

Myer, JR, 1981d, *2,4-dichlorophenoxyacteic acid, isooctyl ester (2,4-D IOE), technical; Determination of acute dermal LD50 in rabbits*. Study No. 490-005. Lab; International Research and Development Corporation, Michigan, USA. Sponsor: Industry Task Force on 2,4-D Research Data. Unpublished [AH Marks; sub: CR 105-1, Vol 76 of 96].

Newton, PE, 2002, *Fundamental inhalation toxicology.* In Handbook of toxicology, 2nd edn, Derelanko MJ and Hollinger MA, eds, CRC Press, Boca Raton, FLA, USA pp 267-351.

NHMRC/TGA, 2002, *Dioxins: Recommendation for a Tolerable Monthly Intake for Australians.* The National Medical Health & Research Council and the Therapeutic Goods Administration. ISBN 1 86496 175 9 (Print); 1 86496 181 3 (On-line).

Nierzedska, E, 2004, *2,4-D ACID: Toxicity evaluation for duckweed Lemna minor L.* UTCC 490. European Union 2,4-D Task Force 2012.

Nigitz, H, 1990a, *2,4-D Acid (As DMA-Salt) 96-Hour Acute Toxicity Study (LC50) in the Carp (Static).* RCC Notox Project 018977. RCC Notox B.V. The Netherlands.

Nigitz, H, 1990b, *2,4-D Acid (As DMA-Salt) 96-Hour Acute Toxicity Study (LC50) in the Rainbow Trout (Flow-Through).* RCC Notox Project 019620. RCC Notox B.V. The Netherlands.

Nitschke, KD, and Lomax, LG, 1990, *2,4-D Triisopropanolamine: Acute Aerosol LC50 Study in Fischer 344 Rats.* Study ID K-00886600-010 Lab: The Toxicology Research Laboratory,

Noe, F, Gragna, D, 2013, *2,4-D acid technical: Acute toxicity to rainbow trout (Oncorhynchus mykiss) in a 96-hour study under static exposure.* UPL Australia Limited.

Noe, F, Gragna, D, 2013. *2,4-D acid technical: toxicity to green algae Pseudokirchneriella subcapitata determined in a growth inhibition study.* UPL Australia Limited.

Noe, F, Gragna, D, 2013. *2,4-D acid technical: Acute toxicity to Daphnia magna in a 48-hour immobilisation test under static exposure*. UPL Australia Limited.

NTP, 1992, *NTP Technical Report on Toxicity Studies of Diethanolamine Administered Topically and in Drinking Water to F344/N Rats and B6C3F1 Mice*. US National Toxicology Program, Study No: 92-3343, Report No: 20. Unpublished, Report date: October, 1992.

NTP, 1999, *NTP technical report on the toxicology and carcinogenesis studies of diethanolamine in F344/N RATS AND B6C3F1 mice (dermal studies).* US National Toxicology Program, NIH Publication No. 99-3968, NTP TR 478.

OCS, 1991, *Evaluation report on 2,4-Dichlorphenol.* TES2-0903

OCS, 2002, *Evaluation Report on 2,4-D, Dicamba and Clopyralid; Nuturf Millennium Herbicide.* CPAS 12121. July 2002.

OCS, 2004, Australian Government Department of Health and Ageing. *Health Risk Assessment of dioxins in Australia, National Dioxins Program Technical Report No. 12,* Australian Government Department of the Environment and Heritage, Canberra. Revised July 2005.

OCS, 2009, *GWO 281. Human health risk assessment of dioxin contamination in quintozene productsOCS (2010)*. GWO 271. Human health risk assessment of dioxin impurities in pesticides.

OCS, 2012, GWO 636. OCS File Number 2012/023072.

OCS, 2013, GWO 772. OCS File Number 2012/023072.

OCS, 2015, CR 356-1. *Human Health Risk Assessment of Products Containing 2,4-D acid, salts and esters*.

OCS, 2016, *Review of the mammalian toxicity and metabolism/toxicokinetics of 2,4-D [(2,4-dichlorophenoxy)acetic acid]*. Office of Chemical Safety, Department of Health, Canberra, ACT, Australia (May, 2016).

OECD, 2008, *2,2'-iminodiethanol SIDS Initial Assessment Report for SIAM 24*, Paris, France, 17 – 20 April 2007. Organisation for Economic Co-operation and Development.

OECD, 2011, *Guidance Notes on Dermal Absorption*. ENV/JM/MONO(2011)36.

Oldersma, H., de Bie, A.Th.H.J, Hamwijk, C, 2008, *The route and rate of degradation of 2,4-D in an anaerobic soil*. European Union 2,4-D Task Force 2012.

Oliveira, GH, and Palermo-Neto, J, 1993, *Effects of 2,4-dichlorophenoxyacteic acid (2,4-D) on open-field behaviour and neurochemical parameters of rats*. Pharmacology and Toxicology, 73, 79–85.

Palmer, S, and Krueger, H, 1997a, *2,4-D (2,4-Dichlorophenoxyacetic acid): A 96 hour Static Acute Toxicity Test with the Leopard Frog Tadpoles (Rana pipiens).* Laboratory Project Number 467A-102. Wildlife International Ltd. Indianapolis Indiana. 17 December 1997.

Palmer, S, and Krueger, H, 1997b, 2*,4-D 2-Ethylhexyl Ester: A 96 hour Static Acute Toxicity Test with the Leopard Frog Tadpoles (Rana pipiens).* Laboratory Project Number 467A-101. Wildlife International Ltd. Indianapolis Indiana. 17 December 1997.

Palmer, S, and Krueger, H, 1997c, *2,4-D Dimethylamine Salt: A 96 hour Static Acute Toxicity Test with the Leopard Frog Tadpoles (Rana pipiens).* Laboratory Project Number 467A-103. Wildlife International Ltd. Indianapolis Indiana. 17 December 1997.

Palmer, S, and Krueger, H, 1997d, *2,4-D 2-Ethylhexyl Ester: An Acute Contact Toxicity Study with the Honey Bee. Laboratory Project Number 467–104.* Wildlife International Ltd. Indianapolis Indiana. 17 December 1997.

Palmer, S, and Krueger, H, 1997e, *2,4-D Dimethylamine Salt: An Acute Contact Toxicity Study with the Honey Bee.* Laboratory Project Number 467-102. Wildlife International Ltd. Indianapolis Indiana. 17 December 1997.

Patel, MR, 2013, *Acute inhalation toxicity study of 2,4-D acid technical in rats*. Study No. 405-1-01-6788. Lab: Jai Research Foundation, Department of Toxicology, Valvada, Dist. Valsad, Gujarat, India. Sponsor: United Phosphorus Ltd, Madhu Park, Mumbai, India. Unpublished Dated: 1 August, 2013

Pavlica, M, Papes, D, and Nagy, B, 1991, *2,4-Dichlorophenoxyacetic acid causes chromatin and chromosome abnormalities in plant cells and mutation in cultured mammalian cells.* Mutation Research 263, 77-81.

PMRA, 2004, *Toxicology re-evaluation of 2,4-dichlorophenoxyacetic acid (2,4-D).* Pest Management Regulatory Agency, Health Canada, Ottawa, Canada.

Porch, et al, 2006, *2,4-D 2-Ethylhexyl Ester (2,4-D 2-EHE): A Toxicity Test to Determine the Effects of the Test Substance on Seedling Emergence of Ten Species of Plants.* Industry Task Force II on 2,4-D Research Data.

Porch, JR, Krueger, HO, Martin, KH, 2006, *2,4-D 2-Ethylhexyl Ester (2,4-D 2-EHE): A Toxicity Test to Determine the Effects of the Test Substance on Vegetative Vigor of Ten Species of Plants Grown Under Greenhouse Conditions.* Industry Task Force II on 2,4-D Research Data.

Porch, JR, Krueger, HO, Martin, KH, 2006, *2,4-D Dimethylamine Salt: A Toxicity Test to Determine the Effects of the Test Substance on Seedling Emergence of Ten Species of Plants.* Industry Task Force II on 2,4-D Research Data.

Porch, JR, Kendall, TZ, Krueger, HO, 2011, *2,4-D: 2,4-dichlorophenoxyacetic acid: A 72-hour toxicity test with the freshwater alga (Pseudokirchneriella subcapitata).* European Union 2,4-D Task Force 2012.

Porch, JR, Kendall, TZ, Krueger, HO, 2011, *2,4-Dichlorophenoxyacetic Acid: A 72 hour Toxicity Test with the Marine Diatom (Skeletonema costatum).* European Union 2,4-D Task Force 2012.

Pore, MP, 1998a, *Acute dermal toxicity of 2,4-D isobutyl ester technical in rat* Study No: 1173003 Report Number: 98.203 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: Not stated Unpublished Dated: 27 June 1998 [RA; CR 105-1; APVMA Study No: 7412; Data protection: Yes].

Pore, MP, 1998b, *Primary skin irritation study of 2,4-D isobutyl ester in rabbit* Study No: 117304 Report Number: 98.204 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: Not stated Unpublished Dated: 27 June 1998 [RA; CR 105-1; APVMA Study No: 7415; Data protection: Yes].

Pore, MP, 1998c, *Mucous membrane irritation study of 2,4-D isobutyl ester technical in rabbit* Study No: 117305 Report Number: 98.205 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: not stated Unpublished Dated: 27 June 1998 [RA; CR 105-1; APVMA Study No: 7414; Data protection: Yes].

Pore, MP, 1999a, *Acute oral toxicity of 2,4-D acid technical to mouse* Study No: 132001 Report Number: 99.368 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 17 May – 17 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7378; Data protection: Yes].

Pore, MP, 1999aa, *Skin sensitisation study (Buehler test) of 2,4-D Isooctylester Technical in guinea pigs*. Study No. 131912. Report No. 99.362. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Pore, MP, 1999ab, *Skin sensitisation study (Buehler test) of 2,4-D Sodium Technical in guinea pigs*. Study No. 132512. Report No. 99.729. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Pore, MP, 1999ac, *Skin sensitisation study (Buehler test) of 2,4-D Dimethylamine Salt in guinea pigs.* Study No. 132312. Report No. 99.560. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Pore MP, 1999ad, *Skin sensitisation study (Buehler test) of 2,4-D Ethylester Technical in guinea pigs*. Study No. 132412. Report No. 99.756. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 6 of 10].

Pore MP, 1999b, *Acute oral toxicity of 2,4-D acid technical to rat* Study No: 132002 Report Number: 99.369 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 18 May – 14 June 1999 Unpublished Dated: 7 July 1999 [RA; CR 105-1; APVMA Study No: 7379; Data protection: Yes].

Pore, MP, 1999c, *Acute oral toxicity of 2,4-D sodium technical to mouse* Study No: 132501 Report Number: 99.705 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 16 May – 30 June 1999 Unpublished Dated: 29 November 1999 [RA; CR 105-1; APVMA Study No: 7386; Data protection: Yes].

Pore, MP, 1999d, *Acute oral toxicity of 2,4-D sodium technical to rat* Study No: 132502 Report Number: 99.706 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 28 May

– 21 June 1999 Unpublished Dated: 29 November 1999 [RA; CR 105-1; APVMA Study No: 7387; Data protection: Yes].

Pore, MP, 1999e, *Acute dermal toxicity of 2,4-D sodium technical to rat* Study No: 132503 Report Number: 99.724 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 23 June–7 July 1999 Unpublished Dated: 14 December 1999 [RA; CR 105-1; APVMA Study No: 7388; Data protection: Yes].

Pore, MP, 1999f, *Acute dermal irritation / corrosion of 2,4-D sodium technical in rabbit* Study No: 132505 Report Number: 99.725 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 14–17 July 1999 Unpublished Dated: 14 December 1999 [RA; CR 105-1; APVMA Study No: 7390; Data protection: Yes].

Pore, MP, 1999g, *Acute eye irritation / corrosion of 2,4-D sodium technical in rabbit* Study No: 132506 Report Number: 99.726 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 5–20 July 1999 Unpublished Dated: 14 December 1999 [RA; CR 105-1; APVMA Study No: 7391; Data protection: Yes].

Pore, MP, 1999h, *Mucous membrane irritation study of 2,4-D sodium technical in rabbit* Study No: 132511 Report Number: 99.728 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 5–8 July 1999 Unpublished Dated: 14 December 1999 [RA; CR 105-1; APVMA Study No: 7392; Data protection: Yes].

Pore, MP, 1999i, *Primary skin irritation study of 2,4-D sodium technical in rabbit* Study No: 132510 Report Number: 99.727 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 14–17 July 1999 Unpublished Dated: 14 December 1999 [RA; CR 105-1; APVMA Study No: 7393; Data protection: Yes].

Pore, MP, 1999j, *Acute dermal toxicity study of 2,4-D dimethylamine salt in rat* Study No: 132303 Report Number: 99.554 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 23 June–7 July 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7396; Data protection: Yes].

Pore, MP, 1999k, *Acute dermal irritation / corrosion study of 2,4-D dimethylamine salt in rabbit Study* No: 132305 Report Number: 99.556 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 31 May–3 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7398; Data protection: Yes].

Pore, MP, 1999l, *Acute eye irritation / corrosion study of 2,4-D dimethylamine salt in rabbit* Study No: 132306 Report Number: 99.557 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 12 July–2 August 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7399; Data protection: Yes].

Pore, MP, 1999m, *Mucous membrane irritation study of 2,4-D dimethylamine salt in rabbit* Study No: 132311 Report Number: 99.559 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 27 May–11 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7400; Data protection: Yes].

Pore, MP, 1999n, *Primary skin irritation study of 2,4-D dimethylamine salt in rabbit* Study No: 132310 Report Number: 99.558 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 31 May–3 June 1999 Unpublished Dated: 29 September 1999 [RA; CR 105-1; APVMA Study No: 7401; Data protection: Yes].

Pore, MP, 1999o, *Acute dermal toxicity of 2,4-D ethyl ester to rat* Study No: 132403 Report Number: 99.748 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 15 June–23 July 1999 Unpublished Dated: 25 December 1999 [RA; CR 105-1; APVMA Study No: 7404; Data protection: Yes].

Pore, MP, 1999p, *Acute dermal irritation / corrosion study of 2,4-D ethyl ester technical in rabbit* Study No: 132405 Report Number: 99.749 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 16–19 June 1999 Unpublished Dated: 25 December 1999 [RA; CR 105-1; APVMA Study No: 7406; Data protection: Yes].

Pore, MP, 1999q, *Acute eye irritation / corrosion study of 2,4-D ethyl ester in rabbit* Study No: 132406 Report Number: 99.750 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 12–15 July 1999 Unpublished Dated: 25 December 1999 [RA; CR 105-1; APVMA Study No: 7407; Data protection: Yes].

Pore, MP, 1999r, *Mucous membrane irritation study of 2,4-D ethyl ester in rabbit* Study No: 132411 Report Number: 99.755 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 1 - 4 June 1999 Unpublished Dated: 25 December 1999 [RA; CR 105-1; APVMA Study No: 7408; Data protection: Yes].

Pore, MP, 1999s, *Primary skin irritation study of 2,4-D ethyl ester in rabbit* Study No: 132410 Report Number: 99.754 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 16–19 June 1999 Unpublished Dated: 25 December 1999 [RA; CR 105-1; APVMA Study No: 7409; Data protection: Yes].

Pore, MP, 1999t, *Acute dermal toxicity of 2,4-D isooctyl ester technical in rat* Study No: 131903 Report Number: 99.353 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 2–16 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7418; Data protection: Yes].

Pore, MP, 1999u, *Acute dermal irritation / corrosion of 2,4-D isooctyl ester technical in rabbit* Study No: 131905 Report Number: 99.355 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 31–3 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7420; Data protection: Yes].

Pore, MP, 1999v, *Acute eye irritation / corrosion study of 2,4-D isooctyl ester technical in rabbit* Study No: 131906 Report Number: 99.356 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 17–20 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7421; Data protection: Yes].

Pore, MP, 1999w, *Mucous membrane irritation study of 2,4-D isooctyl ester technical in rabbit* Study No: 131911 Report Number: 99.361 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India

Study duration: 26–29 May 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7422; Data protection: Yes].

Pore, MP, 1999x, *Primary skin irritation study of 2,4-D isooctyl ester technical in rabbit* Study No: 131910 Report Number: 99.360 Lab: INTOX Institute for toxicological studies, Pune, India Sponsor: Atul Ltd, Gujarat, India Study duration: 31 May–3 June 1999 Unpublished Dated: 30 June 1999 [RA; CR 105-1; APVMA Study No: 7423; Data protection: Yes].

Pore, MP, 1999y, *Skin sensitisation study (Buehler test) of 2,4-D Acid Technical in guinea pigs.* Study No. 132012. Report No. 99.379. Lab: Intox, Pune, India. Sponsor: Atul Ltd, Gujarat, India. Unpublished [Rotam Australia Ltd, NSW; sub: CR 105-1, Vol 4 of 10].

Potter, R, 1990, *2,4-D Ethylhexyl Ester: Solubility in Industrial Water*. Laboratory Project ID ES-DR-0019-1208-8. Dow Chemical Company, Midland, Michigan. 9 September 1990.

Rana, JR, 2014, *Acute oral toxicity study of 2,4-D acid technical in Japanese Quail*, Coturnix coturnix japonica. UPL Australia Limited.

Rana, MD, 2003a, *Acute oral toxicity study of 2,4-D acid in rats.* JRF Study No. 4351. Lab: JAI Research Foundation, Dept of Toxicology, Gujarat, India. Sponsor: KTcom PTE Ltd, Singapore. Unpublished [Kenso Corp; sub: CR105-1, Vol 1 of 96].

Rana, MD, 2003b, *Acute dermal toxicity study of 2,4-D acid in rats*. JRF Study No. 4352. Lab: JAI Research Foundation, Dept of Toxicology, Gujarat, India. Sponsor: KTcom PTE Ltd, Singapore. Unpublished [Kenso Corp; sub: CR105-1, Vol 1 of 96].

Ratte, M, Ratte, T, 2011, *Myriophyllum spicatum* toxicity test: Results of an inter-laboratory ring test using a sediment-free test system, FKZ 363 01 294, final report, Fedrate Environment Agency (UBA), available at: oecd.org/env/ehs/testing/Report%20of%20ring%20test%20Myriophyllum-sediment-free_5%20March%202013.pdf

Rebstock, M, 2011, *2,4-D Acid: Growth Inhibition Test with the Freshwater Diatom, Navicula pelliculosa.* European Union 2,4-D Task Force 2012.

Reim, R, 1989, *Dissociation of 2,4-Dichlorophenoxyacetic Acid (2,4-D) and 2,4-D Dimethlamine Salt in Water.* Laboratory Project ID ML-AL 89-041014. Analytical Sciences Department, Dow Chemica, Michigan. 24 October 1989.

Rodwell, DE, 1983a, *A teratology study in Fischer 344 rats with 2,4-Dichlorophenoxyacetic acid*, study no. WIL-81135; WIL research Laboratory, Inc, USA; USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 31 March 1983.

Rodwell, DE, 1983a, *A teratology study in Fischer 344 rats with 2,4-Dichlorophenoxyacetic acid,* study no. WIL-81135; WIL research Laboratory, Inc, USA; USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 31 March 1983.

Rodwell, DE, 1983b, *A teratology study in Fischer 344 rats with 2,4-dichlorophenol*, study no. WIL-81134; WIL research Laboratory, Inc, USA; USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 31 March 1983.

Rodwell, DE, 1985, *A dietary two-generation reproduction study in Fischer 344 rats with 2,4-Dichlorophenoxyacetic acid,* study no. WIL-81137; WIL research Laboratory, Inc, USA; USA, Sponsor: Industry Task Force II on 2,4-D Research Data. Unpublished. Dated: 26 July 1985.

Ross, JH, Driver, JH, Harris, SA, and Maibach, HI, 2005, *Dermal Absorption of 2,4-D: a review of species differences.* Regulatory Toxicology and Pharmacology 41:82-91.

Roy TA, Hammerstrom K, Schaum J, 2008, *Percutaneous absorption of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) from soil.* J Toxicol Environ Health A. 2008;71(23):1509-15.

Saghir, SA, Marty, MS, Zablotny, CL, Passage, JK, Perala, AW, Neal, BH, Hammond, L, & Bus, JS, 2013, *Life-Stage-, Sex-, and Dose-Dependent Dietary Toxicokinetics and Relationship to Toxicity of 2,4-Dichlorophenoxyacetic Acid (2,4-D) in Rats"* Implications for Toxicity Test Dose Selection, Design, and Interpretation. *Toxicological Sciences*. 136(2):294-307.

Samson, YE, and Gollapudi, BB, 1989, *Evaluation of 2,4-D Triisopropanolamine salt in the Ames Salmonella/Mammalian-Microsome Bacterial mutagenicity assay*. Laboratory Project Study ID TXT:K-008866-007. Unpublished, Report date: December 12, 1989

Sauerhoff, MW, Braun, WH, Blau, GE, & Gehring, PJ, 1977, *The fate of 2,4-dichloro- phenoxyacetic acid (2,4-D) following oral administration to man.* Toxicology, 8, 3-11.

Schaefer, EC, Twilley, BC, 2011, *2,4-Dichlorophenoxyacetic acid: An activated sludge respiration inhibition test.* European Union 2,4-D Task Force 2012.

Schmitzer, S, and Breitwieser, H, 1997, *Study Report Effects of Herbizid Marks D on the Wolf Spider Pardosa spec. (Araneae, Lycosidae) in the Laboratory.* IBACON Project 2304065. Institut fur Biologische Analytik und Consulting (IBACON), Rossdorf. 30 October 1997.

Schmitzer, S, 2012, *Study on the Effect of 2,4-D technical on Honey Bee Brood (Apis mellifera L.)–Brood Feeding Test*. European Union 2,4-D Task Force 2012.

Schoot Uiterkamp, A, 1989, *Effect of U 46 D-Fluid (500 g/L) on the Growth of the Alga Selenastrum Capricornutum (OECD 201).* TNO Division of Technology for Society, Delft, The Netherlands. 18 January 1989.

Schreinemachers, 2003, *Birth malformations and other adverse perinatal outcomes in four U.S wheat-producing States*. Environmental Health Perspectives, 111: 1259-1263.

Schroeder, RE, 1990, *A Teratogenicity Study in rats with 2,4-D Triisopropanolamine*. Laboratory Project Study ID HET K-008866-012. Lab: Bio/dynamics, Inc, East Millstone, New Jersey, USA. Sponsor: The Dow Chemical Company, Midland, Michigan, USA. Unpublished, Report date: 25 May 1990.

Schulze, GE, 1990a, *21-Day dermal irritation and dermal toxicity study in rabbits with 2,4-Dichlorophenoxyacetic acid;* HLA Study No. 2184-109; Hazelton Laboratories America, Virginia, USA; 16 October 1990.

Schulze, GE, 1990a, *21-Day dermal irritation and dermal toxicity study in rabbits with 2,4-Dichlorophenoxyacetic acid;* HLA Study No. 2184-109; Hazelton Laboratories America, Virginia, USA; 16 October 1990.

Schulze, GE, 1990b, *21-Day dermal irritation and dermal range finding study in rabbits with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid.* Study No. 2184-108. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [CR 105-1, Vol 75 of 96]. Study duration: 25th Aug–15th Sep 1989. Report date: 2nd Aug 1990.

Schulze, GE, 1990b, *21-Day dermal irritation and dermal range-finding study in rabbits with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid.* Study No. 2184-108. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [CR 105-1, Vol 75 of 96]. Study duration: 25th Aug – 15th Sep 1989. Report date: 2nd Aug 1990.

Schulze, GE, 1990c, *21-day dermal irritation and dermal toxicity study in rabbits with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid.* Study No. 2184-111. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 60 of 96]. Study duration: 29th Nov – 22nd Dec 1989. Report date: 9th Aug 1990.

Schulze, GE, 1990c, *21-day dermal irritation and dermal toxicity study in rabbits with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid*. Study No. 2184-111. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 60 of 96]. Study duration: 29th Nov – 22nd Dec 1989. Report date: 9th Aug 1990.

Schulze, GE, 1990d, *21-Day dermal irritation and dermal toxicity study in rabbits with 2,4-Dichlorophenoxyacetic acid-2-ethylhexyl ether;* HLA Study No. 2184-110; Hazelton Laboratories America, Virginia, USA; 30 July 1990.

Schulze, GE, 1990d, *21-Day dermal irritation and dermal toxicity study in rabbits with 2,4-Dichlorophenoxyacetic acid-2-ethylhexyl ether;* HLA Study No. 2184-110; Hazelton Laboratories America, Virginia, USA; 30 July 1990.

Schulze, GE, 1991a, *Subchronic toxicity study in mice: 2,4-Dichlorophenoxyacetic acid (2,4-D);* HLA Study No. 2184-117; Hazelton Laboratories America, Maryland, USA; 16 August 1991; Sponsor: Industry Task Force II on 2,4-D Research Data.

Schulze, GE, 1991a, *Subchronic toxicity study in mice: 2,4-Dichlorophenoxyacetic acid (2,4-D)*; HLA Study No. 2184-117; Hazelton Laboratories America, Maryland, USA; 16 August 1991; Sponsor: Industry Task Force II on 2,4-D Research Data.

Schulze, GE, 1991b, *Subchronic toxicity study in rats with 2,4-Dichlorophenoxyacetic acid*; HLA Study No. 2184-116; Hazelton Laboratories America, Maryland, USA; 7 August 1991.

Schulze, GE, 1991b, *Subchronic toxicity study in rats with 2,4-Dichlorophenoxyacetic acid*; HLA Study No. 2184-116; Hazelton Laboratories America, Maryland, USA; 7 August 1991.

Schulze, GE, 1991c, *Subchronic toxicity study in dogs with 2,4-Dichlorophenoxyacetic acid*; HLA Study No. 2184-115; Hazelton Laboratories America, Maryland, USA; 14 December 1990.

Schulze, GE, 1991c, *Subchronic toxicity study in rats with 2,4-Dichlorophenoxyacetic acid-2-ethylhexyl ether*; HLA Study No. 2184-112; Hazelton Laboratories America, Virginia, USA; 11 April 1991.

Schulze, GE, 1991d, *Subchronic toxicity study in rats with 2,4-Dichlorophenoxyacetic acid-2-ethylhexyl ether*; HLA Study No. 2184-112; Hazelton Laboratories America, Virginia, USA; 11 April 1991.

Schulze, GE, 1991d, *Subchronic toxicity study in rats with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid*. Study No. 2184-113. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 58 of 96].

Schulze, GE, 1991e, *Subchronic toxicity study in rats with the dimethylamine salt of 2,4-dichlorophenoxyacetic acid.* Study No. 2184-113. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force II, c/o Dow Elanco, Indianapolis, USA. Unpublished [AH Marks; sub: CR 105-1, Vol 58 of 96].

Scott Ward, G, 1991a, *2,4-D, Dimethylamine Salt: Acute Toxicity to the Tidewater Silverside, Menidia beryllina, Under Flow-Through Test Conditions.* Laboratory Project ID J9002003b. Toxikon Environmental Sciences, Jupiter, Florida. 14 March 1991.

Scott Ward, G, 1991b, *2,4-D, Dimethylamine Salt: Acute Toxicity to Pink Shrimp, Panaeus duorarum, Under Flow-Through Test Conditions.* Laboratory Project ID J9002003a. Toxikon Environmental Sciences, Jupiter, Florida. 14 March 1991.

Scott Ward, G, 1991c, *2,4-D, Dimethylamine Salt: Acute New Shell Growth of the Eastern Oyster, Crassostrea virginica, Under Flow-Through Test Conditions.* Laboratory Project ID J9002003c. Toxikon Environmental Sciences, Jupiter, Florida. 22 July 1991.

Scott Ward, G, 1991d, *2,4-D, Dimethylamine Salt: Chronic Toxicity to the Water Flea, Daphnia magna, Under Flow-Through Test Conditions.* Laboratory Project ID J9002003d. Toxikon Environmental Sciences, Jupiter, Florida. 14 March 1991.

Serota, DG, 1983a, *Subchronic toxicity study in mice: 2,4-dichlorophenoxyacetic acid (2,4-D);* HLA Study No. 2184-100; Hazelton Laboratories America, Virginia, USA; 12 September 1983; Sponsor: Industry Task Force on 2,4-D Research Data.

Serota, DG, 1983a, *Subchronic toxicity study in mice: 2,4-dichlorophenoxyacetic acid (2,4-D);* HLA Study No. 2184-100; Hazelton Laboratories America, Virginia, USA; 12 September 1983; Sponsor: Industry Task Force on 2,4-D Research Data.

Serota, DG, 1983b, *Subchronic toxicity study in rats: 2,4-dichlorophenoxyacetic acid (2,4-D);* HLA Study No. 2184-102; Hazelton Laboratories America, Virginia, USA; 12 September 1983; Sponsor: Industry Task Force on 2,4-D Research Data.

Serota, DG, 1983b, *Subchronic toxicity study in rats: 2,4-dichlorophenoxyacetic acid (2,4-D);* HLA Study No. 2184-102; Hazelton Laboratories America, Virginia, USA; 12 September 1983; Sponsor: Industry Task Force on 2,4-D Research Data.

Serota, DG, 1986, *Combined toxicity and oncogenicity study in rats, 2,4-dichlorophenoxyacetic acid.* Study No. 2184-103. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force I on 2,4-D Research Data.

Serota, DG, 1987, *Oncogenicity study in mice with 2,4-dichlorophenoxyacetic acid (2,4-D).* Study No. 2184-101. Lab: Hazleton Laboratories America Inc, Vienna, Virginia, USA. Sponsor: Industry Task Force on 2,4-D Research Data.

Silvoy, J, 1994a, *Terrestrial Field Dissipation Study of 2,4-D DMA on Wheat in Colorado. Study Number 2000WH05-Colorado.* Environmental Technologies Institute, Inc, Research Triangle Park, North Carolina. 22 November 1994.

Silvoy, J, 1994b, *Terrestrial Field Dissipation Study of 2,4-D DMA on Bare Soil in Colorado.* Study Number 2000WH01-Colorado. Environmental Technologies Institute, Inc, Research Triangle Park, North Carolina. 21 November 1994.

Silvoy, J, 1995a, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Wheat in Colorado.* Study Number 2000WH07. Environmental Technologies Institute, Inc, Research Triangle Park, North Carolina. 1 January 1995.

Silvoy, J, 1995b, *Terrestrial Field Dissipation Study of 2,4-D 2-EHE on Bare Soil in Colorado.* Study Number 2000WH03-Colorado. Environmental Technologies Institute, Inc, Research Triangle Park, North Carolina. 9 January 1995.

Smith, MA, Nolan, RJ, Hermann, EA, and Ramsey, JC, 1980, *Pharmacokinetics of 2,4-dichlorophenoxyacetic acid (2,4-D) in Fischer 344 rats;* Laboratory Report Number HET K-002372 – (24); Toxicology Research Laboratory, Michigan, USA; 9 December 1980.

Softcheck, KA, 2012, *2,4-Dichloroanisole–7-Day Toxicity Test with Duckweed (Lemna gibba)* Following OECD Guideline 221. European Union 2,4-D Task Force 2012.

Softcheck, KA, 2012, *2-4-Dichloroanisole - 72-Hour Acute Toxicity Test with Freshwater Green Alga, Pseudokirchneriella subcapitata*, Following OECD Guideline 201. European Union 2,4-D Task Force 2012.

Sorys, P, 2004, *KWAS 2,4-D Evaluation of Inherent Biodegradation in Water.* European Union 2,4-D Task Force 2012.

Squibb, RE, Tilson, HA, and Mitchell, CL, 1983, *Neurobehavioural assessment of 2,4-dichlorophenoxyacetic acid (2,4-D) in rats.* Neurobehavioural Toxicology and Terratology. 5, 331-335.

Steiss, JE, Braund, KG, and Clark, EG, 1987, *Neuromuscular effects of acute 2,4-dichlorophenoxy acetic acid (2,4-D) exposure in dogs*. Journal of the Neurological Sciences. 78: 295-301.

Stockholm Convention, 2017, *Stockholm Convention on persistent organic pollutions (POPs).* Text and Annexes available at: pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx.

Stott, WT, Johnson, KA, Gilbert, KS, Ormand, JR, and Battjes, JE, 1995, *2,4-Dichlorophenoxyacetic acid (2,4-D): Dietary oncogenicity study in B6C3F1 mice–two year final report.* Study Nos. K-002372-063F & K-002372-063M. Lab: The Toxicology Research Laboratory, Health & Environmental Sciences, Dow Chemical Company, Michigan, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 10 March & 16 November 1995. Unpublished [AH Marks; sub: CR 105-1, Vol 4, 5 & 10 of 10 – Vol 22, 23 & 24 of 96.

SUSMP, 2016, *Standard for the Uniform Scheduling of Medicines and Poisons*, No.10.

Swoboda, T, 2006, *2,4-D Acid*. European Union 2,4-D Task Force 2012.

Thongsinthusak, T, et al, 1993, *Guidance for the preparation of human pesticide exposure assessment documents.* HS-1612, California Department of Pesticide Regulation, Sacramento, CA, USA, Dated 4 May, 1993.

Timchalk, C, 2004, *Comparative inter-species pharmacokinetics of phenoxyacetic acid herbicides and related organic acids Evidence that the dog is not a relevant species for evaluation of human health risk.* Toxicology 200, 1-19, 2004. (Supported by Industry Task Force II on 2,4-D Research Data)

Timchalk, C, Dryzga, MD, and Brzak, KA, 1990, *2,4-Dichlorophenoxyacetic acid, tissue distribution and metabolism of 14C-labelled 2,4-Dichlorophenoxyacetic acid in Fischer 344 Rats Laboratory Project Study ID: K-2372-(47);* The Toxicology Research laboratory, Michigan, USA; Sponsor: Industry Task Force II on 2,4-D Research Data; 5 December 1990.

Urann, K, 2011, *2,4-Dichloroanisola – Acute Toxicity to Water Fleas (Daphnia magna) Under Static-Renewal Conditions in a Closed System, Following OECD Guideline # 202.* European Union 2,4-D Task Force 2012.

Urann, K, 2012, *2,4-Dichloroanisole : Acute Toxicity to Rainbow Trout (Oncorhynchus mykiss) Under Flow-Through Conditions, Following OECD Guideline #203.* European Union 2,4-D Task Force 2012.

US EPA, 1994, Method 1613: Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC-HRMS, Office of Water Engineering and Analysis Division, United States Environmental Protection Agency, October 1994, Revision B.

US EPA, 1997, *Exposure factors handbook.* US Environmental Protection Agency Office of Research and Development. Available at: cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12464

US EPA, 1998, *PHED surrogate exposure guide.* Estimates of worker exposure from The Pesticide Handler Exposure Database Version 1.1. US Environmental Protection Agency, Office of Pesticide Programs, August 1998.

US EPA, 2004, *2,4-D - Second Report of the Hazard Identification Assessment Review Committee.* TXR NO. 0052303, January 15, 2004

US EPA, 2005, *2,4-D. Toxicology discipline chapter for the Reregistration Eligibility Decision document*. United States Environmental Protection Agency, Washington DC, USA

US EPA, 2012, *Standard operating procedures for residential pesticide exposure assessment.* US Environmental Protection Agency, Health Effects Division, Office of Pesticide Programs, Office of Chemical Safety and Pollution Prevention, October 2012.

US EPA, 2013, *Occupational Post-Application Risk Assessment Calculator.* Exposac Policy 3 Calculator, March 2013.

US EPA, 2013, *Science Advisory Council for Exposure (ExpoSAC) Policy 3 Revised March 2013*. US Environmental Protection Agency Office of Pesticide Programs, July 2012. Available at: epa.gov/pesticides/science/exposac-policy-3-march2013.pdf

Vainio, H, Linnainmaa, K, Kahonen, M, Nickels, J, Hietanen, E, Marniemi, J, Peltonen, P, 1983, *Hypolipidemia and Peroxisome Proliferation Induced by Phenoxyacetic Acid Herbicides in Rats*, Biochem Pharmacol. 32(18), 2775-2779, 1983.

Vaishnav, D, Yurk, J, and Wade, B, 1990a, *2,4-Dichlorophenoxyacetic acid: Acute Toxicity to Tidewater Silverside (Menidia beryllina) Under Flow-through Conditions.* ESE Project Identification No. 3903008000-0210-3140. Environmental Science and Engineering (ESE) Inc, Gainesville, Florida. 16 July 1990.

Vaishnav, D, Yurk, J, and Wade, B, 1990b, *2,4-Dichlorophenoxyacetic acid: Acute Toxicity to Pink Shrimp (Penaeus Duorarum) Under Flow-through Conditions.* ESE Project Identification No. 3903008000-0200-3140. Environmental Science and Engineering (ESE) Inc, Gainesville, Florida. 16 July 1990

Van Ravenzwaay, B, Hardwick, TD, Needham, D, Pethen, S, Lappin, GJ, 2003, *Comparative metabolism of 2,4-dichlorophenoxyacetic acid (2,4-D) in rat and dog.* Xenobiotica 33, 805-821.

Van Wesenbeek, I, Goerguelue, N, Fruhmann, T, Gibert, E, 2012, *Literature Review for 2,4-D-Dichlorophenoxyacetic Acid Environmental Fate and Behaviour publications from 2000 to 2011*. European Union 2,4-D Task Force 2012.

Venkov, P, Topashka-Ancheva, M, Georgieva, M, Alexieva, V, and Karanov, E, 2000, *Genotoxic effect of substituted phenoxyacetic acids.* Arch. Toxicol. 74, 560-566.

Wade, B, and Overman, M, *2,4-Dichlorophenoxyacetic Acid: Oyster Shell Deposition Test Under Flow-Through Conditions.* ESE Project Identification No. 3903008-0220-3140. Environmental science and Engineering (ESE) Inc. Gainesville, Florida. 9 November 1990.

Wang, Y, Jay, C, and Chen, Y, 1994, *Accumulation of 2,4-D and Glyphosate in Fish and Water Hyacinth.* Water, air and Soil Pollution 74: 397-403. Kluwer Academic Publishers.

Ward, T, and Boeri, R, 1991a, *Acute Flow-Through Toxicity of 2,4-D, 2-Ethylhexyl Ester to the Tidewater Silverside, Menidia beryllina. Laboratory Project ID 9035-D.* EnviroSystems Division, Hampton, New Hampshire. 10 January 1991.

Ward, T, and Boeri, R, 1991b, *Acute Flow-Through Toxicity of EsteronR 99 Herbicide to the Tidewater Silverside, Menidia beryllina.* Laboratory Project ID 9038-D. EnviroSystems Division, Hampton, New Hampshire. 12 March 1991.

Ward, T, and Boeri, R, 1991c, *Acute Flow-Through Toxicity of 2,4-D, 2-Ethylhexyl Ester to the Grass Shrimp, Palaemonetes pugio.* Laboratory Project ID 9036-D. EnviroSystems Division, Hampton, New Hampshire. 10 January 1991.

Ward, T, and Boeri, R, 1991d, *Acute Flow-Through Mollusc Shell Deposition Test with 2,4-D, 2-Ethylhexyl Ester.* Laboratory Project ID 9034-D. EnviroSystems Division, Hampton, New Hampshire. 6 February 1991.

Ward, T, and Boeri, R, 1991e, *Acute Flow-Through Mollusc Shell Deposition Test with Esteron 99 Herbicide.* Laboratory Project ID 9037-D. EnviroSystems Division, Hampton, New Hampshire. 12 March 1991.

Ward, T, and Boeri, R, 1991f, *Acute Flow-Through Toxicity of Esteron 99 Herbicide to the Grass Shrimp, Palaemonetes pugio.* Laboratory Project ID 9039-D. EnviroSystems Division, Hampton, New Hampshire. 6 February 1991.

Ward, T, and Boeri, R, 1991g, *Chronic Toxicity of 2,4-D to the Daphnid, Daphnia magna.* Laboratory Project ID 9040-D. EnviroSystems Division, Hampton, New Hampshire. 12 March 1991.

Ward, T, and Boeri, R, 1991h, *Chronic Toxicity of 2,4-D 2-Ethylhexyl Ester to the Daphnid, Daphnia magna.* Laboratory Project ID 9041-D. EnviroSystems Division, Hampton, New Hampshire. 12 March 1991.

Ward, T, Magazu, J, and Boeri, R, 1993, *2,4-D: Acute Flow-Through Mollusc Shell Deposition Test.* Laboratory Study Number 286-DE. T.R. Wilbury Laboratories Inc, Massachusetts. 15 October 1993.

Waterman, L, 2004, *A Rate-Response Laboratory Test to Determine the Effects of GF-1387 on the Predatory Mite Typhlodromus pyri.* Report No DOW-04-11, Dow Agrosciences Australia Ltd

Waterman, L, 2005, *An Extended Laboratory Test to Determine the Effects of GF-1387, containing 905 g/L 2,4-D 2-Ethylhexyl Ester, on the Predatory Mite Typhlodromus pyri.* Report No DOW-05-1, Dow Agrosciences Australia Ltd

WHO, 1998, Van den Berg, M, Birnbaum, L, Bosveld, BTC, Brunstrőm, B, Cook, P, Feeley, M, Giesy, JP, Hanberg, A, Hasegawa, R, Kennedy, SW, Kubiak, T, Larsen, JC, Van Leeuwen, FXR, Liem, AKD, Nolt, C, Peterson, RE, Poellinger, L, Safe, S, Schrenk, D, Tillitt, D, Tysklind, M, Younes, M, Waern, F & Zacharewski, T 1998, *Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife.* Environmental Health Perspectives 106: 775-792.

WHO, 1998, Van den Berg, M, Birnbaum, L, Bosveld, BTC, Brunstrőm, B, Cook, P, Feeley, M, Giesy, JP, Hanberg, A, Hasegawa, R, Kennedy, SW, Kubiak, T, Larsen, JC, Van Leeuwen, FXR, Liem, AKD, Nolt, C, Peterson, RE, Poellinger, L, Safe, S, Schrenk, D, Tillitt, D, Tysklind, M, Younes, M, Waern, F, & Zacharewski, T, 1998, *Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife*. Environmental Health Perspectives 106: 775-792.

WHO, 2005, *Chemical-Specific Adjustment Factors for Interspecies Differences and Human Variability*: Guidance Document for use of data in Dose/Concentration–Response Assessment.

International Programme on Chemical Safety (IPCS), WHO Document Production Services, Geneva, Switzerland. 2005

WHO, 2005, Van den Berg, M, Birnbaum, L, Denison, M, De Vito, M, Farland, W, Feeley, M, Fiedler, H, Hakansson, H, Hanberg, A, Haws, L, Rose, M, Safe, S, Schrenk, D, Tohyama, C, Tritscher, A, Tuomisto, J, Tysklind, M, Walker, N and Peterson, RE, 2005, *Review: The 2005 World Health Organisation Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*. Toxicological Sciences 93(2): 223–241.

WIL Research Laboratories, 1981a, *Acute oral toxicity study in albino rats with ITF-5; 2,4-dichlorophenoxyacetic acid, sodium salt.* Report Project No. WIL-81233 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 12 of 96].

WIL Research Laboratories, 1981b*, Acute dermal toxicity study in albino rabbits with ITF-5; 2,4-dichlorophenoxyacetic acid, sodium salt.* Report Project No. WIL-81233 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 15 of 96].

WIL Research Laboratories, 1981c, *Acute oral toxicity study in albino rats with ITF-6; 2,4-dichlorophenoxyacetic acid, butoxyethanol ester (2,4-D BEE).* Report Study No. WIL-81234 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 17 of 96].

WIL Research Laboratories, 1981d, *Acute dermal toxicity study in albino rabbits with ITF-6; 2,4-dichlorophenoxyacetic acid, butoxyethanol ester (2,4-D BEE).* Report Study No. WIL-81234 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 13 of 96].

WIL Research Laboratories, 1981e, *Acute oral toxicity study in albino rats with ITF-7; 2,4-dichlorophenoxyacetic acid, butyl ester (2,4-D BE).* Report Study No. WIL-81235 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 14 of 96].

WIL Research Laboratories, 1981f, *Acute dermal toxicity study in albino rabbits with ITF-7; 2,4-dichlorophenoxyacetic acid, butyl ester (2,4-D BE).* Report Study No. WIL-81235 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [CR 105-1, Vol 16 of 96].

WIL Research Laboratories, 1981g, *Acute oral toxicity study in albino rats with ITF-4; 2,4-dichlorophenoxyacetic acid, isobutyl ester (2,4-D IBE).* Report Study No. WIL-81232 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [AH Marks sub: CR 105-1, Vol 76 of 96].

WIL Research Laboratories, 1981h, *Acute dermal toxicity study in albino rabbits with ITF-4; 2,4-dichlorophenoxyacetic acid, isobutyl ester (2,4-D IBE).* Report Study No. WIL-81232 Lab: WIL Research Laboratories Inc, Cincinnati, Ohio, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [AH Marks sub: CR 105-1, Vol 76 of 96].

Wilson RD, 1986, *An acute inhalation toxicity study of 2,4-dichlorophenoxyacetic acid in the rat.* Study No. 86-7893 Lab: Bio/dynamics, Division of Biology and Safety Evaluation, NJ, USA. Sponsor: Industry Task Force on 2,4-D research data, USA. Unpublished [AH Marks sub: CR 105-1, Vol 76 of 96].

Witte, B, 2010, *Effects of 2,4-Dichlorophenol on Reproduction and Growth of Earthworms Eisenia fetida in Artificial Soil with 5% Peat.* European Union 2,4-D Task Force 2012.

Witte, B, 2011, *Acute Toxicity (14 Days) of 2,4-dichloroanisole to the Earthworm Eisenia fetida in Artificial Soil with 5% Peat*. European Union 2,4-D Task Force 2012.

Yano, BL, Cosse, PF, Markham, DA, and Atkin, L, 1991, *2,4-D Triisopropanolamine salt (2,4-D TIPA): A 13 week dietary toxicity study in Fischer 344 rats.* Study ID: K-008866-006 Lab: The Toxicology Research Laboratory, Health and Environmental Sciences, The Dow Chemical Company, Midland, Michigan, USA. Sponsor: DowElanco, Indianapolis, Indiana, USA. Unpublished. Report date: 4 September 1991.

Yoder, RN, Adusumilli, H, 2011, *Batch Equilibrium Adsorption/Desorption of 2,4-D and Adsorption of its Aerobic Soil Metabolites.* European Union 2,4-D Task Force 2012.

Zohner, A, 1989a, *Study on the Effect of U 46-D Fluid (500 g/L 2,4-D Acid as DMA Salt) on Soil Respiration*. Project M8818-1. Report No. 978. Agrolinz, Linz, Austria. April, 1989.

Zohner, A, 1989b. *Investigation of the Side Effects of U 46-D Fluid (500 g/L 2,4-D Acid as DMA Salt) on the Ammonification and Nitrifiction in Two Representative Agricultural Soils. Project M8823*. Report No. 969. Agrolinz, Linz, Austria. 6 March 1989.

Zohner, A, 1990a, *Determination of the Mobility of Soil-Aged Residues by Soil Column Leaching Test for 14C-2,4-D Acid.* Laboratory Project ID M8816. Agrolinz Agrarchemikalien, Austria. February 1990.

Zohner, A, 1990b. *Determination of the Mobility of Soil-Aged Residues by Soil Column Leaching Test for 14C-2,4-D Acid*. Laboratory Project ID M8812. Agrolinz Agrarchemikalien, Austria. February 1990.