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Australian Quarantine and Inspection Service

Pesticide risk profile for the grazing of oilseed (linseed, rape, safflower, sesame, sunflower) forage and/or cutting of hay and feeding to cattle and sheep

Dugald MacLachlan
Chemical Residues
Residues and Food Safety
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Abbreviations

ai	active ingredient
APVMA	Australian Pesticide and Veterinary Medicines Authority
bw	body weight
DM	dry matter
ECRP	Existing Chemical Review Program
EU	European Union
F	MRL is based on the residue in the fat portion of the tissue
FAO	Food and Agriculture Organisation of the United Nations
g	gram
GAP	good agricultural practice
ha	hectare
HAFT	Highest average field trial
JMPR	Joint Meeting on Pesticide Residues
kg	kilogram
LOD	Limit of detection for the analytical method, sometimes also used for limit of determination which is the same as LOQ
LOQ	limit of analytical quantitation
mby	Meat by products
mg	milligram = 0.001 grams
MRL	maximum residue limit
N	Negligible residue (when next to US MRL)
PAFC	primary animal feed commodity
PHI	pre-harvest interval
P _{ow}	octanol water partition coefficient
ppb	Parts per billion = µg/kg
ppm	parts per million = mg/kg
PSD	Pesticide Safety Directorate
TF	transfer factor = concentration in animal tissue or milk divided by concentration in feed
TRR	total radioactive residue
US EPA	United States of America Environmental Protection Agency
WHP	withholding period
*	before MRL indicates that the residue is at or about the LOQ, <i>i.e.</i> should be less than the LOQ.

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Potential for violative residues in cattle and sheep fed oilseed (linseed, rape, safflower, sesame, sunflower) forage and hay

Chemical residues in animal feeds may be transferred to the tissues of livestock on feeding. While it is unlikely that the chemical residues present in meat and offal arising from feeding represent a concern regarding food safety they can result in disruption to trade where the relevant Australian and overseas market standards differ.

The observation of chemical product withholding periods does not guarantee that the chemical residues in the feed are such that when fed to livestock, the residues in meat and offal will meet export market requirements.

The aim of the current report is to profile the risk of violative residues in export meat and edible offal posed by the presence of pesticide residues in oilseeds other than cotton and peanut (linseed, rape, safflower, sesame, sunflower) animal feed commodities fed to cattle and sheep.

Assessment of currently registered chemicals that may be used on oilseed crops

Estimates of residues in livestock tissues and milk are usually made on the basis of the propensity of a chemical to transfer to tissues and milk combined with anticipated animal dietary exposure.

Most experiments in the area of transfer of pesticide residues to animal tissues and milk following ingestion have been designed based on the requirements of regulators. The relevant studies required are livestock metabolism studies (lactating goat or dairy cow) and animal transfer (feeding) studies.

The feeding studies are used to determine transfer factors (TF) that are defined as the ratio of the pesticide residue in the tissue or commodity of interest (fat, muscle, liver, kidney or milk) to the residue in the diet (expressed on a dry matter intake basis).

In utilizing transfer factors derived from feeding or metabolism studies for risk assessment management purposes, the user needs to be aware of the limitations and assumptions used. The TF derived is dependent on the duration of the feeding or dosing, the concentration in the feed or dose level, the nature of the feed (if added to the feed), lactational status, bodyweight, age, sex and breed of the animal studied. For chemicals administered as a mixture, the presence of other chemicals may alter the metabolism and/or rate of excretion by induction of the various routes of decontamination. The duration of a feeding study required for the steady state concentration to be reached in tissue or milk is a function of the elimination half-life. Residue definitions set by different regulators are not always the same and residue definition is a factor that should also be taken into account when utilizing TF for managing residue risks and trade. Care must be taken in extrapolating TFs from goat metabolism studies to all ruminants as is demonstrated by endosulfan, for which the residue definition is the sum of α -endosulfan, β -endosulfan and endosulfan sulphate, where only low levels of residues are found in goats but significant transfer to tissues occurs for cattle^{1,2}.

¹ Indraningsih, McSweeney, C.S. & Ladds, P.W. (1993) Residues of endosulfan in the tissues of lactating goats. *Aust. Vet. J.*, **70**, 59-62.

² Reregistration Eligibility Decision for Endosulfan Case No. 0014 EPA 738-R-02-013 November 2002 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division. <http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg>

The transfer factors utilised here were calculated from residues reported in the scientific literature using the highest individual animal tissue divided by the nominal feed level. If the highest residue was not reported the average residue divided by the nominal feed level were used instead. In the case of milk the average residue was divided by the nominal feed level.

For the purposes of profiling risk conservative estimates of animal dietary burden (intake) are required. The APVMA “*Stockfeed Guideline Document 1 Primary Feed Commodities As A Proportion of Livestock Diets*” (Version 1.1 March 2002)³ lists the maximum proportion of forage and fodder included in animal feed as 100% and this value was used in the current evaluation. Estimates of residues in pasture and hay were obtained from scaling of literature studies, MRLs or based on conservative assumptions. The dietary burden is then the residue in crop × maximum proportion in the diet. To overcome errors that may result from differences in moisture contents of feed items it is accepted practice to calculate dietary burdens for a ration on a dry matter basis. Hay is typically 80-90% dry matter and it was not considered necessary to adjust residue values as any correction would be minor. In the case of forage which typically contains 30% dry matter, a correction of residues in forage was not used as most residue estimates were based on conservative assumptions (e.g. day of application residues) and the correction would lead to gross overestimates of animal dietary exposures.

The estimated residue in animal commodities is:
 $Residue = TF \times dietary\ burden$ [ppm DM basis]

Unless stated otherwise, the following assumptions have been used in the risk assessment:

- The oilseeds are harvested at maturity and that the fodder/straw/hay is derived at this time.
- The crop has been treated at the maximum rate and with the shortest interval between application and harvest permitted by the product label⁴.
- The maximum rate of incorporation in the ration/diet is 100%
- That residue transfer for cattle is greater than for sheep and therefore that the assessment of residues in cattle also covers sheep

The potential for violative residues in animals is assessed against the Australian, Codex and US tolerances as listed in February 2010⁵. Other markets may have different standards, however, for the bulk of Australian meat exports it is assumed that if the lower of these tolerances (or the LOQ of the analytical method if no Codex or US tolerance exists) can be met, the feeding of forage, fodder, hay and straw will not pose an unacceptable risk.

Appendix 1 provides the details of a risk assessment for each of the compounds registered in Australia for use on oilseeds.

Most of the compounds registered for use on oilseeds also have registrations in other crops that are major animal feed commodities. Indeed, for most compounds listed in appendix 1 the major route of exposure for animals to the chemical is expected to be through feeding of these other crops (pasture, cereal waste etc).

³ http://www.apvma.gov.au/residues/Stockfeed_Guideline_1.pdf

⁴ In general, only one or two product labels were selected per pesticide. There is a possibility that the maximum permitted rate may be higher than identified.

⁵ MRLs and approved use patterns change with time. The assessments include the most recent decisions of the Codex Alimentarius Commission (32nd Session, July 2009) with regard to Codex MRLs, US tolerances as listed in the Code of Federal Regulations at February 2010 and MRLs as they appear in Table 1 of the APVMA *MRL Standard* as at February 2010.

The conclusion of the analysis is the risk of residue violations in meat and edible offal posed by the feeding of oilseed forage, fodder, straw and hay derived from oilseed crops treated with currently registered products is low for the majority of chemicals.

Based on the available information, the following pesticides are identified as requiring further investigation and/or the development of additional risk management strategies:

Pesticide	Tissue	Residue (mg/kg)		Decline information located	
		Estimated ¹	Target ²	Crop	Animal
Bromoxynil	Offal	7	0.05	No	No
Carbaryl	Kidney	0.7/1.2	0.2/1	No	No
Chlorpyrifos	Fat	0.96	0.3	Yes	No
Clopyralid	Kidney	0.38	0.01	No	No
Cypermethrin(s)	Fat	1.5	0.05	Yes	Yes
Deltamethrin	Fat	0.15	0.05	Yes	Yes
Diclofop	Fat	0.6	0.01	No	No
Fluquinconazole	Fat	0.3	0.01	No	Yes
Haloxfop	Kidney	1.9	0.01	Yes	Yes

¹residue in tissue estimated using assumptions outlined above

²target residue = lowest of Australian, Codex and US MRL or in absence of these the LOQ (often assumed to be 0.01 mg/kg)

Adequate data were not located to enable an assessment to be made for the following compounds: asulam, diflufenican, fluazifop-p, fluroxypyr, flutriafol, MCPA and prometryn.

The current assessment has only identified pesticides of concern and not considered industry based QA programs that address the potential for residues in animal feeds to transfer to animals and mitigate risks; The National Vendor Declaration (NVD) form for traded livestock and the Commodity Vendor Declaration (CVD) and By-product Vendor Declaration (BVD) forms which are used for traded livestock feedstuffs.

Appendix 1

2,2-DPA (2,2-dichloropropionic acid also known as dalapon)

- is a systemic herbicide used for the control of annual and perennial grasses and rushes. It is registered on a variety of crops including potential animal feeds sunflower, maize, soybean and pastures. The application for *sunflowers* is up to 3.7 kg ai/ha.

No harvest WHP is required.

All crops have the following grazing restraint:

DO NOT graze or cut for stock food for 6 weeks after application

There are no Codex or USA MRLs for 2,2-DPA in animal tissues. The critical Australian MRL is 0.2 mg/kg for meat (mammalian) and *0.1 mg/kg for milks. Residues are not expected in sunflowers at harvest as reflected in the MRL of *0.1 mg/kg for sunflower seed. No residues are expected to result from the feeding of sunflower trash or seed to animals. Dalapon and all of its known breakdown products dissolve easily in water. They are readily washed from cells and tissues. Because dalapon is insoluble in organic solvents and lipids, it does not build up in animal tissues^{6,7}.

It is anticipated that animal product residues will be below typical method LOQs.

2,4-D

- is a selective herbicide used widely for the control of weeds. It is registered on a variety of crops including potential animal feeds pasture and cereals. Application to canola, linseed, safflower and sunflower is as a preparatory spray for *fallow crops* and *seed beds* at rates up to 0.81 kg ai/ha.

No harvest WHP is required.

All crops have the following grazing restraint:

DO NOT graze or cut for stock food for 7 days after application

There are Australian, Codex and USA MRLs for 2,4-D in animal tissues however, the residue definitions that apply differ. The residue definition for Codex and Australia is parent compound. For the USA the residue definition is the sum of 2,4-D and 2,4-DCP. This added complication potentially makes comparison of the respective MRLs more difficult. The Australian MRLs are 0.2 mg/kg for meat (mammalian), 2 mg/kg for edible offal (mammalian) and *0.05 mg/kg for milks. The critical USA tolerance is 4 mg/kg for cattle kidney while the MRL for milk is 0.05 mg/kg. The critical Codex tolerances are 5 mg/kg for edible offal, 0.2 mg/kg for meat (mammalian) while the MRL for milk is 0.01 mg/kg (step 8). The Australian MRL for oilseed is *0.05 mg/kg.

In an animal transfer study cows were dosed at the equivalent of 1446, 2890, 5779 and 8585 ppm in the diet for 28 days⁸. Residues in liver, kidney, muscle and fat for the 1446 ppm group were 0.2, 6.5, 0.24 and 0.51 mg/kg respectively. Given the nature of the application and long interval between application and grazing it is unlikely that residues would be observed in commodities from grazing livestock.

It is anticipated that animal product residues will be below typical method LOQs

⁶ Kuhnert M, Freytag B, Freytag HH, Fuchs V. (1992) [The tolerance and residue accumulation of sodium-2,2-dichloropropionate (Dalapon) administered over 90 days to dairy cows] *Dtsch Tierarztl Wochenschr.* 99 (4), 148-51. German.

⁷ Fertig, S. N.; Schreiber, M. M. (1961). Effects Of Herbicide Ingestion. Effect of dalapon ingestion on performance of dairy cattle and levels of residue in the milk. *J. Ag. Food Chem.* 9:369

⁸ 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

alpha-Cypermethrin (cypermethrin and zeta-cypermethrin)

- is a synthetic pyrethroid insecticide used for the control of various insects in crops.

The application rates for oilseeds are reported in the table below together with the harvest WHPs and any label feeding restraints.

Crop	Rate (g ai/ha)	Harvest WHP (days)	Grazing WHP (days)
Canola	40	21 days	-
Linola	20	12 weeks	-
Linseed	30	14 days	-
Sunflowers	40	21 days	-

Alpha-cypermethrin residues decline with typical half-lives of 30 and 5 days for soil and foliage respectively. The half-life for the decline of residues in animal tissues is approximately 7 days. There are no grazing restraints

There are Australian, Codex and USA MRLs for cypermethrin in animal tissues. The relevant MRLs for cattle fat are 0.5, 0.2 and 1 mg/kg for Australia, Codex and the USA respectively. The milk MRLs for the same are 1 [in the fat = 0.04 mg/kg whole milk], 0.05 F mg/kg and 2.5 mg/kg respectively. The US also has separate MRLs for zeta cypermethrin of 1 mg/kg for cattle fat and 2.5 mg/kg in milk fat (reflecting a residue of 0.1 mg/kg in whole milk). There are Australian MRLs of linola 0.1 mg/kg, linseed 0.5 mg/kg, rape seed 0.2 mg/kg, sunflower seed 0.1 mg/kg. Feeding of forage or fodder at 100% of the diet could result in cypermethrin residues in fat of $5 \text{ ppm} \times 0.1 = 0.5 \text{ mg/kg}$, higher than the Codex MRL (assumed residues at PAFC MRL of 5 ppm). There is an MRL of 15 ppm for canola forage and fodder (green). The TF for fat is $0.1^{9,10}$. Feeding forage and fodder with residues as high as 15 ppm could give rise to residues in fat of 1.5 mg/kg. Anticipated residues in whole milk (TF 0.003-0.1) are the same as for fat.

Livestock residues may exceed international and/or domestic market standards.

Asulam

-is a herbicide used on *oilseed poppies* at up to 1 kg ai/ha.

No grazing or harvest restraints; spray any time after the 4-6 leaf stage.

There are Australian and US but no Codex MRLs for asulam in animal commodities. The Australian MRLs have all been set at $*0.1 \text{ mg/kg}$. The US MRL for cattle meat byproducts is 0.2 while MRL for fat, meat and milk is 0.05 mg/kg . Australian MRL for poppy seed is $*0.01 \text{ mg/kg}$.

In a ruminant feeding study lactating dairy cows were dosed with asulam *per se* at 50, 200, or 800 ppm in the diet for 28 days¹¹. Half the test animals were sacrificed within 24 hours of the final dose and the remaining animals were sacrificed after a 14- or 21-day withdrawal period. Residues of asulam and its metabolites containing the sulfanilamide moiety were determined using an adequate

⁹ Chen-AW; Fink-JM; Letinski-DJ; Barrett-GP; Pearsall-JC (1997) Residue of cypermethrin and its major acid metabolites in milk and tissues from dairy bovines treated with cypermethrin. *J. Ag. Food Chem.* 45: 12, 4850-4855.

¹⁰ 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982 <http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm>

¹¹ Reregistration Eligibility Decision, Asulam List A Case 0265 EPA 738-R-95-024 September 1995 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division.

<http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg>

HPLC method (Method No. 154) in fat, kidney, liver, muscle, and milk. At the 50 ppm dose level, residues ranged from 0.04 - 0.11 mg/kg in milk and from <0.05 - 0.34 mg/kg in the tissues; at the 200 ppm dose level residues ranged from 0.10 - 0.32 mg/kg in milk and from <0.05 - 1.03 mg/kg in tissues; and at the 800 ppm dose level residues ranged from 0.48 - 1.16 mg/kg in milk and from <0.05 - 3.56 mg/kg in tissues. Kidney tissue had the highest residue levels (>4×) as compared to the other tissues.

In a second ruminant feeding study, lactating dairy cows were dosed with asulam *per se* at 0.5, 5, 50, 200, or 800 ppm in the diet for 28 days. Residues of asulam were determined using an adequate spectrophotometric method. Residues were nondetectable (<0.025 mg/kg) in milk from cows dosed at 0.5- 50 ppm. Residues were nondetectable (<0.05 mg/kg) in all tissues of cows dosed at 0.5 ppm and in the fat of cows from all feeding levels. In cows fed at 5 ppm, residues were nondetectable (<0.05 mg/kg) in all tissues except kidney (0.06-0.12 mg/kg). In cows fed at 50 ppm, residues were nondetectable in all tissues except kidney (0.11-0.13 mg/kg) and heart (0.06 mg/kg). In cows fed at 200 ppm, residues were nondetectable in all tissues except kidney (0.32-0.34 mg/kg) and heart (0.07 mg/kg). In cows fed at 800 ppm, residues were 1.19-1.39 mg/kg in kidney, 0.10-0.11 mg/kg in liver, 0.08-0.10 mg/kg in muscle, 0.13-0.17 mg/kg in heart, and 0.07 mg/kg in brain.

Insufficient data were located to provide confident opinion on livestock residue risks. However, poppies are unlikely to be grazed shortly after spraying. Residues in the failed crop are expected to be less than 50 ppm and more likely less than 5 ppm. Asulam poses a low risk of transfer on feeding failed poppy crops to livestock.

Atrazine

- is a triazine herbicide used for the control of grass and weeds in crops such as sugarcane, maize, lupins, canola and sorghum. It is applied to *canola* (including triazine resistant canola) at rates up to 2 kg ai/ha.

No harvest WHP is required.

The following grazing WHPs apply:

pre-emergent use: Do not graze or cut for stock food for 15 weeks after application

post-emergent use: Do not graze or cut for stock food for 6 weeks after application

There are no Codex animal tissue MRLs for atrazine. The US MRLs for animal tissues are lower (0.02 mg/kg for cattle fat, mbyp, meat and milk) than the Australian MRL of T*0.01 mg/kg for edible offal mammalian and T*0.01 mg/kg for milk. The MRL for rape seed is *0.02 mg/kg. There are Australian MRLs for primary animal feed commodities of T40 ppm, rape seed forage of 10 ppm and rape seed straw or fodder of 0.5 ppm.

Residues in soil and foliage decline with typical half-lives of 60 and 5 days respectively.

Feeding at 37.5 ppm in the diet for 28 days gave residues that were <0.01 mg/kg in milk and tissues at slaughter¹². Therefore detectable residues are not expected to result from the feeding of forage/fodder/straw/hay to animals.

It is anticipated that animal product residues will be below typical method LOQs.

Beta-cyfluthrin

¹² Atrazine Reregistration Eligibility Decision Residue Chemistry Considerations PC Code 080803; Case 0062 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on *canola* for the control of heliothis. The application rate is up to 10 g ai/ha. Cyfluthrin residues decline with typical half-lives of 60 and 3-5 days for soil and foliage respectively. Residues in cattle from pour-on application decline with a half-life of <14 days, a shorter half-life would be expected for tissue residues when animals are on "clean feed".

Do not harvest for 14 days after application.

Do not graze or cut for stock food for 14 days after application.

There are Australian, USA and Codex MRLs for cyfluthrin. The relevant MRLs for cattle fat are 0.5, 1 and 2 mg/kg for Australia, Codex and the USA respectively. The relevant MRLs for cattle milk are 0.1, 0.04 and 5 mg/kg for milkfat (1 mg/kg in whole milk) for Australia, Codex and the USA respectively. There is an Australian MRL for rape seed at *0.05 mg/kg as well as cereal grain and various forage MRLs (grass pasture, legume pasture, chickpea, field pea, canola, faba bean, navy bean, sorghum) of 2-5 mg/kg. The MRL for canola forage (green) is 1 ppm and for canola fodder (dry) 2 ppm.

TF fat = 0.05¹³. Estimated residues in fat are 0.05×2 ppm = 0.1 mg/kg. The low levels of residue anticipated in fat lead to the conclusion that feeding of forage and fodder from canola treated with beta-cyfluthrin should not present a problem. The TF for milk is 0.005 giving anticipated residues of 2×0.005 = 0.01 mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Bifenthrin

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on *canola* for control of mites (bare earth application). The application rate is up to 20 g ai/ha. Bifenthrin residues decline with typical half-lives of 26 and 7 days for soil and foliage respectively. Do not graze or cut for stock food for 4 weeks after application

There are Australian, Codex and USA MRLs for bifenthrin in animal tissues. The relevant MRLs for cattle fat are 2, 0.5 and 1 mg/kg for Australia, Codex and the USA respectively. The MRLs for milk are 0.5 mg/kg, *0.05 mg/kg (cattle milk) and 1 mg/kg (milk fat, 0.1 mg/kg for whole milk). The Australian MRL for rape seed is *0.02 mg/kg. There are also MRLs for fodder and forage of canola at *0.01 and 1 ppm respectively. Assuming similar levels in canola forage as the MRL and a maximum TF of 0.3¹⁴ would give residues in fat of 0.3 mg/kg. The TF for milk is 0.02 giving anticipated residues in milk of 1×0.02 = 0.02 mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Bromoxynil

- is a selective herbicide used for the control of broad-leafed weeds in *linseed*. The application rate is up to 0.4 kg ai/ha with applications made when the crop is 50-150 mm high. No harvest WHP is required.

There are no Codex animal tissue MRLs for bromoxynil. The Australian residue definition for bromoxynil is parent compound while the US definition includes a metabolite. The US MRLs for

¹³ 1998 JECFA Residues of some veterinary drugs in animals and foods. Forty-eighth meeting of the Joint FAO/WHO Expert Committee on Food Additives, 1998, FAO Food and Nutrition Paper 41/10

¹⁴ 1992 JMPR - Pesticide Residues in Food – 1992 evaluations. Part II. Toxicology. WHO, WHO/PCS/93.34, Geneva, 1993

animal tissues are 0.5 mg/kg for meat, 3.5 mg/kg for mby and 0.1 mg/kg for milk. The Australian MRL of T1 mg/kg for meat (mammalian) and T0.1 mg/kg for milk. Residues of bromoxynil in soil and foliage decline with typical half-lives of 7 and 3 days respectively. The Australian MRL for linseed is *0.02 mg/kg. No detectable residues are expected in stubble or hay at harvest and as a result no residues are expected in the tissues of animals from the feeding of linseed stubble/hay.

In a study where bromoxynil was fed to lactating dairy cows for 4 days at 5 ppm, bromoxynil (parent compound) was not detected in milk (LOD 0.1 ppm)¹⁵.

The APVMA reported: The bromoxynil residue (expressed as bromoxynil phenol) in tissues and milk after dosing at 0.7 ppm (as bromoxynil phenol – dosed as bromoxynil octanoate at 1 ppm) for 29 days (mean of 2 observations for tissues, 3 for milk) and also the highest bromoxynil residue (expressed as bromoxynil phenol) in tissues and milk after dosing at 42 ppm (bromoxynil phenol) for 34 days.

Sample	Residue (mg/kg expressed as bromoxynil phenol)	
	0.7 ppm	42 ppm
Liver	0.98	11.7
Kidney	0.46	18.7
Muscle	<0.05	3.2
Fat	0.31	9.8
Milk	0.04	0.58

No residue trial data were located for forage or fodder however, the US EPA report¹⁶ residues in wheat straw and hay of up to 4 ppm and barley straw and hay of up to 9 ppm. US GAP is 0.7 kg ai/ha with a grazing interval that varies with crop and time of the year but is a minimum of 30 days. Anticipated residues in offal are 5 ppm × 1.4 = 7 mg/kg for offal (US residue definition).

Livestock residues may exceed international and/or domestic market standards
Insufficient data were located to provide confident opinion on livestock residue risks

Butroxydim (p)

-is a cyclohexanedione herbicide used for the control of grass weeds in various crops. The application rate for *sunflowers* is up to 45 g ai/ha.

Do not graze or cut for stock food for 14 days after application.

There are no Codex or USA MRLs for butroxydim. The Australian residue definition for butroxydim is parent compound. The Australian MRLs are *0.01 mg/kg for meat (mammalian), edible offal (mammalian) and milk. There is a legume animal feed MRL of *0.01 ppm.

It is anticipated that animal product residues will be below typical method LOQs.

Carbaryl

- is a carbamate insecticide used for the control of various insects in crops. It is registered on *linseed* for control of various pests at rates of up to 1.1 kg ai/ha. The harvest WHP is 3 days.

¹⁵ Reregistration Eligibility Decision Bromoxynil List B Case 2070EPA738-R-98-013 December 1998 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

¹⁶ Bromoxynil, Diclofop-methyl, Dicofol, Diquat, Etridiazole, *et al.*; Proposed Tolerance Actions [Federal Register: August 4, 2004 (Volume 69, Number 149)] [Proposed Rules] [Page 47051-47068] From the Federal Register Online via GPO Access [wais.access.gpo.gov] [DOCID:fr04au04-28] ENVIRONMENTAL PROTECTION AGENCY 40 CFR Part 180 [OPP-2004-0154; FRL-7368-7] Bromoxynil, Diclofop-methyl, Dicofol, Diquat, Etridiazole, *et al.*; Proposed Tolerance Actions AGENCY: Environmental Protection Agency (EPA). ACTION: Proposed rule.

Carbaryl residues decline with typical half-lives of 10 and 7 days for soil and foliage respectively.

There are Australian, Codex and USA MRLs for carbaryl in animal tissues. The Australian and Codex residue definition is carbaryl for both plant and animal commodities. The Australian MRLs for edible offal and meat are T0.2 mg/kg while that for milk is T*0.05 mg/kg. The Codex MRL for kidney is 3 mg/kg and liver 1 mg/kg while the MRL for meat is 0.05 mg/kg. The Codex milk MRL is 0.05 mg/kg.

The USA residue definition is the sum of carbaryl and 1-naphthol expressed as carbaryl for plant commodities, the sum of carbaryl, 1-naphthol, 5,6-dihydrodihydroxycarbaryl and 5,6-dihydrodihydroxynaphthol expressed as carbaryl for animal tissues and the sum of carbaryl, 1-naphthol, 5,6-dihydrodihydroxycarbaryl and 5-methoxy-6-hydroxycarbaryl expressed as carbaryl. The US tolerance for cattle meat is 1 fat 0.5 and for milk 1 mg/kg.

The Australian MRLs are 5 mg/kg for vegetables, T100 ppm for forage of cereal grains and T100 ppm for straw and fodder (dry) of cereal grains.

The TF for kidney is 0.007 for the Australian/Codex residue definition and 0.012 for the US residue definition¹⁷ giving rise to anticipated maximum residues in kidney from feeding oilseed forage/fodder $0.007 \times 100 = 0.7$ mg/kg and $0.012 \times 100 = 1.2$ mg/kg respectively for the Australian/Codex and USA residue definitions.

The TF for milk is 0.0002 for the Australian/Codex residue definition and 0.002 for the US residue definition giving rise to anticipated maximum residues in milk from feeding oilseed forage/fodder of $0.0002 \times 100 = 0.02$ mg/kg and $0.002 \times 100 = 0.2$ mg/kg respectively for the Australian/Codex and USA residue definitions.

Livestock residues may exceed international and/or domestic market standards.

Chlorpyrifos

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on *oilseeds* as a foliar spray at rates up to 0.75 kg ai/ha for *rape seed* and up to 450 g ai/ha for other oilseeds.

Do not graze or cut for stock food for 2 days after application (may or may not apply).

There are Australian, Codex and USA MRLs for chlorpyrifos in animal tissues. The Australian and Codex residue definition is chlorpyrifos while the USA definition includes the metabolite TCP. The MRLs for cattle fat are T0.5, 1 and 0.3 mg/kg for Australia, Codex and the USA respectively. The MRLs for milk are T0.2 [milk in the fat] mg/kg, 0.02 mg/kg and 0.01 mg/kg (0.25 mg/kg for milk fat). The MRL for oilseed is T0.01 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm for rape and scaling for application rate forage residues are expected to be $0.75 \times 80 = 60$ ppm at day 0.)

¹⁷ 2002 JMPR. Pesticide Residues in Food - 2002 Evaluations – Part I: Residues Volume 1, FAO Plant Production and Protection Paper 175/1. FAO and WHO 2003 <http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm>

The maximum transfer factor for feeding cattle at 10 ppm in the diet was 0.016 for cattle fat¹⁸. Residues from feeding forage with residues of 60 ppm at 100 % of the diet $60 \times 0.016 = 0.96$ mg/kg; above the Australian and US but below the Codex MRL. Anticipated residues for milk would be $60 \times 0.0007 = 0.04$ mg/kg.

Livestock residues may exceed international and/or domestic market standards.

Clethodim (see Sethoxydim)

-is registered for use on *canola* at rates of up to 120 g ai/ha.
Do not apply later than 8 weeks before harvest.

There are Australian, Codex and US MRLs for clethodim. The Australian and Codex residue definition is clethodim and its metabolites containing 5-(2-ethylthiopropyl)cyclohexane-3-one and 5-(2-ethylthiopropyl)-5-hydroxycyclohexane-3-one moieties and their sulphoxides and sulphones, expressed as clethodim. The US residue definition is clethodim and its metabolites containing the 2-cyclohexen-1-one moiety. The Australian MRLs for animal commodities have been set at *0.05 mg/kg. The Codex MRLs are *0.2 mg/kg for edible offal and meat and *0.05 mg/kg for milk. The US MRLs for cattle tissues are all 0.2 mg/kg. The MRL for rape seed is 0.5 mg/kg. There are Australian animal feed MRLs of 15 ppm for Legume animal feeds [except peanut fodder and peanut forage (green)], 10 ppm for Peanut fodder, Peanut forage (green) and Rape seed fodder and forage.

The TF for the US residue definition is 0.006¹⁹ for offal giving an anticipated residue of $15 \times 0.006 = 0.09$ mg/kg for liver and kidney, below the US MRL. Anticipated residues in milk (TF 0.0011) are $15 \times 0.0011 = 0.016$ mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Clomazone

- is an isoxazolidinone herbicide used to control broad-leafed annual weeds in crops. The application rate for *poppies* is 0.48 kg ai/.
Do not graze or cut for stock food until after harvest.

There are no Australian, Codex or US MRLs for clomazone in animal commodities. The Australian MRL for poppy seed has been set at *0.05 mg/kg. No detectable residues are expected to be found in crops at harvest, following application of clomazone.

It is anticipated that animal product residues will be below typical method LOQs.

Clopyralid

-is a selective pyridine herbicide used for the control of certain weeds in *canola*. Application is made up to the 8 leaf stage of crop growth at rates of up to 90 g ai/ha.
Do not apply later than 12 weeks before harvest.
Do not graze or cut treated canola for stock feed for 12 weeks after application

There are Australian and US but no Codex MRLs for clopyralid in animal commodities. The Australian MRLs are 0.1 mg/kg for meat (mammalian), 5 mg/kg for kidney of cattle goats, pigs and

¹⁸ 2000 JMPR. Pesticide Residues in Food - 2000 Evaluations – Part I, FAO Plant Production and Protection Paper 165. FAO and WHO 2001 <http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm>

¹⁹ 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

sheep, 0.5 mg/kg for edible offal (mammalian) except kidney and 0.05 mg/kg for milk. The US MRLs are 36 mg/kg for meat by-products except liver, 3 mg/kg for liver, 1 mg/kg for fat and meat and 0.2 mg/kg for milk. The Australian MRL for rape seed is 0.5 mg/kg. There is also an animal feed MRL of 100 ppm for pasture. The Australian MRL for canola forage is 25 ppm and canola fodder 10 ppm. The US MRLs for rape forage and seed are both 3 ppm.

Average clopyralid residues in tissues at the end of an experiment where calves were dosed at the equivalent of 1000 ppm in the diet for 28 days were 0.3 mg/kg in muscle, 0.2 mg/kg in fat, 1.3 mg/kg in liver and 15 mg/kg in kidney²⁰. Anticipated residues from feeding oilseed forage containing clopyralid residues at 25 ppm at 100% of the diet are $25 \times 0.015 = 0.38$ mg/kg for kidney.

Two goats were fed radiolabeled clopyralid at rates equivalent to 230 and 69 ppm in feed for 7 days²¹. The ¹⁴C residues in liver (approx. 0.04 ppm) and kidney (approx. 0.6 ppm) tissues were shown to be unchanged clopyralid. Residues in muscle and fat were too low (less than 0.02 ppm) to characterize. The milk residue averaged approximately 0.03 ppm and was shown to consist of approximately equal amounts of clopyralid and its glycine conjugate.

Livestock residues may exceed international and/or domestic market standards.

Cypermethrin

see alpha-cypermethrin

- is a synthetic pyrethroid insecticide used for the control of various insects in crops.

The application rates for oilseeds are reported in the table below together with the harvest WHPs and any label feeding restraints.

Crop	Rate (g ai/ha)	Harvest WHP (days)	Grazing WHP (days)
Canola	50	21 days	21 days
Sunflowers	100	21 days	-

Cypermethrin residues decline with typical half-lives of 30 and 5 days for soil and foliage respectively. The half-life for the decline of residues in animal tissues is approximately 7 days.

There are Australian, Codex and USA MRLs for cypermethrin in animal tissues. The relevant MRLs for cattle fat are 0.5, 0.2 and 1 mg/kg for Australia, Codex and the USA respectively. The respective milk MRLs are 1 [in the fat = 0.04 mg/kg whole milk], 0.05 F mg/kg and 2.5 mg/kg for Australia, Codex and the USA. There are Australian MRLs of linola 0.1 mg/kg, linseed 0.5 mg/kg, rape seed 0.2 mg/kg, sunflower seed 0.1 mg/kg.

The TF for fat is $0.1^{22,23}$. Feeding of forage or fodder at 100% of the diet could result in cypermethrin residues in fat of $5 \text{ ppm} \times 0.1 = 0.5$ mg/kg, higher than the Codex MRL (assumed residues at PAFC MRL of 5 ppm). There is an MRL of 15 ppm for canola forage and fodder

²⁰ Draft Assessment Report (DAR) – public version- Initial risk assessment provided by the rapporteur Member State Finland for the existing active substance Clopyralid of the second stage of the review programme referred to in Article 8(2) of Council Directive 91/414/EEC, Volume 3, Annex B, B.7, February 2005.

²¹ Dow Agrosciences Technical profile: Clopyralid, July 1998

²² Chen-AW; Fink-JM; Letinski-DJ; Barrett-GP; Pearsall-JC (1997) Residue of cypermethrin and its major acid metabolites in milk and tissues from dairy bovines treated with cypermethrin. *J. Ag. Food Chem.* 45: 12, 4850-4855.

²³ 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982 <http://www.fao.org/ag/AGP/AGPP/Pesticid/Default.htm>

(green). Feeding forage and fodder with residues as high as 15 ppm could give rise to residues in fat of 1.5 mg/kg. Anticipated residues in whole milk (TF 0.003-0.1) are also 1.5 mg/kg.

Livestock residues may exceed international and/or domestic market standards.

Deltamethrin

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on *canola*, *linseed*, *safflower* and *sunflowers* at 13.75 g ai/ha. Deltamethrin residues decline with typical half-lives of 7 and 4-8 days for soil and foliage respectively. The half-life for the decline of residues in animal tissues is approximately 7-10 days.

The harvest WHP is 7 days

There are no grazing restraints

There are Australian, Codex and USA MRLs for deltamethrin in animal tissues. The relevant MRLs for cattle fat are 0.5, 0.5 and 0.05 mg/kg for Australia, Codex and the USA respectively. The Australian MRL for milks is 0.05 mg/kg. The Codex MRL for milks is 0.02 F mg/kg. The US MRL is for milk fat 0.1 mg/kg reflecting 0.02 mg/kg in whole milk. The MRL for oilseed is 0.1 mg/kg. There are Australian animal feed MRLs of 5 ppm for fodder and forage or cereal grains, oilseeds, pulses and sweet corn and 7 ppm for rice hulls.

Residues in canola plants after application at 13 g ai/ha were 0.05-0.6 ppm on the day of the last application (JMPPR 2002). The TF for deltamethrin in fat is roughly 0.03^{24} . Feeding of forage with residues of 0.6 mg/kg at 100% of the diet could result in deltamethrin residues in fat of $0.6 \times 0.03 = 0.018$ mg/kg; this is less than the Australian, Codex and USA tolerances. Anticipated residues in milk (TF 0.009) are $0.6 \times 0.009 = 0.00054$ mg/kg.

Feeding of straw/stubble with residues at the APVMA MRL for forage and fodder of 5 mg/kg at 100% of the diet could result in deltamethrin residues in fat of $5 \times 0.03 = 0.15$ mg/kg, this is less than the Australian and Codex but higher than the USA tolerance.

Anticipated residues in milk (TF 0.009) are $5 \times 0.009 = 0.045$ mg/kg.

Livestock residues may exceed international and/or domestic market standards.

Diazinon

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on *oilseed crops* for the control of various pests including grasshoppers and locusts. The application rate is up to 0.68 kg ai/ha.

Do not harvest, graze or cut for stock food for 14 days after application.

There are Australian, Codex and USA MRLs for diazinon in animal tissues. The MRLs for cattle fat are 0.7 mg/kg for Australia, 2 for Codex and 0.5 mg/kg for the US. For milk the MRLs are 0.5 [in the fat], 0.02 F mg/kg and not specified. The Australian MRL for vegetables is 0.7 mg/kg. The average half-lives for residues in soil and foliage are reported to be 40 and 4 days respectively.

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.68 kg ai/ha gives a day 0 residue of 54 ppm, and at 14 days or 3 half-lives, 6.8 ppm). The TF for fat from a dairy cow

²⁴ 2002 JMPPR. Pesticide Residues in Food - 2002 Evaluations – Part I: Residues Volume 1, FAO Plant Production and Protection Paper 175/1. FAO and WHO 2003

feeding study (400 ppm feed level) was 0.002²⁵. Feeding forage, fodder, hay or straw at 100% of the diet could result in fat residues of $6.8 \times 0.002 = 0.01$ mg/kg. No residues were detected in milk of cows dosed at the equivalent of 120 ppm in the diet.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Diclofop-methyl

-is an aryloxyphenoxypropionate herbicide used for control of annual grasses in *linseed*, *safflower*, *canola* and *poppies*. The application rate is up to 0.75 kg ai/ha for linseed, safflower and canola and 1.125 kg ai/ha for poppies.

Do not graze or cut for stock feed for 7 weeks after application.

There are Australian but no Codex or US tolerances for diclofop-methyl in animal commodities. The Australian MRLs have all been set at *0.05 mg/kg. The MRLs for oilseeds have been set at 0.1 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm for rape and scaling for application rate forage residues are expected to be $0.75 \times 80 = 60$ ppm at day 0.)

The US EPA reported an animal feeding study for diclofop methyl and noted that animal MRLs would be required to be established. Four groups of lactating dairy cows were dosed orally *via* capsules for 28 consecutive days with diclofop-methyl at levels equivalent to 0.11, 0.33, 1.1, and 25.0 ppm in the diet²⁶. In tissues, residues were highest in kidney and lowest in muscle. For the 25 ppm feed level, the combined residues were 12-23 mg/kg in kidney, 3.9-6.1 mg/kg in liver, 0.75-0.85 mg/kg in fat, and 0.32-0.57 mg/kg in muscle. The TF for kidney and fat were 0.9 and 0.03 respectively.

Residues in whole milk plateaued by Day 4 at all dose levels. The maximum combined residues in whole milk were 0.023, 0.114, 0.212, and 2.759 ppm for the 0.11, 0.33, 1.1, and 25.0 ppm groups, respectively. Diclofop-methyl residues concentrated in milk fat, with residues in cream being 2.4-3.4× higher than in whole milk.

Residues in forage and fodder of a variety of crops including peas, beans, brassicas and cereals were <0.7 ppm at 49 days after application at rates of up to 2 kg ai/ha. Anticipated residues in kidney are $<0.7 \times 0.9 = <0.6$ mg/kg.

Livestock residues may exceed international and/or domestic market standards.

Di flufenican

-is a nicotinamide herbicide used to control various weeds in *oilseed poppies*. Application is at rates of up to 100 g ai/ha when at the 6-10 leaf crop growth stage.

There are Australian but no Codex or US MRLs for di flufenican in animal commodities. The Australian MRLs (parent compound) are 0.1 mg/kg for edible offal mammalian and 0.01 mg/kg for meat (mammalian) and milk. The MRL for legume animal feeds is 5 mg/kg.

²⁵ 1996 JMPR - Pesticide Residues in Food - 1996 Evaluations, Part I: Residues FAO Plant Production and Protection Paper 142. FAO and WHO 1997

²⁶ Diclofop-Methyl Reregistration Eligibility Decision Residue Chemistry Considerations PC Code 110902; Case 2160 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.1 kg ai/ha gives a day 0 residue of 8 ppm).

EFSA DAR - In a metabolism study lactating cows were dosed at 1 and 20 ppm feed with [difluorophenyl-¹⁴C]-diflufenican and 5 and 50 ppm feed with [pyridine-¹⁴C]-diflufenican for 7 days (2 doses/day). Cows were sacrificed 18-23 h after the last dose. TRR in milk reached a plateau after 3 days at 0.01 and 0.02 mg/kg in the 20 and 50 ppm feeding studies respectively. Parent compound represented 48-52% of TRR in milk. TRR in tissues were <0.01 mg/kg for muscle, 0.07-0.08 mg/kg for fat, 0.03-0.04 mg/kg for kidney and 0.26-0.40 mg/kg for liver in the 20 and 50 ppm studies. At the 1 and 5 ppm dose levels residues in tissues were <0.01 mg/kg with the exception of liver (0.02-0.05 mg/kg) and fat (<0.01-0.03 mg/kg). Parent compound represented 82-91% of the TRR in fat. Parent residues in the highest residue liver sample were 0.02 mg/kg (about 6% TRR)

It is anticipated that animal product residues will be below typical method LOQs.

Dimethenamid-P

- is a pre-emergent herbicide used for the control of weeds in *poppies*. It is registered on poppies at application rates of up to 1.0 kg ai/ha.

DO NOT harvest for 100 days after application.

There are Australian and Codex but no USA MRLs (negligible residue) for dimethenamid in animal tissues. The Australian and Codex MRLs for animal commodities have been set at *0.01 mg/kg. There is an Australian MRL of *0.01 mg/kg for poppy seed. Poppy plants are unlikely to be grazed shortly after spraying in which case residues in plant material would not lead to residues above LOD in animals.

It is anticipated that animal product residues will be below typical method LOQs.

Dimethoate

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on *oilseeds* at application rates of up to 300 g ai/ha.

The harvest WHP is 14 days

The WHP statements are confusing, 7 days for peanuts but 14 days for oilseeds (which includes peanuts).

There are Australian, Codex and USA MRLs for dimethoate in animal tissues. The Australian and Codex MRLs for animal commodities have been set at *0.05 mg/kg while the US ones are set at 0.02 mg/kg. There is an Australian MRL of 0.1 mg/kg for oilseeds (except peanuts).

A metabolism study with lactating goats dosed orally with dimethoate at a rate equivalent to feeding at 30 ppm in the diet suggests that residues are not expected in animal tissues²⁷.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be 24 ppm).

It is anticipated that animal product residues will be below typical method LOQs.

Dimethomorph

²⁷ 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

-is a fungicide. It is used on *oilseed poppies* at application rates of 180 g ai/ha. The harvest WHP is are 6 weeks.

There are Australian but no Codex or US MRLs for dimethomorph in animal commodities. The Australian MRLs have all been set at *0.01 mg/kg. The Australian MRL for poppy seed is *0.02 mg/kg.

The UK PSD reported a feeding study²⁸. Three groups of lactating dairy cows were administered dimethomorph (48/52 E/Z) orally, twice daily at feeding levels equivalent to 50, 150 or 500 mg/cow/day for 4-5 weeks. Residues of dimethomorph, VII (Z67), VIII (Z69) and XIII (CUR 7117) were all below 0.01, 0.02, 0.02 and 0.01 mg/kg respectively except for cow 14 from the highest dose group on day 45 of the study when residue levels were determined to be 0.03, 0.03 and 0.02 respectively for metabolites VII, VIII and XI.

It is anticipated that animal product residues will be below typical method LOQs.

Diquat

- is a herbicide used for the control of weeds in various crops. It is applied to *linseed, rape and sunflower* at 600 g ai/ha and *oilseed poppies* at 300 g ai/ha, and as a salvage treatment at rates up to 0.6 kg ai/ha.

Do not graze or cut sprayed vegetation for stock food for at least 1 day after application for linseed and oilseed poppies and 4 days for rape and sunflowers.

The Australian and Codex MRLs for diquat in meat (mammalian) are the same at *0.05 mg/kg. The US MRL for meat is 0.02 mg/kg. The MRLs for milk are *0.01 mg/kg, *0.01 mg/kg and 0.02 mg/kg respectively. Residues in soil and foliage decline with typical half-lives of *ca.* 1000 and 30 days respectively. There is a legume animal feed MRL of 100 ppm. No residues were detected in tissues of cows fed diquat for 28 days at 100 ppm in the diet and slaughtered on the last day of dosing (LOD 0.01 mg/kg)²⁹.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be 48 ppm).

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Endosulfan

- is an organochlorine insecticide used for the control of various pests in a variety of crops. The application rate, pre-emergence, is up to 0.35 kg ai/ha for mite control in *canola, linseed, safflower and sunflower*.

Canola (rapeseed), linseed, safflower or sunflower:

DO NOT graze or cut for stockfood for 8 weeks after application.

There are Australian, Codex and USA MRLs for animal commodities. The Australian and Codex MRL for cattle fat is 0.2 mg/kg while the US MRL is 13 mg/kg. The Australian MRL for milk [in

²⁸ Evaluation of fully approved or provisionally approved products. Issue 99: Evaluation on dimethomorph, April 1994, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK

²⁹ Reregistration Eligibility Decision, Diquat Dibromide, List A, Case 0288, EPA 738-R-95-016 July 1995 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division. <http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg>

the fat] is 0.2 mg/kg, USA 2 mg/kg for milk fat and Codex 0.1 F mg/kg. There is an Australian MRL for oilseeds set at 1 mg/kg and a forage of oilseed crops of 0.3 ppm.

Residues in soil and foliage decline with typical half-lives of 50 and 3 days respectively although the decline of residues in senescent foliage is much slower.

The TF for fat is 0.3-0.4³⁰. Assuming residues in forage and fodder are less than the animal feed commodity MRL of 0.3 ppm, residues in fat would be $0.3 \times 0.4 = 0.12$ mg/kg.

The TF for milk is 0.02. Residues in milk would be $0.3 \times 0.02 = 0.006$ mg/kg. The TF for cream is 0.12. Residues in cream would be $0.3 \times 0.12 = 0.036$ mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

EPTC (eptam)

-is a thiocarbamate herbicide used for the pre-emergent control of certain grasses and broad-leafed weeds and is used as a pre-plant application in dryland safflower and oilseed rape crops and furrow irrigated sunflowers. It is used on safflower and oilseed rape at 2.0 kg ai/ha and sunflowers at 2.88 kg ai/ha.

No harvest WHP required.

There are Australian but no Codex or US tolerances for EPTC in animal commodities. The Australian MRLs are all set at *0.1 mg/kg. The MRL for oilseeds is 0.1 mg/kg. As no residues are present in the crops at harvest there is no reasonable expectation of residues in animal commodities.

Note: The US EPA in its RED reported that the only residue of toxicological concern in goats was EPTA cysteine conjugate and this was only found at low concentrations on dosing at highly exaggerated rates. The agency concluded that there is no reasonable expectation of the occurrence of finite residues in animal tissues.

It is anticipated that animal product residues will be below typical method LOQs.

Esfenvalerate

- is a synthetic pyrethroid insecticide used for the control of various insects in crops.

The application rates for oilseeds are reported in the table below together with the harvest WHPs and any label feeding restraints.

Crop	Rate (g ai/ha)	Harvest WHP (days)	Grazing WHP (days)
<i>Canola</i>	25	14	7
<i>Fodder rape</i>	25	2	2
<i>Linseed</i>	25	14	7
<i>Safflower</i>	16.5	14	7
<i>Sunflower</i>	25	14	7

Esfenvalerate residues decline with typical half-lives of 35 and 8 days for soil and foliage respectively.

³⁰ Reregistration Eligibility Decision for Endosulfan Case No. 0014 EPA 738-R-02-013 November 2002 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division. <http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg>

There are Australian, Codex and USA (expire on 2/4/2010) MRLs for fenvalerate in animal tissues. The relevant MRLs for cattle fat are 1 (meat mammalian [in the fat]), 1 and 1.5 mg/kg for Australia, Codex and the USA respectively. The relevant MRLs for milk are 0.2 mg/kg, 0.1 mg/kg and 0.3 mg/kg (7 mg/kg for milk fat) for Australia, Codex and the USA respectively. There are MRLs of 0.5 mg/kg for oilseeds and a PAFC MRL of 10 ppm.

Residues in forage, straw, stubble and hay are not expected to exceed 10 ppm, the maximum level that fenvalerate should be fed at in the diet for animals to still comply with the Australian MRL³¹. Residues of esfenvalerate from feeding these products are unlikely to present a trade risk.

The JMPR reported residues in rape plants on the day of application at 12.5 g ai/ha of 0.01-0.54 ppm.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Ethofumesate

- is a herbicide used for the control of various grass and weeds in *oilseed poppies*. The application rate is up to 1 kg ai/ha.

There are Australian and US but no Codex MRLs for ethofumesate in animal commodities. The Australian MRLs are 0.5 mg/kg for edible offal and meat (mammalian) (fat) with parent compound as the residue definition. The MRL for milks [in the fat] is 0.2 mg/kg. The US MRLs are all 0.05 mg/kg (the sum of ethofumesate and its metabolites 2-hydroxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate and 2,3-dihydro-3,3-dimethyl-2-oxo-5-benzofuranyl methanesulfonate, both calculated as the parent compound). No MRL for milk has been set. The US also has MRLs of 5 ppm for beet tops, 1 ppm for grass straw and 0.5 ppm for sugar beet molasses. The Australian MRL for poppy seed is *0.02 mg/kg.

The US EPA reported³² a feeding study in which three groups of dairy cows were dosed orally via capsules with ethofumesate at the equivalent of 2.2, 6.6, and 22 ppm of ethofumesate in the diet. Milk and tissue samples were analyzed using a GC/FPD-S method (Method B-93R-04/05) that specifically determined residues of ethofumesate and its metabolites NC 8493 and NC 9607. Using the above GC/FPD-S method, residues of ethofumesate, NC 8493, or NC 9607 were each <0.01 ppm in all milk samples taken from the highest dose group, whole milk samples taken from the two low dose groups on days 21, 24 and 28, and in cream and skim milk sample from Day 28 for all 3 dose groups. For tissues, residues of ethofumesate, NC 8493, or NC 9607 were also <0.01 ppm in all tissues samples from each dose group, with the exception of one fat sample from the highest dose group bearing residues of ethofumesate at 0.02 ppm.

It is anticipated that animal product residues will be below typical method LOQs.

Fipronil

- is a phenylpyrazole insecticide used for control of red legged earth mite in *canola* (250 g ai/100 kg seed) and false wireworm in *sunflower* (75 g ai/100 kg seed)..

The harvest WHP is 14 days.

Canola: Do not graze plants grown from treated seed or cut for stock feed within 9 weeks of sowing

³¹ APVMA Animal Residue Data Sheet for Fenvalerate & Esfenvalerate, May 2004.

³² MEMORANDUM, Date: 9/21/04, Subject: Ethofumesate. Residue Chemistry Considerations for Reregistration Eligibility Decision. Case No. 2265. DP Barcode: D288646 PC Code: 110601 40 CFR: §180.345 From: José J. Morales To: Nancy McCarroll

Sunflower: Do not graze plants grown from treated seed or cut for stock feed within 3 weeks of sowing.

The relevant Australian, Codex and US tolerances for fipronil in animal fat are 0.1, 0.5 (cattle meat in the fat) and 0.4 mg/kg respectively while the milk MRLs are 0.01, 0.02 mg/kg while the US MRL is 1.5 mg/kg for milk fat (representing 0.05 mg/kg in whole milk). There are animal feed MRLs of *0.01 ppm for rape forage, fodder and straw, at 0.005 mg/kg for rice straw and fodder (dry), 0.02 ppm for sorghum forage (green) (fresh weight) and *0.01 ppm for sorghum straw and fodder (dry). The Australian MRL for rape seed is *0.01 mg/kg and for sunflower seed *0.01 mg/kg.

If maximum residues in oilseed forage/fodder/straw/hay and stubble are assumed to be at the highest MRL (0.02 mg/kg) and using the transfer factor for fat reported by the 2001 JMPR (TF = 1.1-1.2)³³, anticipated maximum residues in cattle fat are $\approx 0.02 \times 1.2 = 0.024$ mg/kg. The TF for milk is 0.1 giving anticipated residues in milk of $\approx 0.02 \times 0.1 = 0.002$ mg/kg.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Fluazifop-p

-is an aryloxyphenoxypropionate (fop) herbicide used for the control of certain grasses in various crops. It is used in *canola* and *linseed* at rates up to 53 g ai/ha.

The harvest WHP is 17 weeks

Do not graze or cut for stock food for 21 days after application.

There are Australian and USA but no Codex animal tissue MRLs for fluazifop. The relevant Australian MRLs are *0.05 for edible offal and meat and 0.1 for milk. The US tolerances for animal commodities have all been set at 0.05 mg/kg (fluazifop-butyl). The relevant Australian MRL is 0.5 mg/kg for oilseeds.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be 4.2 ppm at day 0.). The TFs for kidney, fat and milk are 0.01, 0.05 and 0.012 respectively (12 ppm feeding level)³⁴. Residues above typical regulatory limits (0.01 mg/kg) may occur in tissues of animals fed forage or fodder of oilseeds.

Livestock residues may exceed international and/or domestic market standards.

Insufficient data were located to provide confident opinion on livestock residue risks.

Fludioxonil

-is a fungicide used for the control of damping off disease and seedling blackleg in canola. It is applied as a seed treatment at an application rate of 10 g ai/100 kg seed.

A harvest WHP is not required.

DO NOT graze or cut for stock food for 6 weeks after application (probably should read planting treated seed)

³³ 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002

³⁴ UK PSD Evaluation of fully approved or provisionally approved products. Issue No. 10 Evaluation on: Fluazifop-P-butyl, October 1988

There are Australian but no Codex or US MRLs for animal tissues. The Australian MRLs have been set at *0.05 for edible offal and *0.01 mg/kg for meat and milk. The Australian MRL for rape seed (canola) is *0.01 mg/kg. The animal feed MRLs are *0.02 ppm for canola straw and fodder and *0.01 mg/kg for canola forage.

No residues were observed above the analytical LOQ of 0.01 mg/kg (meat) and 0.05 mg/kg (liver and kidney) in an animal transfer study conducted in dairy cattle³⁵. Lactating cows were treated with fludioxonil in gelatine capsules equivalent to 0.55, 1.6 and 5.5 ppm in feed for 28-30 consecutive days. There is no expectation of residues in tissues above regulatory method LOQs.

It is anticipated that animal product residues will be below typical method LOQs

Flumioxazin

-is a diphenyl ether herbicide use to control weeds prior to sowing of *canola* (rape) and *cotton*. The application rate is 15 g ai/ha.

A harvest WHP is not required.

DO NOT crop or treated vegetation for 6 weeks after application.

There are Australia MRLs set at *0.01 mg/kg for animal commodities including milk. The cotton seed is *0.1 mg/kg and for rape seed *0.1 mg/kg. The MRLs for animal feed commodities are *0.05 mg/kg for forage of oilseeds (fresh) and *0.1 for oilseed straw and fodder (dry).

Goats were orally dosed with 0.5 mg/kg bw ¹⁴C-flumioxazin for 5 days (equivalent to a nominal dose rate of 12 ppm)³⁶. The majority of the radioactivity from oral dosing was eliminated in the urine and faeces as metabolites. Negligible residues were transferred into the milk (<0.03 mg/kg equivalents) and into tissues of the animals (<0.19 mg/kg equivalents)

There is no likelihood of residues in animal commodities.

It is anticipated that animal product residues will be below typical method LOQs.

Fluquinconazole

-is a triazole fungicide used as a seed treatment for canola for the control of blackleg. It is applied at an application rate of 3.34 kg ai/tonne of seed.

No harvest WHP required.

Do not graze plants grown from treated seed or cut for stock food within 8 weeks of sowing.

There are Australian but no Codex or US MRLs for fluquinconazole in animal commodities. The Australian MRLs are 0.2 mg/kg for edible offal and 0.5 mg/kg for meat (mammalian)(in the fat) and *0.02 mg/kg for milk. The Australian MRL for rapeseed is *0.01 mg/kg. The animal feed MRLs are 0.5 ppm for canola forage and *0.01 ppm for straw and fodder (dry).

The TF for fat is 0.6³⁷. Anticipated residues are 0.5 ppm × 0.6 = 0.3 mg/kg. Residues in fat declined with a half-life of *ca.* 7 days (< 7 days) when on clean-feed.

³⁵ Public Release Summary on Evaluation of the new active Fludioxonil in the product Maxim 100 FS Fungicide Seed Treatment National Registration Authority for Agricultural and Veterinary Chemicals April 2000 Canberra Australia

³⁶ Public Release Summary on Evaluation of the new active FLUMIOXAZIN in the product Pledge 500 WG Herbicide Australian Pesticides and Veterinary Medicines Authority December 2003 Canberra Australia

³⁷ Evaluation of fully approved or provisionally approved products. Issue 184: Evaluation on Fluquinconazole, May 1999, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK

The TF for milk is 0.04. Anticipated residues are $0.5 \text{ ppm} \times 0.04 = 0.02 \text{ mg/kg}$.

It is anticipated that animal product residues will be below typical method LOQs when grazed on dry straw/fodder, however the situation is not clear for the grazing of green forage.

Livestock residues may exceed international and/or domestic market standards.
Insufficient data were located to provide confident opinion on livestock residue risks.

Fluroxypyr

- is a selective herbicide used for the control of broadleaf weeds in crops such as maize, sorghum and winter cereals as well as pastures. It is applied post-emergent to *poppies* at up to the 8-10 leaf growth stage at rates of up to 0.3 kg ai/ha.

The harvest WHP is 10 weeks.

Do not graze failed crops or cut for stock food for 7 days after application.

There are no Codex animal tissue MRLs for fluroxypyr. The US (parent + metabolite) residue definition differs to that used in Australia (parent). The relevant US MRL for animal tissue is 1.5 mg/kg for cattle kidney. The relevant Australian MRL is 0.1 mg/kg for edible offal (mammalian except kidney), mammalian kidney *0.01 mg/kg. The MRL for milk in Australia 0.1 and the US is 0.3 mg/kg. There is no MRL for poppies. The Australian MRL for cereal grains is 0.2 mg/kg. There are animal feed MRLs of 100 ppm for forage of cereal grains and other grass-like plants and for straw and fodder (dry) and hay of cereal grains and other grass-like plants. Fluroxypyr residues decline rapidly upon cessation of dosing at 1000 ppm for 28 days such that after 6 days residues in all tissues are less than the limit of analytical quantitation.

Livestock residues may exceed international and/or domestic market standards.
Insufficient data were located to provide confident opinion on livestock residue risks.

Flutriafol

-is a DMI fungicide used for the control of blackleg in *canola*. Application is made in-furrow at 100 g ai/ha.

Do not graze or cut for stock food for 4 weeks after application.

There are Australian but no Codex or US MRLs for flutriafol in animal commodities. The Australian MRLs are 0.5 mg/kg for edible offal and *0.05 mg/kg for meat mammalian and milk. The MRL for rape seed is *0.02 mg/kg.

EFSA DAR: In a metabolism study a 3 yr old Friesian cow was dosed at 2 ppm diet (as two doses per day) for 7 days. The cow was sacrificed 4 hours after the last dose. Milk production was about 10 L/day. Residues in milk reached a plateau of 0.007-0.008 mg/kg after 4 days. Flutriafol was 1% TRR in milk, 29% in liver and 7% in kidney.

A powdered formulation containing 100 g ai/ka flutriafol and 5.33 g ai/kg cypermethrin was incorporated into animal feed and administered to chickens (Rhode Island Red/White Leghorn ×), Merino sheep, pig boars and lactating cows (Jersey/Friesian or Friesian). The level in the feed was 150 ppm flutriafol for chickens, sheep and pigs and 54.5 ppm for cows. Animals were exposed to flutriafol in feed for 7 days and then sacrificed. Additional animals were slaughtered after a further 7 or 14 days on clean feed.

No residues were detected in milk. Residue in eggs showed a steady increase to reach a maximum of 1.63 mg/kg after 7 days dosing. Following cessation of dosing residues declined steadily to be undetectable by day 14. No residues were detected in tissues of animals slaughtered after 7 or 14 days on clean feed.

Residues of flutriafol (mg/kg) in various animal tissues following 7 days continuous dosing.

Tissue	Chicken	Sheep	Pig	Cow
Heart	0.36	0.03	2.56	<0.02
Liver	1.44	0.55	26.4	0.72
Kidney	-	<0.02	5.22	0.03
Fat (peritoneal)	0.82	0.10	6.70	<0.02
Muscle (loin)	-	<0.02	1.90	<0.02
Muscle (leg)	-	<0.02	1.72	<0.02
Gizzard	0.38	-	-	-
Breast meat	0.15	-	-	-
Brain	-	<0.02	-	-

Residues of flutriafol on canola were not located but residues in wheat plants after foliar application (worst case) at approximately the same rate as in-furrow (expect lower residues) were generally <5 ppm. Assuming a maximum residue in canola forage of <5 ppm, residues in tissues would be expected to be <0.05 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Glufosinate ammonium

-is a non-selective foliar herbicide used for control of certain broadleaf and grass weeds in InVigor hybrid canola varieties. The application rate is up to 0.4 kg ai/ha with two applications at 7-14 day intervals at the two leaf to bolting stage of crop growth.

The harvest WHP is not required.

Do not graze or cut treated areas for stock food for 8 weeks after application

The Australian MRLs are 5 mg/kg for offal, 0.1 mg/kg for meat and *0.05 mg/kg for milk. The Codex MRLs are *0.1 mg/kg for edible offal, *0.05 mg/kg for meat and *0.02 mg/kg for milks. The relevant USA MRL is 6 mg/kg for cattle mbyw while the MRLs for meat and fat are 0.15 and 0.4 mg/kg respectively. The US MRL for milk is 0.15 mg/kg. There is an MRL for rapeseed at *0.05 mg/kg, for canola forage at 5 ppm, canola meal at 0.2 ppm and canola straw and fodder (dry) of 3 ppm.

The JMPR have reported that residues were <0.01 mg/kg in edible offal and meat of cattle fed at the equivalent of 27 ppm in the diet³⁸.

It is anticipated that animal product residues will be below typical method LOQs.

Glyphosate

-is a non-selective foliar herbicide used for the control of broadleaf weeds and grasses in crops such as sugarcane, maize, sorghum and winter cereals as well as *oilseeds*. It is applied prior to sowing of crops at application rates up to 2.16 kg ai/ha.

No harvest or grazing WHPs are required.

³⁸ Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

The relevant Australian and Codex MRLs are the same at 2 mg/kg for cattle offal. MRL for milk is *0.1 and *0.05 mg/kg for milk respectively. The relevant USA MRL is 4 mg/kg for cattle meat byproducts. The primary animal feed commodity MRL for glyphosate is 150 mg/kg and the MRL for rape forage 50 ppm and rape straw and fodder dry 1 ppm. As registration includes an assessment of likely animal exposure, the feeding of forage or hay should not give rise to residues in excess of the Australian (or Codex and USA) MRL.

Residues in cattle, pig and poultry meat, eggs and milk were negligible after the animals were fed with a diet containing 100 mg/kg glyphosate and aminoglyphosate acid³⁹. The highest residues were in pig liver and kidney (up to 0.16 and 0.91 mg/kg, respectively) and cattle kidney (up to 1.4 mg/kg).

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Haloxifop

-is an aryloxyphenoxypropionate (fop) herbicide used for the control of certain grasses in various crops.. It is registered for weed control in *canola*, *linseed* and *linola* at an application rate of up to 52 g ai/ha and *sunflowers* (2nd leaf to head initiation) at an application rate of up to 78 g ai/ha. A harvest WHP is not required.

Do not graze or cut for stock food for 28 days after application.

There are Australian but no USA or Codex animal tissue MRLs for haloxifop. The relevant Australian MRLs are 0.5 mg/kg for edible offal, 0.02 mg/kg for meat (fat) and 0.02 mg/kg for milk. The MRLs for rapeseed, linola seed and linseed are all 0.1 mg/kg and sunflower seed *0.05 mg/kg. There are MRLs of 10 ppm for canola forage and 0.5 ppm for fodder. The MRLs for linseed and linola forage are 10 ppm and linola and linseed fodder 0.5 ppm.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $80 \times 0.078 = 6.2$ ppm at day 0. The foliar $t_{1/2}$ is 14-24 days, assuming one $t_{1/2}$ gives and estimated residue of 3.1 ppm at 28 days after application).

The TF for cattle fat is 0.05 and cattle kidney 0.19⁴⁰. If it is assumed residues are present at the same level as the MRL residues in cattle tissues would be $10 \times 0.05 = 0.5$ mg/kg in fat and $10 \times 0.19 = 1.9$ mg/kg in kidney if rape forage is included at 100% of the diet. Maximum residues of haloxifop in fat of cows dosed at the equivalent of 10 ppm in the diet were 0.53 mg/kg at the end of the 28 day feeding period, 0.21 mg/kg after 7 days on clean feed and 0.22 mg/kg after 14 days on clean feed. More information is required on the depletion of residues.

The TFs for milk and cream are 0.016 and 0.15. If it is assumed residues are present at the same level as the MRL, residues in milk and cream would be $10 \times 0.016 = 0.16$ mg/kg in milk and $10 \times 0.15 = 1.5$ mg/kg in cream.

Livestock residues may exceed international and/or domestic market standards.

³⁹ FAO/WHO (1986a) Pesticide residues in food - Evaluations 1986. Part I - Residues. Joint Meeting of the FAO Panel of Experts Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, Rome, 29 September-8 October 1986. Rome, Food and Agriculture Organization of the United Nations (FAO Plant Production and Protection Paper 78/1).

⁴⁰ Pesticide Residues in Food - 1995 Evaluations, Part I Residues FAO Plant Production and Protection Paper 137. FAO and WHO 1996

Imazapic

-is a imidazolinone herbicide used for the control of broad leaf and grass weeds in *canola*. It is applied at an application rate of up to 28 g ai/ha.

Do not graze or cut for stock food for 42 days after application.

There are no Codex MRLs for imazapic. The relevant US MRLs for animal tissues are 1 mg/kg for kidney and 0.1 mg/kg for meat, fat and meat bypr except kidney while the Australian MRL for edible offal (mammalian) is *0.05 mg/kg, for meat (mammalian (in the fat) *0.05 mg/kg and for milk *0.01 mg/kg. The MRLs for rape seed is *0.05 mg/kg. MRLs for canola forage (green) and fodder (dry) are *0.05 ppm. Feeding at this level is not expected to result in significant residues in animals (<LOQ or 0.05 mg/kg).

In the goat metabolism study 3 goats were exposed to ¹⁴C-imazapic at doses of 0, 3.76 and 15.1 mg in gelatin capsules for seven consecutive days⁴¹. These levels were considered to be 0, 33×, and 197× of maximum residue that foraging animals would likely receive in the diet in the US. The limits of detection for imazapic were 0.02 mg/kg in fat and 0.01 mg/kg for milk and tissues. Daily milk residues were below the limits of detection as were all tissue concentrations with the exception of the kidney: 0.01 mg/kg at the low dose and 0.05 mg/kg at the high dose. Residues from the kidney consisted of 30% parent compound.

The US EPA reported a feeding study where Holstein dairy cows were dosed orally for 28 days at rates equivalent to 67, 232 and 676 ppm in the diet. Animals were slaughtered within 24 h of the last dose. Residues of metabolite CL263284 were not detected.

Maximum residues of imazapic (mg/kg) were:

Matrix	66.8 ppm	232 ppm	676 ppm
Muscle	<0.05	<0.0674	0.086
Liver	<0.05	0.126	0.231
Kidney	0.465	2.2	3.75
Fat	<0.05	<0.054	0.053
Milk	0.035	0.121	0.374

It is anticipated that animal product residues will be below typical method LOQs.

Imazapyr

-is a imidazolinone herbicide used for the control of weeds in *canola* with Clearfield® technology.

It is applied at an application rate of up to 9.6 g ai/ha.

No harvest WHP is required.

Do not graze or cut for stock food for 6 weeks after application.

There are Australian and US but no Codex MRLs for imazapyr in animal tissues. The relevant Australian MRLs are *0.05 mg/kg for edible offal (mammalian), meat (mammalian)(in the fat) and *0.01 mg/kg for milk. The US MRLs are 0.05 mg/kg for meat, fat and meat bypds except kidney for which the MRL is 0.2 mg/kg and milk for which the MRL is 0.01 mg/kg. The rape seed MRL is *0.05 mg/kg. MRLs for canola forage (green) and fodder (dry) are *0.05 ppm. Feeding at this level is not expected to result in significant residues in animals (<LOQ or 0.05 mg/kg).

⁴¹ ERA TR 00-21-28-01e IMAZAPIC [Plateau and Plateau DG]-Human Health and Ecological Risk Assessment Final Report Prepared for: USDA, Forest Service Task No. 28 USDA/FS Contract No. 53-3187-5-12 USDA/FS Order No. 43-3187-0-0153 Submitted to: Leslie Rubin, COTR Animal and Plant Health Inspection Service (APHIS) Biotechnology, Biologics and Environmental Protection Environmental Analysis and Documentation United States Department of Agriculture Submitted by: Syracuse Environmental Research Associates, Inc. January 28, 2001

The US EPA reported⁴² that based on results from a cattle feeding study where animals were dosed at the equivalent of 58 ppm in the feed, maximum expected imazapyr residues in cattle commodities when fed at 24 ppm are <0.01 mg/kg in milk, <0.05 mg/kg in muscle, fat, and liver; and 0.15 mg/kg in kidney. The estimated TF for kidney is 0.00625.

It is anticipated that animal product residues will be below typical method LOQs.

Imidacloprid

- is a chloronicotinyl (pyridylmethylamine) insecticide. Application to *canola* for the control of red-legged earth mite and blue oat mite and *sunflowers* for the control of wireworm and is as a seed treatment. The application rate is up to 240 g ai/100 kg seed for canola and 258 g ai/100 kg seed for sunflower.

Do not graze canola plants grown from treated seed or cut for stock food within 6 weeks of sowing.

There are Australian Codex and US MRLs for imidacloprid in animal tissues. The relevant Australian and US tolerances for imidacloprid in edible offal are 0.2 and 0.3 mg/kg respectively and for milk 0.05 and 0.1 mg/kg. The Codex MRL for edible offal is 0.05 mg/kg and for milk *0.02 mg/kg. There is an animal feed MRL of 1 ppm for mixed pastures. The MRL for rape seed is *0.05 mg/kg and for sunflower *0.02 mg/kg. The MRLs for rape seed fodder and forage is 1 ppm.

The TF for liver is 0.01⁴³. Assuming residues in forage at 1 ppm and feeding at 100% of the diet, residues in liver would be $0.01 \times 1 = 0.01$ mg/kg. The TF for milk is 0.003. Anticipated maximum residues in milk are $1 \times 0.003 = 0.003$ mg/kg.

The $t_{1/2}$ in forage/fodder is about 7 to 10 days.

It is anticipated that animal product residues will be below typical method LOQs.

Iprodione

It is used on *canola* for the control of sclerotinia rot with application at rates of up to 500 g ai/ha. The WHP is 6 weeks for harvest and grazing of canola.

There are Australian and US MRLs but no Codex MRLs for iprodione in animal tissues. The Australian MRLs have all been set at *0.1 mg/kg. The US MRLs are 3 mg/kg for cattle liver and kidney and 0.5 mg/kg for cattle fat, meat and meat by-products (except liver and kidney) and milk. The US residue definition is the sum of iprodione + isomer (RP-30228) + metabolite (RP-32490) + metabolite (RP-36114). There is an MRL of 20 ppm for peanut forage (green) and 0.05 mg/kg for peanuts. The MRL for rapeseed is 0.5 mg/kg and for canola forage, fodder and straw 1 ppm.

The TF for fat and milk (US residue definition) are 0.03 and 0.007 respectively (at 15 ppm feeding level)⁴⁴. Assuming residues in rapeseed are at the MRL and feeding rapeseed at 100% of the diet

⁴² MEMORANDUM dated 8th December 2005, SUBJECT: Imazapyr: Revised HED Chapter of the Reregistration Eligibility Document (RED). PC Code: 128821, CAS Reg 81334-34-1, Case #3078, DP Barcode: D324106. Regulatory Action: Phase 3 Reregistration Action Risk Assessment Type: Single Chemical/Aggregate FROM: Christina Jarvis, TO: Sherrie Kinard

⁴³ 2002 JMPR. Pesticide Residues in Food - 2002 Evaluations – Part I: Residues Volume 1, FAO Plant Production and Protection Paper 175/1. FAO and WHO 2003

⁴⁴ 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

the anticipated residues in fat are $0.3 \times 1 \times 0.03 = 0.009$ mg/kg. Anticipated residues in milk are $0.3 \times 1 \times 0.007 = 0.002$ mg/kg.

If parent compound is monitored in tissues in other countries, as in Australia, residues in tissues are expected to be below the method LOQ.

It is anticipated that animal product residues will be below typical method LOQs.

Lambda-cyhalothrin

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on *sunflowers* at 17.5 g ai/ha and *canola* and *forage brassica* at 9 g ai/ha. Cyhalothrin residues decline with typical half-lives of 30 and 5 days for soil and foliage respectively. Residues in cattle fat decline with a half-life of 7-9 days when animals are on "clean feed".

The following harvest/grazing/cutting for stock food WHPs apply.

Sunflowers: 28 days for harvest.

Canola: 7 days for harvest and grazing

Forage brassica: 2 days for harvest and grazing

There are Australian, Codex and USA MRLs for cyhalothrin in animal commodities. The relevant MRLs for cattle fat are 0.5 and 3 mg/kg for Australia and the USA respectively. The Australian MRL for milk is 0.5 [in the fat] mg/kg while the US one is 10 mg/kg for milk fat (reflecting 0.4 mg/kg in whole milk). The Codex MRLs are 3 mg/kg for fat and 0.2 mg/kg for milk. The MRL for rapeseed is 0.02 mg/kg and for sunflower seed *0.01 mg/kg. There is an Australian MRLs of 2 ppm for rape/canola forage (dry).

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.0175 kg ai/ha gives a day 0 residue of 1.4 ppm).

If residues in forage are fed to animals are assumed to be at the same level as the MRL, residues in fat (TF 0.3-0.5)⁴⁵ would be $2 \times 0.5 = 1$ mg/kg. The TF for milk is 0.02 giving anticipated maximum residues of $2 \times 0.02 = 0.04$ mg/kg for whole milk. Sunflower forage/fodder is unlikely to be fed at 100% of the diet such that residues should be less than 50% of that estimated above (<0.5 mg/kg in fat).

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Maldison (malathion)

- is an organophosphate insecticide used for the control of Rutherglen bug in *canola* and *sunflowers*.

The application rate is up to 0.575 kg ai/ha.

No harvest WHP is required.

There are Australian and US but no Codex MRLs malathion in animal tissues. The relevant Australian and USA MRLs for malathion in animal tissues are 1 mg/kg in Australia and 4 mg/kg in the US. The Australian MRL for milk is 1 [in the fat] mg/kg while the US MRL is 0.5 mg/kg for milk fat (from application to dairy cows).

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.575 kg ai/ha gives a day 0 residue of 46 ppm).

⁴⁵ Cyhalothrin. (Environmental health criteria ; 99) 1.Pyrethrins - adverse effects 2.Pyrethrins - toxicity I. Series ISBN 92 4 154299 3 (NLM Classification: WA 240) ISSN 0250-863X

No residues of malathion were detected in tissues in a goat metabolism study conducted at a nominal feeding level of 115 ppm⁴⁶. There is no expectation of residues of malathion in tissues arising from the feeding of canola forage or derived hay.

It is anticipated that animal product residues will be below typical method LOQs.

Mancozeb (see Dithiocarbamates)

Is registered for use on *poppies* for the control of downy mildew at a maximum rate of 1.875 kg ai/ha.

The harvest WHP is 7 weeks

There are Australian, Codex and US MRLs for mancozeb in animal commodities. The Australian MRL for edible offal is 2 mg/kg while the Codex MRL is 0.1 mg/kg, both as CS₂. The USA residue definition is zinc ethylenebisdithiocarbamate and the MRL 0.5 mg/kg for liver and kidney. The MRLs for milk are *0.05 mg/kg for both Australia and Codex.

The poppy seed MRL is *0.2 mg/kg. The Australian PAFC MRL is 50 ppm. (If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $1.875 \times 80 = 150$ ppm).

Residues in forage would be expected to be less than 150 ppm. The target tissue is liver. The TF for liver (45 ppm feeding study) was 0.003⁴⁷ giving an anticipated maximum residue from the feeding of forage of $150 \times 0.003 = 0.45$ mg/kg, less than the relevant international MRLs. The TF for milk was <0.008.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

MCPA (4-chloro-2-methylphenoxy)acetic acid or in the USA 2-methyl-4-chlorophenoxyacetic acid -is a selective herbicide used for the control of broadleaf weeds in *linseed* (1.05 kg ai/ha), *oilseed poppies* (0.75 kg ai/ha) and *flax* (0.245 g ai/ha).

Do not graze or cut for stock food for 7 days after application.

Oilseed poppies: do not harvest for 5 weeks after application.

There are no Codex MRLs for MCPA in animal tissues. The Australian (parent) and US (parent + metabolite) residue definitions differ. The Australian MRL for meat (mammalian) is *0.05 mg/kg as is the milk MRL. The US MRL for meat is *0.1 mg/kg as is the milk MRL. Residues decline in soil and foliage with typical half-lives of 25 and 8 days respectively.

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 1.05 kg ai/ha gives a day 0 residue of 84 ppm). Cattle and sheep fed low to moderate doses of MCPA in the diet for 2 weeks showed no residues from levels less than about 18 mg/kg⁴⁸. The major metabolite of MCPA is 2-methyl-4-chlorophenol in the free and conjugated form, which is formed in the liver. The US has a tolerance of 300 mg/kg for pasture indicating that feeding at this level should not result in residues in animal tissues above the US MRL (i.e. the residues would be <LOQ or 0.1 mg/kg).

⁴⁶ 1999 JMPR - Pesticide Residues in Food - 1999 Evaluations, Part I Residues FAO Plant Production and Protection Paper 157. FAO and WHO 2000

⁴⁷ 1993 JMPR - Pesticide Residues in Food - 1993 Evaluations, Part I Residues FAO Plant Production and Protection Paper 124. FAO and WHO 1994

⁴⁸ MCPA. List A Reregistration Case 0017. Chemical No. 030501, 030502, 030516, 030564. Revised Product and Residue Chemistry Chapters for the Reregistration Eligibility Decision. DP Barcode: D299360

In a feeding study where calves were fed in the diet at 250 or 500 ppm for 28 days, residues were <LOQ in meat and fat at slaughter and <LOQ for liver at the 250 ppm feeding level⁴⁹. Residues in kidney at 250 ppm feed level were 1.4 mg/kg. Residues in kidney and liver at the 500 ppm feed level were 0.14 and 2.3 mg/kg respectively. Residues at 7 days on clean feed after feeding at 500 ppm were 0.1 mg/kg in kidney. The half-life for depletion in tissues is estimated to be <2 days. Estimated TF for fat is $<0.1 \text{ mg/kg} \div 500 \text{ ppm} = <0.0002$ and for offal (kidney) is $2.3 \text{ mg/kg} \div 500 \text{ ppm} = 0.005$. No residues are expected in milk of animals fed at up to 300 ppm in the diet.

Residues in tissues other than kidney are expected to be <LOQ. Kidney residues are expected to be <0.4 mg/kg (80×0.005). Noting the conservativeness of the estimates, it is considered that livestock residues should not exceed international and/or domestic market standards.

Metalaxyl

- is a fungicide used on a variety of crops. It is used on poppies at 140 g ai/100 kg seed as a seed treatment.

Do not harvest for 150 days following application.

There are Australian and US but no Codex MRLs for metalaxyl in animal commodities. The Australian and Codex residue definition is parent compound. The Australian MRLs for edible offal and meat are *0.05 mg/kg while the MRL for milk is *0.01 mg/kg. The US residue definition is the sum of metalaxyl and its metabolites containing the 2,6-dimethylaniline moiety, and N-(2-hydroxymethyl-6-methylphenyl)-N-(methoxyacetyl)-alanine methyl ester, each expressed as metalaxyl equivalents. The USA MRLs are 0.4 mg/kg for fat, liver and kidney and 0.05 mg/kg for meat and meat by-products and 0.02 mg/kg for milk.

In a lactating goat metabolism study conducted at a dose level equivalent of feeding at 7 ppm, radioactive residues in tissues, expressed in metalaxyl equivalents, were all <0.06 mg/kg⁵⁰. It is considered unlikely that feeding of oilseed forage or fodder derived from plants grown from metalaxyl treated seed would generate tissue residues above regulatory LOQs.

It is anticipated that animal product residues will be below typical method LOQs.

Methidathion

- is an organophosphate insecticide used for the control of insects and mites in *sunflowers* and *oilseeds*. The maximum application rate is 80 g ai/ha for mite control (bare earth treatment) in oilseeds and for grey cluster bug and Rutherglen bug in sunflowers at 400 g ai/ha.

Sunflowers: harvest WHP 3 days

Oilseeds: harvest WHP 7 days

There are Australian and Codex but no USA MRLs for methidathion in animal tissues. The Australian (Codex) and USA residue definitions differ: methidathion (Australia, Codex), sum of methidathion, its oxygen analogue, the sulfoxide and the sulfone (USA). The Australian and Codex that apply to animal tissues are 0.5 and *0.02 mg/kg respectively. The corresponding milk MRLs are 0.5 [in the fat] and 0.001 mg/kg.

⁴⁹ Leng, M.L., Comparative metabolism of phenoxy herbicides in animals, in Fate of pesticides in large animals edited by Ivie, G.W. and Dorough, H.W., Academic Press, New York 1977.

⁵⁰ 1982 JMPR Pesticide Residues in Food - 1982 Evaluations, FAO Plant Production and Protection Paper 49. FAO and WHO 1983

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.4 kg ai/ha gives a day 0 residue of 32 ppm). No residues of methidathion were observed in tissues of cows fed at up to 50 ppm in the diet when measured by the Australian or USA residue definitions⁵¹. There is no expectation of residues in animal tissues.

It is anticipated that animal product residues will be below typical method LOQs.

Methiocarb

is a carbamate molluscicide and is used in *oilseeds* to control snails. The application rate is up to 0.44 kg ai/ha.

The harvest WHP is 7 days.

Do not graze or cut for stock food for 7 days after application.

There no Australian, Codex or US MRLs for methiocarb residues in animal commodities.

There is no Australian MRL for oilseeds.

The 1981 JMPR reported the results of beef and dairy cattle feeding studies where cattle were fed rations containing 10, 30 and 100 ppm methiocarb for 29 days⁵². Residues were detected only in the liver (animals fed 30 and 100 ppm methiocarb) and kidney (animals fed 100 ppm methiocarb). All other tissues (brain, heart, muscle and fat) showed no detectable residues. There is no reasonable expectation for residues of methiocarb in animal tissues resulting from the feeding of waste derived from treated oilseed crops.

It is anticipated that animal product residues will be below typical method LOQs.

Methomyl (also thiodicarb)

- is a carbamate insecticide used for the control of heliothis in *canola, linseed, poppies, sesame seed* and *sunflowers* at rates of up to 450 g ai/ha.

The harvest WHP is 14 days for poppies and sesame and 7 days for canola, linseed and sunflowers.

Methomyl residues decline with typical half-lives of 7 and 4 days for soil and foliage respectively.

There are Australian and Codex but no USA MRLs for methomyl (as thiodicarb) in animal tissues.

The MRLs have all been set at the LOQ.

The Australian MRL for rape seed is 0.5 mg/kg, poppy seed *0.05 mg/kg, linseed, sunflower and sesame seed*0.1 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $0.45 \times 80 = 36$ ppm at day 0 and <1.9 ppm at 14 days).

⁵¹ Methidathion Reregistration Eligibility Decision Residue Chemistry Considerations Shaughnessy No. 100301; Case No. 0034 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

⁵² 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982

No residues of methomyl/thiodicarb were observed in tissues (<0.01 mg/kg) of cows fed at up to 86 ppm in the diet when measured by the Australian or USA residue definitions⁵³. There is no expectation of residues in animal tissues.

It is anticipated that animal product residues will be below typical method LOQs.

Metolachlor

-is a selective herbicide used for the control of annual grasses and broadleaf weeds in crops. It is applied at an application rate of up to 0.36 kg ai/ha for *canola* and 2.88 kg ai/ha for *sunflowers*. No harvest WHP required.

Canola: do not graze treated field for 10 weeks after application.

There are no Codex MRLs for metolachlor in animal tissues. The Australian (parent) and US (parent + metabolite) residue definitions differ. The relevant US MRLs for animal tissues are 0.02 mg/kg for cattle meat, 0.2 mg/kg for cattle kidney and 0.02 mg/kg for milk. The Australian MRLs for meat (mammalian) and milk are *0.05 mg/kg. Residues decline in soil and foliage with typical half-lives of 90 and 5 days respectively. Metolachlor has a primary animal feed commodity MRL of 5 ppm.

The US EPA Metolachlor Registration Standard dated March, 1980, concluded that the qualitative nature of the residue in animals was adequately understood. Metolachlor is rapidly metabolized and almost totally eliminated in the urine and feces of ruminants (goats), non-ruminants (rats), and poultry. Metolachlor *per se* was not detected in any of the excreta or tissues. Finite residues were detected in animal transfer studies.

In a study cows were fed 60 ppm metolachlor in the diet for up to 28 days (equivalent to 2.4 mg ai/kg bw/day)⁵⁴. Metolachlor residues in meat and fat were all below the LOQ (<0.02 mg/kg); and residues in milk were all <LOQ (<0.01 mg/kg). In contrast, finite residues of ~0.4 mg/kg for kidney and ~0.1 mg/kg for liver were reported.

It is anticipated that animal product residues will be below typical method LOQs.

Metosulam

-is a triazolopyrimidine sulfonanilide herbicide used for the control of broad-leaved weeds in *oilseed poppies*. It is applied at an application rate of up to 7.14 g ai/ha.

Do not graze or cut for stock food for 12 weeks after application.

There are Australian but no Codex or US MRLs for metosulam in animal commodities. The Australian MRLs have all been set at *0.01 mg/kg. The MRL for lupins (dry) is *0.02 mg/kg. The MRL for lupin forage is *0.1 ppm. No oilseed MRLs.

It is anticipated that animal product residues will be below typical method LOQs.

Metsulfuron-methyl

⁵³ 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002

⁵⁴ Revised Metolachlor and S-Metolachlor Residue Chemistry Chapter for the Tolerance Reassessment Eligibility Decision (TRED); PC codes 108801 and 108800; DP Barcode D282931; Rereg. Case 0001. Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

is a sulfonylurea herbicide used for the control of various weeds in linseed and *safflower*. Application is at rates up to 4.2 g ai/ha. A harvest WHP is not required. Do not use treated crop (eg failed crop) for grazing or fodder

There are Australian and US but no Codex MRLs for metsulfuron-methyl in animal commodities. The Australian MRLs for animal commodities have all been set at *0.1 mg/kg. The US MRLs are 0.5 mg/kg for kidney and 0.1 mg/kg for other meat by-products, meat and fat and 0.05 mg/kg for milk.

The MRL for safflower and linseed is *0.02 mg/kg while those for feed commodities are 1 ppm for forage of cereal grains and other grass-like plants and 1 ppm for straw and fodder (dry) and hay of cereal grains and other grass-like plants.

The fate of metsulfuron methyl and its metabolite was investigated in the lactating goat. Metsulfuron methyl and the metabolite were eliminated mostly in the urine and faeces. Traces of radioactivity were found in some tissues and in milk of the parent (0.008-0.009%) and no radioactivity of the metabolite was detected in the milk or any organ or tissue sample. In a cattle feeding study, metsulfuron methyl was rapidly excreted in the urine and faeces of the treated cows. Less than 0.1% of the daily dose was excreted in the milk as metsulfuron methyl and <10% of the metsulfuron methyl residue level was found as the glucuronide conjugate. Residues (<0.1 ppm) were found in the kidney of cows slaughtered 12 hours after treatment stopped but not in cows slaughtered a week later.

A lactating cow study reported the following disposition of metsulfuron-methyl residues (dosing regime: 0, 5, 20 or 100 ppm in the diet for 4 weeks)⁵⁵. Fat and meat tissues were < 0.01 mg/kg (LOQ), except for one cow (100 ppm feeding study) with meat residues of 0.014 to 0.02 mg/kg. Liver and kidney tissues from cows fed 5 ppm were not greater than 0.053 mg/kg. Metsulfuron-methyl residues in milk samples from cows fed 5 ppm were less than 0.011 mg/kg; 20 ppm feeding resulted in residues that reached a plateau at day 7 post-treatment with residues at 0.016-0.033 mg/kg over the 4 week period.

The US EPA reported⁵⁶ a lactating goat metabolism study conducted at a dose level equivalent to 3.4 ppm in the feed, metsulfuron-methyl was the major component in milk. Saccharin was the major component in liver and was judged not to be of concern. Levels in other tissues were ≤20 ppb.

It is anticipated that animal product residues will be below typical method LOQs.

Omethoate

- is an organophosphate insecticide used for the control of mites in *oilseeds* and *poppies*. The maximum application rate is 34.8 g ai/ha. Do not graze or cut for stock food for 1 day after application.

There are Australian but no Codex or US MRLs for omethoate in animal tissues. The Australian MRLs for animal commodities including milk have been set at *0.05 mg/kg. There is an Australian MRL at 20 ppm for a series of miscellaneous forage and fodder crops.

⁵⁵ Pest Management Regulatory Agency Decision Document E95-04 Tribenuron methyl 8 December 1995

⁵⁶ Metsulfuron methyl; Pesticide Tolerances for Emergency Exemptions [Federal Register: December 16, 1999 (Volume 64, Number 241)] [Page 70184-70191]

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $0.0348 \times 80 = 2.8$ ppm).

A metabolism study with lactating goats dosed orally with dimethoate suggests that residues of omethoate are not expected in animal tissues⁵⁷.

It is anticipated that animal product residues will be below typical method LOQs.

Paraquat

- is a herbicide used for the control of weeds in *oilseeds* (post-emergent). The application rate is up to 0.432 kg ai/ha.

The following grazing restraints apply:

Do not graze or cut sprayed vegetation for stock food for 1 day after application. Remove stock from treated areas at least 3 days before slaughter

The Australian and Codex MRLs for paraquat in kidney are 0.5 and 0.05 mg/kg respectively, while *0.1 and 0.005 mg/kg for milk, respectively. The US MRL for kidney is 0.5 mg/kg and for milk 0.01 mg/kg. Residues in soil and foliage decline with typical half-lives of *ca.* 1000 and 30 days respectively. The Australian PAFC MRL is 500 ppm.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $0.432 \times 80 = 35$ ppm).

For residues in kidney to be less than the US MRL of 0.3 mg/kg, cattle would have to fed at less than *ca.* 80 ppm in the diet.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Pendimethalin

-is a selective dinitroaniline herbicide used for the control of annual ryegrass and certain broadleaf weeds in *sunflower*, *safflower* and *canola*. It is applied at a maximum rate of 0.99 kg ai/ha at the time of sowing.

A harvest WHP is not required.

There are Australian but no Codex or US MRLs for pendimethalin in animal tissues. The Australian MRL for animal commodities all have been set at *0.01 mg/kg. Residues decline in soil and foliage with typical half-lives of 90 and 50 days respectively. The Australian MRL for oilseeds is *0.05 mg/kg. The MRL for rape seed forage and fodder is also *0.05 ppm. The US EPA notes that animal metabolism studies in goats conducted at exaggerated feeding levels indicate that there is no reasonable expectation for residues of pendimethalin in tissues⁵⁸.

It is anticipated that animal product residues will be below typical method LOQs.

Permethrin

⁵⁷ 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

⁵⁸ Reregistration Eligibility Decision Pendimethalin List A Case 0187, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on *linseed* with application at rates of up to 0.15 kg ai/ha. Permethrin residues decline with typical half-lives of 30 and 8 days for soil and foliage respectively.

The harvest WHP is 3 days.

There are Australian, Codex and USA MRLs for permethrin in animal tissues. The Australian and Codex residue definitions are parent compound while the USA residue definition includes some metabolites. The relevant MRLs for fat are 1, 1 and 1.5 mg/kg for Australia, Codex and the USA respectively. The relevant MRLs for offal are 0.5, 0.1 and 0.1 mg/kg for Australia, Codex and the USA respectively. The relevant MRLs for milk are 0.1 F, 0.1 F and 3 mg/kg for Australia, Codex and the USA respectively, the latter is for milk fat and represents 0.25 mg/kg on a whole milk basis.

(If assume residues at day 0 from application at 1 kg ai/ha are 80 ppm in forage, scaling for rate gives an estimated day of residue of 10 ppm). Residues in forage/hay could be as high as 10 ppm. The TF for fat is 0.04⁵⁹. Anticipated maximum residues in fat resulting from feeding linseed forage or hay at 100% of the diet are $10 \times 0.04 = 0.4$ mg/kg. The TF for milk is 0.002 and if fed at 10 ppm would give rise to residues in whole milk of 0.02 mg/kg, less than the relevant international standards.

The residues in fat were reported to decline with an initial half-life of < 7 days.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Pirimicarb

-is a carbamate aphicide used for the control of aphids in *canola*. The application rate is up to 500 g ai/ha.

The harvest WHP is 14 days.

Do not graze or cut for stock food or feed to poultry for 14 days after application.

There are Australian and Codex but no USA MRLs for pirimicarb in animal commodities. The Australian and Codex MRLs for meat and milk are all set at *0.1 mg/kg . As the MRLs are set at the limit of analytical quantitation and are essentially the same.

(Scaling anticipated residues in forage at day 0 of 80 ppm for application at 0.5 kg ai/ha gives a day 0 residue of 40 ppm).

There is a PAFC MRL of 20 ppm. In a feeding study reported by JMPR residues of pirimicarb were <0.05 mg/kg for animals dosed at the equivalent of 200 ppm in the diet⁶⁰, a level of exposure much greater than would be anticipated to arise from canola forage and straw/hay. The TF for milk is 0.00065 indicating a little likelihood that residues would be detected in milk.

It is anticipated that animal product residues will be below typical method LOQs.

Prometryn

- is a triazine herbicide used for the control of certain grasses in crops such as cotton, sunflower, legumes and pastures. It is used on *sunflowers* as a pre-emergent application at rates of up to 2 kg ai/ha.

⁵⁹ 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982

⁶⁰ 1978 JMPR - Pesticide Residues in Food - 1978 Evaluations, FAO Plant Production and Protection Paper 15 Suppl. FAO and WHO 1979

No harvest WHP is required.

There are Australian but no Codex or US animal commodity MRLs for prometryn. The Australian MRLs are all set at *0.05 mg/kg. It is considered unlikely that residues of prometryn would be detected in animal tissues. There is an MRL of *0.1 mg/kg for sunflower and 50 ppm for hay or fodder (dry) of grasses.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $2 \times 80 = 160$ ppm. However, material for grazing would not be present until at least 4 weeks after sowing).

The US EPA considered that there is no reasonable expectation of detectable residues. Animals exposed to residues at levels anticipated in forage/fodder are not expected to have detectable residues (US EPA refer to a feeding study conducted at 50 ppm)⁶¹.

Pre-emergent use is unlikely to result in significant residues in forage/fodder. While no data were located for sunflowers, results for cotton suggest residues would be less than 1 ppm in forage/fodder (EPA RED).

It is anticipated that animal product residues will be below typical method LOQs.

Propaquizafop

-is a herbicide used for the control of grass weeds in various crops. It is used on *canola*, *linseed* and *safflower* at rates of up to 45 g ai/ha and on sunflowers at rates of up to 90 g ai/ha.

The harvest WHP is 16 weeks for canola and linseed, 20 weeks for safflower and 14 weeks for sunflowers.

Sunflowers: Do not graze or cut for stock food for 14 weeks after application.

There are Australian but no Codex or US MRLs for propaquizafop in animal commodities. The tissue MRLs have been set at *0.02 mg/kg while the milk MRL is *0.01 mg/kg. There is an MRL of 5 ppm for legume pastures (green), *0.05 ppm for peanut fodder and 2 ppm for peanut forage. The MRL for oilseeds is *0.05 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $0.09 \times 80 = 7.2$ ppm). The relevant TFs for propaquizafop are 0.004 for both kidney and fat⁶². Assuming the residues in legume pasture reflect a worst case, anticipated maximum residues on feeding oilseed fodder/forage with residues of 5 ppm are $5 \times 0.004 = 0.02$ mg/kg for both kidney and liver. The TF for milk is 0.001-0.002 which gives rise to anticipated residues of $5 \times 0.002 = 0.01$ mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Propiconazole

-is a DMI fungicide used for the control of various fungal rust, scald and mildew diseases in crops.

It is used for the control of leaf smut in *poppies*. Application is at rates of up to 125 g ai/ha.

The harvest WHP is 28 days.

⁶¹ Reregistration Eligibility Decision Prometryn List A Case 0467, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division, EPA 738-R-95-033 February 1996

⁶² Evaluation of fully approved or provisionally approved products: Issue No. 94 propaquizafop February 1994

There are Australian, Codex and US MRLs for propiconazole in animal commodities. The Australian MRLs (propiconazole) are 1 mg/kg for edible offal, 0.1 mg/kg for meat and *0.01 mg/kg for milk. The Codex MRLs (propiconazole) for animal commodities are all set at *0.01 mg/kg. The US residue definition is the sum of propiconazole and its metabolites determined as 2,4-dichlorobenzoic acid, expressed as parent compound. The US MRLs are 2 mg/kg for liver and kidney, 0.05 mg/kg for fat and meat by-products (except liver and kidney) and 0.05 mg/kg for milk.

Animal transfer studies were reported by the 1987 JMPR at feeding levels of 15-100 ppm for cows and 4.5 ppm for goats resulted in undetectable residues of parent compound (Australian and Codex residue definitions) in milk and tissues (<0.05 mg/kg)⁶³. After feeding cows for 14 days at 15 ppm the total residues (proxy for US residue definition) were undetectable in milk and 0.63 mg/kg in kidney.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

Pyridate

Is registered for use on *oilseed poppies* at 0.45 kg ai/ha.

A harvest WHP is not required.

Do not allow livestock to graze poppy stubble.

There are Australian but no Codex or US MRLs for pyridate in animal commodities. The Australian MRLs have all been set at *0.2 mg/kg. The MRL for chickpea forage is *0.2 ppm and chickpea (dry) *0.1 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Quizalofop-P

-is used for the control of certain grass and broad leaf weeds in *canola*. The application rate is up to 38 g ai/ha.

The harvest WHP is 11 weeks.

There are Australian and US but no Codex MRLs for animal commodities. The Australian MRL for meat (mammalian) has been set at *0.02 mg/kg and for edible offal (mammalian) 0.2 mg/kg. The US MRLs are 0.05 mg/kg for fat and meat by-products and 0.02 mg/kg for meat. The US MRL for milk is 0.01 mg/kg and for milk fat 0.25 mg/kg. The US residue definition is the sum of quizalofop-ethyl, quizalofop-methyl and quizalofop expressed as quizalofop ethyl. There are MRLs of *0.02 mg/kg for rape seed and *0.05 mg/kg for sunflower seed and 5 ppm for canola forage and fodder.

In a feeding study, three groups of three lactating dairy cows plus a control group were fed 0.1, 0.5, and 5 ppm quizalofop ethyl ester (encapsulated) for 28- consecutive days⁶⁴. Whole milk, skim milk, and cream from the control, and the 0.1 and 0.5 ppm dose groups showed no quizalofop to <0.02 ppm (0.05 ppm in cream). From the 5 ppm dose, quizalofop residues ranged from 0.01 to 0.02 ppm in whole, and when these samples were separated into cream and skim milk, the quizalofop partitioned into the cream with residues plateauing at 0.26 to 0.31 ppm.

⁶³ 1987 JMPR Pesticide Residues in Food - 1987 Evaluations, Part I Residues FAO Plant Production and Protection Paper 86/1. FAO and WHO 1988

⁶⁴ [Federal Register: August 25, 2004 (Volume 69, Number 164)] [Notices] [Page 52256-52261] ENVIRONMENTAL PROTECTION AGENCY [OPP-2004-0245; FRL-7372-4] Quizalofop-Ethyl; Notice of Filing a Pesticide Petition to Establish a Tolerance for a Certain Pesticide Chemical in or on Food)

No quizalofop to <0.02 ppm was detected in skeletal muscle, and to <0.05 ppm was detected in any liver or fat sample from any of the three doses. Quizalofop was detected in one kidney sample as 0.05 ppm from the 5 ppm dose.

It is anticipated that animal product residues will be below typical method LOQs.

Sethoxydim

- is a cyclohexanedione herbicide used for the control of certain grass weeds in crops. It is used for the control of various weeds in *canola*, *linseed* and *sunflowers* with application at rates of up to 0.192 kg ai/ha.

The harvest WHP is 17 weeks.

There are Australian and US MRLs for sethoxydim but no Codex MRLs. However, the Codex residue definition for clethodim is the “sum of clethodim and its metabolites containing 5-(2-ethylthiopropyl)cyclohexene-3-one and 5-(2-ethylthiopropyl)-5-hydroxycyclohexene-3-one moieties and their sulphoxides and sulphones, expressed as clethodim”. Comparison with the Australian residue definition indicates residues for sethoxydim will be covered by Codex MRLs for clethodim. The Codex MRLs for clethodim are *0.2 mg/kg for edible offal and meat and *0.05 mg/kg for milk. The Australian residue definition is sethoxydim and its metabolites containing 5-(2-ethylthiopropyl)cyclohexane-3-one and 5-(2-ethylthiopropyl)-5-hydroxycyclohexene-3-one moieties and their sulphoxides and sulphones, expressed as sethoxydim. The US residue definition is sethoxydim and its metabolites containing the 2-cyclohexen-1-one moiety. The Australian MRLs for animal commodities have been set at *0.05 mg/kg. The US MRLs for cattle tissues are 1 mg/kg for meat by-products, 0.2 mg/kg for other tissues while the milk MRL is 0.5 mg/kg. There are MRLs for rape seed at 0.5 mg/kg, poppy seed at 0.2 mg/kg and sunflower seed at *0.1 mg/kg as well as peanut fodder and peanut forage (green) at 10 ppm and for peanuts at 3 mg/kg. The MRLs for rapeseed forage and fodder are 10 ppm.

The US EPA reported⁶⁵ a study where lactating goats were fed hay containing 75 ppm sethoxydim for 28 days; residues of sethoxydim and its metabolites containing the 2-cyclohexen-1-one moiety were <0.05 mg/kg in muscle and fat, <0.44 mg/kg in kidney, 0.14 mg/kg in liver, and <0.01-0.18 mg/kg in milk. The TF for kidney and milk are 0.0059 and 0.0024 respectively. Anticipated residues are $10 \times 0.0059 = 0.059$ mg/kg for kidney and $10 \times 0.0024 = 0.024$ mg/kg for milk.

It is anticipated that animal product residues will be below typical method LOQs.

Simazine

- is a triazine herbicide used for the control of weeds in vegetable crops. It is registered for control of certain weeds in *canola* with application rates up to 2 kg ai/ha.

A harvest WHP is not required.

Do not graze or cut for stock food for 15 weeks after application.

There are Australian and US but no Codex MRLs for animal commodities. The Australian MRLs for animal tissue have been set at *0.01 mg/kg and milk at *0.02 mg/kg. The US MRLs are 0.03 mg/kg for animal commodity MRLs.

⁶⁵ MEMORANDUM Date: 22-JUN-2005 Subject: Revised as per 30-day Error Only Registrant Comments. Sethoxydim. HED Chemistry Chapter of the Reregistration Eligibility Decision (RED). Summary of Analytical Chemistry and Residue Data. Case No. 2600 DP Number: D318169 PC Code: 121001 Chemical Class: Cyclohexenone From: William H. Donovan To: James Parker

Studies in rats, goats, and sheep reveal that 60 to 70% of the ingested dose may be absorbed into the system, with approximately 5 to 10% distributed systemically to tissues⁶⁶. The remainder is eliminated via urine within 24 hours. Distribution led to detectable levels in red blood cells (highest), liver, kidney, fat, bone, and plasma. When a cow was fed 5 ppm for 3 days, no simazine was found in the cow's milk during the next 3 days. It has been reported that simazine residues were present in the urine of sheep for up to 12 days after administration of a single oral dose. The maximum concentration in the urine occurred from 2 to 6 days after administration.

The Australian rape forage MRL is 5 ppm and fodder/straw MRL 1 ppm.

The US EPA reported⁶⁷ a ruminant feeding study where dairy cows were dosed with simazine at levels equivalent to 0.5, 2.5, and 5 ppm in the diet for 28 consecutive days. The combined residues of simazine, G-28279, and G-28273 in milk throughout the dosing period were <0.03 mg/kg (<0.01 mg/kg for each analyte) in milk from cows dosed at 0.5 ppm; 0.03 mg/kg (G-28273 was detected at 0.01 mg/kg) from cows dosed at 2.5 ppm; and 0.03-0.05 mg/kg (G-28273 detected at 0.01-0.04 mg/kg) from cows dosed at 5 ppm. The combined residues of simazine, G-28279 and G-28273 were <0.03 mg/kg (each at <0.01 mg/kg) in samples of meat, kidney, liver, and fat from cows in each dose group, with the exception of one cow dosed at 5 ppm and sacrificed on Day 21 which had residues of G-28273 at 0.01 mg/kg in tenderloin and kidney samples.

Anticipated residues in muscle and kidney samples are <0.03 mg/kg and 0.05 mg/kg for milk.

Livestock residues are not anticipated to exceed international and/or domestic market standards.

S-metolachlor

see metolachlor

Tepraloxym

-is a cyclohexanedione herbicide for early post-emergence control of various grass weeds in canola. The application rate is up to 60 g ai/ha.

A harvest WHP is not required.

Do not graze or cut for stock food for 4 weeks after application.

The Australian MRLs for animal commodities are all *0.1 mg/kg except milk which is *0.02 mg/kg. The US MRLs are 0.5 mg/kg for kidney, 0.2 mg/kg for other meat by-products and meat, 0.15 mg/kg for fat and 0.1 mg/kg for milk. The MRL for canola is *0.1 mg/kg and for canola forage and fodder 3 ppm.

The APVMA PRS reported⁶⁸ an animal transfer study. In an animal transfer study, cattle were dosed for 28 consecutive days at either 6.3, 19 or 63 ppm in the feed. At the 6.3 ppm feed level residues in all tissues and milk were below quantifiable levels (<0.02 mg/kg milk and <0.1 mg/kg tissues). At the 19 ppm feed level residues were below LOQ in all tissues except muscle, which contained residues of 0.15 mg/kg. At the highest feeding level (63 ppm) quantifiable residues were detected in milk and all tissues of animals slaughtered at the end of the dosing period, except fat.

⁶⁶ Evaluation of fully approved or provisionally approved products: Issue No. 72 simazine (2) July 1993: Evaluation on: Simazine (2) Disclosure document, Evaluation of the mammalian and ecotoxicity of simazine, UK PSD

⁶⁷ MEMORANDUM. DATE: 26 May 2005 SUBJECT: SIMAZINE: Residue Chemistry Chapter for the RED, Revised for Errors; PC Code 080807; DP Barcode D316474 FROM: David Soderberg TO: Diane Sherman,

⁶⁸ Public Release Summary on Evaluation of the new active TEPRALOXYDIM in the product Aramo Herbicide Australian Pesticides and Veterinary Medicines Authority May 2003 Canberra Australia

Highest residues were present in kidney (0.39 mg/kg). After 2 days depuration residues in all tissues and milk had fallen below LOQ.

It is anticipated that animal product residues will be below typical method LOQs.

Terbufos

-is a organophosphorous insecticide/nematicide used for the control of wireworms in *sunflower* and is applied to the soil at 3 g ai/100 m row at the time of planting.

A harvest WHP is not required.

There are Australian and Codex but no US MRLs for terbufos in animal commodities. The Australian and Codex MRLs are *0.05 mg/kg for cattle edible offal and cattle meat. The Australian and Codex MRLs for milk have been set at *0.01 mg/kg.

It is anticipated that animal product residues will be below typical method LOQs.

Thiabendazole

-is used as a seed dressing in *sunflowers* with an application rate of 360 g ai/100 kg seed (QDPI Board Approval 70058).

No grazing/cutting restraints are required.

There are Australian, Codex and US MRLs for thiabendazole in cattle tissues. The Australian MRL for animal tissues have been set at 0.2 mg/kg while the milk MRL is 0.05 mg/kg. There is an Australian MRL for apples at 10 mg/kg. The Codex MRL for cattle kidney is 1 mg/kg while the MRL for cattle milk is 0.2 mg/kg. The US MRL for cattle meat and milk are 0.1 mg/kg while the meat byproducts MRL is 0.4 mg/kg.

It is considered unlikely that treated oil seed would give rise to residues in crops fed to animals.

It is anticipated that animal product residues will be below typical method LOQs.

Triallate

-is a thiocarbamate herbicide used for the control of certain grass weeds (wild oats, annual rye grass) prior to crop emergence in *canola*, *linseed* and *safflower*. The maximum application rate is 0.8 kg ai/ha.

A harvest WHP is not required.

There are Australian but no Codex or US MRLs for triallate in animal commodities. The Australian MRLs are *0.1 for edible offal (except kidney), 0.2 mg/kg for kidney, 0.2 mg/kg for fat and *0.1 mg/kg for meat and milk.

The MRL for oilseeds is *0.05 mg/kg.

In a diary cattle feeding study conducted at dose levels equivalent to 3 and 10 ppm in the diet, residues in tissues at slaughter were <0.01 mg/kg for muscle, kidney and liver for both dose groups and were 0.01 and 0.03 mg/kg in fat for the 3 and 10 ppm dose groups respectively. Residues in milk were <0.01 mg/kg.

The US EPA RED suggests residue in pea hay may require a tolerance of 1 ppm. Assuming feeding at 1 ppm in the diet, residues of triallate would be less than typical regulatory method LOQs⁶⁹.

It is anticipated that animal product residues will be below typical method LOQs.

Tribenuron-methyl

-is a sulfonylurea herbicide used for the control of various weeds in *fallow fields* and *pre-crop situations*. The maximum application rate is 22.5 g ai/ha.

A harvest WHP is not required.

It is recommended that weeds are grazed 2-3 days after application.

There are Australian but no Codex or US MRLs for animal commodities. The Australian MRLs have all been set at *0.01 mg/kg.

The Australian MRLs for rape and sunflower seed are *0.01 mg/kg. The PAFC MRL (fresh weight) is *0.05 ppm.

In a lactating goat study with labelled tribenuron methyl at a level of 6.7 ppm there was a total of 0.5% of the administered dose found in the assayed tissues and organs. Based on this low potential for transfer of residues to tissues, it is concluded that feeding forage, straw, hay and stubble will not result in detectable residues in animal commodities.

The Canadian PMRA noted in their evaluation of tribenuron-methyl that *“large animal metabolism studies were not performed for tribenuron methyl, however metsulfuron-methyl (¹⁴C-phenyl labeled) animal metabolism studies can be used as a faithful model; structurally the herbicides are identical except for the absence of a methyl group at the 2-N of the urea”*⁷⁰.

While this approach is not ideal it can serve as a starting point in the risk assessment.

A lactating cow study reported the following disposition of metsulfuron-methyl residues (dosing regime: 0, 5, 20 or 100 ppm in the diet for 4 weeks). Fat and meat tissues were < 0.01 mg/kg (LOQ), except for one cow (100 ppm feeding study) with meat residues of 0.014 to 0.02 mg/kg. Liver and kidney tissues from cows fed 5 ppm were not greater than 0.053 mg/kg. Metsulfuron-methyl residues in milk samples from cows fed 5 ppm were less than 0.011 mg/kg; 20 ppm feeding resulted in residues that reached a plateau at day 7 post-treatment with residues at 0.016-0.033 mg/kg over the 4 week period.

Tribenuron methyl residues (by analogy with metsulfuron-methyl) of up to 5 ppm in total diet may be fed to cattle with residues in meat and dairy products expected to be less than 0.01 mg/kg in milk, meat, and liver, and less than 0.05 mg/kg in kidney.

The log P_{ow} for tribenuron-methyl at pH 7 is -0.44 suggesting little propensity for residues to accumulate in fat. Using empirical relations between log P_{ow} and TF, the predicted maximum TF for offal is 0.02 and for fat and milk 0.01.

It is anticipated that animal product residues will be below typical method LOQs.

⁶⁹ Reregistration Eligibility Decision for Triallate List B Case 2695EPA 738-R-00-021 March 2001. Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

⁷⁰ PMRA Decision Document E95-04 Tribenuron methyl

Trichlorfon

- is an organophosphate insecticide used for the control of various insects in crops. It is registered on *linseed*, *oilseed rape*, *sunflowers* and *safflower* crops for the control of various pests. The application rate is up to 0.6 kg ai/ha.

The harvest WHP is 2 days.

Do not graze or cut for stock food for 2 days after application.

There are no Codex MRLs for trichlorfon in animal tissues. The Australian MRL for cattle fat is 0.1 mg/kg and 0.5 mg/kg for the US tolerance. The Australian MRL for milks is *0.05 mg/kg while no milk MRL has been set in the US. The Australian MRL for oilseeds (except peanuts) is 0.1 mg/kg. Residues decline in soil and foliage with typical half-lives of 10 and 3 days respectively. Following peroral uptake of the trichlorfon (12.5 and 20 ppm in feed), no trichlorfon residues were detected (<0.1 ppm) in any of the examined tissues and organs (brain, heart, kidney, steak, fat) after a four week feeding period⁷¹.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 80 ppm and scale for application rate, forage residues are expected to be $0.6 \times 80 = 48$ ppm at day 0 and 0.24 ppm at day 3).

Residues in forage and fodder/straw/hay/stubble are expected to be less than 50 ppm. No detectable residues are expected in tissues of animals fed forage and fodder/straw/hay/stubble.

It is anticipated that animal product residues will be below typical method LOQs.

Trifluralin

-is a selective dinitroaniline herbicide used for the control of certain grasses and annual broad-leaved weeds in *linseed*, *rape seed*, *safflower* and *sunflower*. Application is at a maximum rate of 0.816 kg ai/ha.

No grazing WHP is required.

There are no Codex or US MRLs for trifluralin in animal tissues although there are registrations in the US including on vegetables (except carrot) MRL 0.05 mg/kg and carrot (MRL 1 mg/kg). There are no Codex or US MRLs for trifluralin in animal tissues. The Australian MRL for meat (mammalian) and milk are *0.05 mg/kg. The MRL for oilseeds is *0.05 mg/kg.

The US EPA evaluation of trifluralin states that based on a goat metabolism study where animals were fed at exaggerated rates there is no expectation of finite residues of trifluralin in animal tissues⁷². Therefore no residues are expected to result from the feeding of straw/hay/stubble to animals. Residues decline in soil and foliage with typical half-lives of 60 and 3 days respectively.

It is anticipated that animal product residues will be below typical method LOQs.

⁷¹ 1971 JMPR. Evaluations of some pesticide residues in food. AGP/1971/M/9/1; WHO Pesticide Residues Series No. 1, 1972

⁷² Reregistration Eligibility Decision, Trifluralin, List A Case 0179, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division EPA 738-R-95-040, April 1996