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Pesticide risk profile for the feeding of cereal forage and stubble/hay to cattle and sheep

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Chemical Residues
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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
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
mg	milligram = 0.001 grams
MRL	maximum residue limit
PAFC	primary animal feed commodity
PHI	pre-harvest interval
P_{ow}	octanol water partition coefficient
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.e.* should be less than the LOQ.

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Potential for violative pesticide residues in cattle and sheep fed cereal forage, stubble 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 cereal forage and fodder/straw/hay fed to cattle and sheep.

Assessment of currently registered chemicals that may be used on cereal 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 cereal fodder and forage included in animal feed as 100%. Estimates of residues in fodder and forage were obtained from scaling of literature studies, MRLs or based on conservative assumptions. The dietary burden is then residue in crop × maximum proportion in 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. As cereal straw and hay contain approximately 90% dry matter it was not considered necessary to correct for moisture content. Forage is approximately 25% dry matter and a correction is applied in this case.

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

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

- The cereals are harvested according to good agricultural practice (label) and that the fodder/silage/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 label[4]
- 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 2010[5]. 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 cereal forage and fodder/straw/hay 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 cereals.

Most of the compounds registered for use on cereals also have registrations in other crops that are major animal feed commodities.

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

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[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.

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	Fat	12.6	0.05	No	No
Carbaryl	Offal	0.7/1.2	0.2/1	Yes	No
Chlormequat	Kidney/liver	0.23	0.01	Yes	Yes
Clopyralid	Kidney	0.135	0.01	Yes	Yes
Cypermethrin(s)	Fat	0.2-0.7	0.05	Yes	Yes
Deltamethrin	Fat	0.15	0.05	Yes	Yes
Dicamba	Kidney	0.22	0.01	No	No
Diclofop	Kidney	1.1	0.01	Yes	No
Fluquinconazole	Fat	0.3	0.01	Yes	Yes
Imidacloprid	Liver	0.1	0.05	Yes	No
Linuron	Tissues	1.4	0.01	Yes	No
Metolachlor	Kidney	0.035	0.01	Yes	No
Propachlor	Kidney	0.15	0.01	No	No
pyrasulfotole	Kidney	0.2	0.01	Yes	No
Terbutryn	Offal	1.5	0.01	No	No

[1]residue in tissue estimated using assumptions outlined above
[2]target 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: 2,2-DPA (dalapon), 2,4-DB, bromoxynil, diflufenican, diuron, fluroxypyr, flutriafol, halosulfuron-methyl, MCPA, MCPB, methabenzthiazuron, propanil, triallate and triasulfuron-methyl.

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-dichlorpropionic 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 rate for maize is 3.7 kg ai/ha (spray between rows).
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 maize at harvest (MRL for cereal grains *0.1 mg/kg). 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].

Note: the US EPA revoked tolerance for corn fodder and forage and sorghum forage was 5 ppm. Utilising the US EPA revoked tolerances a conservative TF of 0.01 is estimated for meat and offal and 0.006 for milk. Assuming residues occur at the US revoked tolerance for cereal forages, anticipated maximum residues in tissues are 5 × 0.01 = 0.05 mg/kg and 5 × 0.006 = 0.03 mg/kg in milk.

Although insufficient data were located to provide confident opinion on livestock residue risks, livestock residues are not anticipated to exceed international and/or domestic market standards.

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 barley, rye, wheat, oats and triticale is 0.85 kg ai/ha when made up to the boot stage of crop growth. A rate of 1.05 kg ai/ha is permitted for use on stubble of winter cereals and maize prior to direct drilling and sowing and to winter cereals, maize and sorghum when applied as a harvest aid or salvage spray with application at the dough stage.
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. The Australian MRL for cereal grains is 0.2 mg/kg.

[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

The 1998 JMPR reported maximum residues in maize forage of 5.2 ppm at 7 days after application at 0.58 kg ai/ha. In an animal transfer study cows were dosed at the equivalent of 1446, 2890, 5779 and 8585 ppm in the diet for 28 days[8]. 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. Assuming forage has residues at the same level as the maize trial (5.2 ppm scaled for rate = 10 ppm and a typical dry matter content 40%) and using TFs from the 1446 ppm feeding study, anticipated residues in kidney and fat from feeding at 100% of the diet are 10×0.0045÷0.4 = 0.11 mg/kg and 10×0.00035÷0.4 = 0.0088 mg/kg respectively. The LOQ for tissues was reported to be 0.05 mg/kg. Residues in tissues of animals dosed at the highest feed level declined with a half-life of <1.5 days.
The TF for milk is 0.00006 (2890 ppm feed level) giving an anticipated residue in milk of 10×0.00006÷0.4 = 0.0015 mg/kg.

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

2,4-DB
- 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. Application to barley, wheat and oats undersown with lucerne, medic or subterranean clover is at 1.6 kg ai/ha
No harvest WHP is required.
DO NOT graze or cut for stock food for 7 days after application

There are Australian but no Codex or USA MRLs for 2,4-DB in animal tissues. The Australian MRLs are 0.2 mg/kg for meat (mammalian) and edible offal (mammalian) and *0.05 mg/kg for milks. The Australian MRL for cereal grains is *0.02 mg/kg.

The US residue definition for plant commodities is the sum of 2,4-DB and its metabolite 2,4-D.

The US EPA reported a ruminant feeding study that indicated residues of 2,4-DB may transfer to beef liver as a result of the current registered uses of 2,4-DB on livestock feedstuffs[9]. Residues of 2,4-DB ≤0.01 mg/kg for all milk samples from the 1×, 3×, and 10× (the maximum theoretical dietary burden of 1.65 ppm) feeding rate. For all tissue matrices, residues of 2,4-DB were <0.05 mg/kg (LOQ) in samples from the 1× and 3× dose groups. One sample each of kidney and liver from the 10× dose group bore residues of 2,4-DB at 0.05 and 0.11 mg/kg, respectively.

Information is required on the likely residues in forage and fodder.
Insufficient data were located to provide confident opinion on livestock residue risks.

alpha-Cypermethrin
- is a synthetic pyrethroid insecticide used for the control of various insects in crops. The application rates for cereals are reported in the table below together with the harvest WHPs and any label feeding restraints.

[8] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999
[9] Memorandum dated 19 July 2004: Subject: 2,4-DB [4-(2,4-dichlorophenoxy) butyric acid] and 2,4-DB dimethylamine salt (PC Codes 030801, 030819): REVISED Product Chemistry and Residue Chemistry Summary Documents for the Reregistration Eligibility Decision Document (RED). Reregistration Case 0196. DP Barcode. D291212. FROM: Danette Drew, Chemist Reregistration Branch 3 Health Effects Division (7509C) TO: Mika Hunter Special Review Branch Special Review and Reregistration Division (7508C)

Crop	Rate (g ai/ha)	Harvest WHP	Feeding restraints
Winter cereals	24	7 days	14 days (stubble)
Maize	40	7 days	-
Rice	20	7 days	-
Sorghum	40	7 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 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. 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 1 mg/kg for cereal grains (except wheat) and 0.2 mg/kg for wheat. The Australian PAFC MRL for cypermethrin is 5 ppm.

From data presented in the 1981 JMPR evaluation it is apparent that residues in field corn (maize) trash may be as high at 2 or 3 ppm. Residues in wheat (green plant and straw) when scaled for the Australian application rate were up to 0.8 ppm in the green plant and 1.5 ppm in straw. Residues in sorghum (whole plants) were 2.1 ppm at 8 days after application at 30 g ai/ha. The TF for fat is 0.1[10,11]. If residues in wheat, maize and sorghum forage/fodder are present at the same level as reported by the 1981 JMPR, anticipated residues in fat are 2-3×0.1 = 0.2-0.3 mg/kg if fed at 100% of the diet. Anticipated residues in whole milk (TF 0.003-0.1) are also 0.2-0.3 mg/kg.

Noting the conservative assumptions used, livestock residues are not anticipated to exceed international and/or domestic market standards

Aminopyralid
-is a herbicide used to control weeds in a variety of situations. The application rate for *barley, oats, wheat and triticale* is up to 7.5 g ai/ha.
No harvest WHP is required.
DO NOT graze or cut crops for stock food for 7 days after application.
ESI 3 days. EGI 42 days. EAFI 42 days.

There are Australian, Codex and US MRLs for aminopyralid in animal commodities. The Australian MRLs are 0.3 mg/kg for kidney, 0.03 mg/kg for other offal, *0.0.1 mg/kg for meat and *0.01 mg/kg for milk. The Codex MRLs are 1 mg/kg for kidney, 0.05 mg/kg for other offal, 0.1 mg/kg for meat and 0.02 mg/kg for milk. The US tolerances are 0.3 mg/kg for kidney, 0.02 mg/kg for fat, meat and other offal and 0.03 mg/kg for milk. The Australian MRL for cereal grains is 0.1 mg/kg, an MRL of 3 mg/kg for forage of cereal grains and an MRL of 0.2 mg/kg for cereal straw.

The APVMA reported: When applied to cereals at 7.5-10 g ai/ha (1-1.3 ×) in Australia, aminopyralid residues in forage at 6-7 days after treatment were in ranked order: 0.16, 0.34, 0.40, 0.45, 0.48, 0.54, 0.71, 0.77, 0.79 and 1.02 mg/kg (dry weight). Similarly, samples treated at 15 g ai/ha (2×), forage residues at 7 days after treatment in ranked order were: 0.45, 0.5, 0.59, 0.66, 0.99, 1.04, 1.09, 1.27, 1.33,

[10] 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.
[11] 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

and 1.43 mg/kg (dry weight). When corrected to the proposed 1× rate, the equivalent residue levels were: 0.23, 0.25, 0.30, 0.33, 0.50, 0.52, 0.55, 0.64, 0.67 and 0.72 mg/kg.
When forage data from Australian and USA/Canada trials are considered as one dataset (n=20), the highest residue (HR) found was 1.08 mg/kg from a USA trial; the Australian highest residue was 1.02 mg/kg. When applied to cereals at 7.5-10 g ai/ha (1-1.3×) in Australia, residues of aminopyralid in straw collected at harvest, 80-117 days after treatment, were: 0.02, 0.02, 0.02, 0.03, 0.03, 0.03, 0.04, 0.04, 0.04, 0.04, 0.04, 0.04, 0.05, 0.05, 0.06, 0.06, 0.07, 0.07, 0.07, 0.08, 0.08, 0.09, 0.1, 0.11, 0.12, and 0.13 mg/kg (dry weight).

The 2006 JMPR reported: Groups of lactating dairy cows received the equivalent of 0, 32.8, 64.5, 181.5 and 644.7 ppm in the feed for 28 days. Following the dosing period, there was an additional depuration phase of 14 days, with slaughter intervals of 3, 7 and 14 days after withdrawal from dosing. Residues in whole milk following dosing at 32.8 ppm in the feed were < 0.01 mg/kg over the 28 days period. Residues reached plateau within 2 to 3 days of dosing. Residues in milk ranged <0.01−0.024 mg/kg and 0.011−0.028 mg/kg following dosing at 64.5 and 181.5 ppm, respectively. Aminopyralid residues ranged 0.023−0.127 mg/kg following dosing at 644.7 ppm. Residues had declined to < 0.01 mg/kg within 2 days of withdrawal from dosing at the highest level of 644.7 ppm. The highest aminopyralid residues in tissues following dosing at 32.8 ppm level were: muscle < 0.01 mg/kg, fat 0.01 mg/kg, liver < 0.01 mg/kg, and kidney 0.1 mg/kg. Following dosing at 64.5 ppm, aminopyralid residues were < 0.01 mg/kg in muscle, 0.01 mg/kg in fat and liver and 0.2 mg/kg in kidney. The highest aminopyralid residues in tissues following dosing at 181.5 ppm level were 0.05 mg/kg in muscle and liver, 0.09 mg/kg in fat, and 1.5 mg/kg in kidney. The highest aminopyralid residues in tissues following dosing at 644.7 ppm level were 0.03 mg/kg in muscle, 0.04 mg/kg in fat, 0.06 mg/kg in liver, and 2.5 mg/kg in kidney.

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

Amitrole
-is a herbicide used to control weeds in a variety of situations. The application rate for *wheat and barley* is up to 1.4 kg ai/ha pre-plant when used as part of the preparation for sowing.
No harvest WHP is required.

There are Australian but no Codex or US MRLs for amitrole in animal commodities. The Australian MRLs, including milk, have all been set at *0.01 mg/kg. The Australian MRL for cereal grains is *0.01 mg/kg. As no residues are expected at harvest, no residues are expected in animals feeding on stubble.

The JMPR have stated that[12] "*There do not appear to be any grounds for assuming that livestock grazing on plant materials growing on land that had been treated with amitrole for the control of weeds would absorb or retain significant amounts of amitrole or its metabolites*".

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

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 maize and sorghum with an application rate of up to 3 kg ai/ha.
No harvest or grazing WHP is required.

[12] 1974 JMPR. Evaluations of some pesticide residues in food. FAO/AGP/1974/M/11; WHO Pesticide Residues Series No. 4, 1975

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*0.1 mg/kg for edible offal mammalian and T*0.01 mg/kg for milk. The Australian MRLs for sorghum and maize are *0.1 mg/kg. There is an Australian PAFC MRL of T40 ppm. Residues in soil and foliage decline with typical half-lives of 60 and 5 days respectively.

The APVMA draft final ECRP review reported residues of 2500 to 6100 ppm in sorghum forage (2 trials) on the day of application at the Australian maximum rate (3 kg ai/ha) declining to be 21-351 ppm at 7 days, 0.67-60 ppm at 14 days and 0.53-9.3 ppm at 28 days after application[13]. Residues in maize forage (single trial) were 1600 ppm at day 0 declining to be 20 ppm at 14 days and 0.1 ppm at 28 days after application.
Feeding at 37.5 ppm in the diet for 28 days gave residues that were <0.01 mg/kg in milk and tissues at slaughter[14]. On this basis (also see below) it is considered unlikely that forage crops would be grazed within 14-28 days of spraying, therefore detectable residues are not expected to result from the feeding of sorghum and maize forage/fodder to animals.

NOTE: The APVMA draft final ECRP recommendations recommend a 28 day grazing/cutting WHP for forage/fodder crops.

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

Azimsulfuron
-is a herbicide used for control of aquatic broadleaf weeds and suppression of Barnyard grass in *rice*. Application is at up to 20 g ai/ha.
A harvest WHP is not required.
DO NOT graze or use for stockfeed for 2 weeks after application.

There are Australian but no Codex or US MRLs for animal commodities. The Australian MRLs for animal tissues and milk have been set at *0.02 mg/kg. An Australian MRL has been set for rice grain at *0.02 mg/kg and for rice straw and fodder (dry) at *0.05 ppm.

The APVMA reported that "No animal feeding studies were included in the product submission. On the basis of non-detectable residues resulting in animal feed commodities (ie grain, forage, straw and fodder) following the proposed use on rice, it is unlikely that residues will be found in animal commodities. Metabolism studies conducted on rats show that azimsulfuron is rapidly absorbed and eliminated from animals. Following an oral dose of 1000 mg/kg of radiolabelled azimsulfuron, there was less than 1% of radioactivity remaining in the body after three days. The majority of the radioactivity was eliminated in the urine and faeces".

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

Azoxystrobin
-is a strobulurin fungicide used for control of powdery mildew and rust in *barley* and *wheat* crops. Application is at up to 160 g ai/ha.

[13] The reconsideration of approvals of the active constituent atrazine, registrations of products containing atrazine, and their associated labels. Second Draft Final Review Report Including additional assessments October 2004 Australian Pesticides &Veterinary Medicines Authority Canberra Australia
[14] Atrazine Reregistration Eligibility Decision Residue Chemistry Considerations PC Code 080803; Case 0062 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

The harvest WHP is 42 days.
DO NOT graze or cut for stock food for 21 days after application.

There are Australian and US but no Codex MRLs for animal commodities. The Australian MRLs for animal tissues have been set at *0.01 mg/kg while the milk MRL is 0.005 mg/kg. The US MRLs for animal commodities are set at 0.03, 0.01 and 0.07 mg/kg for cattle fat, meat and meat by-products respectively and 0.006 mg/kg for milk. An Australian MRL has been set for barley and wheat at *0.02 mg/kg, for barley and wheat forage at 10 ppm and for barley and wheat straw and fodder (dry) at 3 ppm.

Residues in tissues of lactating cows were ≤0.01 mg/kg after feeding at levels up to 25 ppm in the diet for 28 days[15]. It is not considered likely that residues from feeding barley or wheat forage or fodder will exceed 0.01 mg/kg in tissues.

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

Bensulfuron-methyl
-is a selective herbicide used to control the weeds arrowhead, dirty dora and star fruit in rice. Application is at up to 51 g ai/ha with application early in the crop growth.
A harvest WHP is not required.

There are no Australian, Codex or US MRLs for bensulfuron-methyl in animal commodities. There are Australian MRLs of *0.02 mg/kg for rice and *0.05 mg/kg for rice straw and fodder, dry.

The US EPA noted that[16] "*Rice straw is fed to animals, thus exposure of humans to residues of rice straw might result if such residues are transferred to meat, milk, poultry, or eggs. However, based on the results of livestock metabolism studies in which no quantifiable residues were reported when feeding levels were approximately 500× the potential dietary burden from feeding bensulfuron-methyl treated rice straw, the EPA has concluded that there is no reasonable expectation that measurable residues of bensulfuron-methyl will occur in meat or milk."* The US MRL for rice is 0.02 mg/kg and for rice straw 0.3 mg/kg. This gives an estimated animal dietary burden of 0.038 ppm for the US (10% rice straw + 40% rice grain). It is estimated that the metabolism study was conducted at a feeding level of 19-20 ppm.

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

Bentazone
-is a benzathiadazole herbicide used for the control of dirty dora in rice. It may be applied to rice crops at 1 kg ai/ha.
A harvest WHP is not required.
Do not graze or cut for stock food for 7 weeks after application.

The Australian MRLs for tissues and milk are *0.05 mg/kg. The Codex MRL for milk is *0.05 mg/kg. The EU MRL for milk and cream is *0.02 mg/kg. The Australian MRL for rice is 0.1 mg/kg. The MRLs for rice forage, fodder and straw are *0.03 mg/kg.

[15] APVMA Animal Residue Data Sheet – Azoxystrobin (October 2002)
http://www.apvma.gov.au/residues/stockfeed.shtml
[16] [Federal Register: May 16, 1997 (Volume 62, Number 95)] [Notices] [Page 27033-27040] ENVIRONMENTAL PROTECTION AGENCY [PF-734; FRL-5717-7] Notice of Filing of Pesticide Petitions

Residues of bentazone in pea hay derived from crops treated at 1.12 kg ai/ha were 0.48-2.0 ppm at 30-34 days after application (1.26-5.4 ppm for the sum of bentazone and 6-OH- and 4-OH-bentazone). Residues of bentazone in soya bean forage, fodder and hay were <0.05-0.15 ppm (PHI 28-34 days), <0.05-0.2 (PHI 78-119 days) and <0.05-0.62 ppm (PHI 36-53 days) respectively (total residues were 0.18-5.3, <0.15-0.79 and <2.2-5.9 ppm for forage, fodder and hay).

Animal metabolism studies (5 to 8 day goat study, up to 1420 ppm) and a goat feeding study (35 days) at 75 and 150 ppm suggest that no detectable residues are expected with exposure of 10 to 15 ppm[17]. (TF for kidney was 0.04 and fat 0.002)

Note: the US EPA indicate that a lactating cow animal transfer study exists with feeding levels of 1, 5 and 20 ppm with ^{14}C bentazone and its 6 and 8-hydroxy metabolites[18].

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

Benzofenap

-is a selective pyrazole herbicide used to control weeds in rice. Application is at up to 0.6 kg ai/ha
Do not graze for 7 weeks after application.

There are no Australian, Codex or US MRLs for benzofenap in animal commodities. There are Australian MRLs of *0.01 mg/kg for rice and *0.02 mg/kg for rice straw and fodder, dry and for rice forage (green).

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

Beta-cyfluthrin

- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on cereals for the control of various insect pests. The application rate is up to 25 g ai/ha. Cyfluthrin residues decline with typical half-lives of 60 and 3-5 days for soil and foliage respectively.
The harvest WHP is 14 days.
Do not graze or cut for stock feed for 7 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 milk fat (1 mg/kg in whole milk) for Australia, Codex and the USA respectively. There are Australian MRLs for cereal grains at 2 mg/kg and forage, straw and fodder (dry) of cereal grains at 5 ppm.

Data on residues in forage and straw were reported by the 1991 JMPR[19]. Residues in barley straw from crops treated at 20 g ai/ha were up to 2.7 ppm at 7 or more days after application. Residues in wheat and barley forage at 7 days after application at 20 g ai/ha were up to 1.1 ppm (*ca.* 3.7 ppm if expressed on a dry weight basis) and residues in sorghum forage were 0.24 ppm (0.8 ppm if expressed on a dry weight basis). Residues in maize forage on the day of application at 40 g ai/ha were 0.89 ppm (2.2 ppm if expressed on a dry weight basis).

[17] 1995 JMPR - Pesticide Residues in Food - 1995 Evaluations, Part I Residues FAO Plant Production and Protection Paper 137. FAO and WHO 1996
[18] Reregistration Eligibility Decision Bentazon List A Case 0182EPA 738-R-94-029 September 1994 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[19] 1991 JMPR. Pesticide Residues in Food - 1991 Evaluations, Part I Residues FAO Plant Production and Protection Paper 113/1. FAO and WHO 1991

Residues in the animal diet from cereal stubbles would not be expected to lead to exposure of greater than 5 ppm in the diet. TF fat = 0.05[20]. Estimated residues in fat are 5×0.05 = 0.25 mg/kg. 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".

The TF for milk is 0.005 giving anticipated residues of 5×0.005 = 0.025 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 barley and wheat for control of mites. 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.
No harvest WHP is required.
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 corresponding 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 cereal grains is T2 mg/kg and for forage (green) of cereal grains 0.2 ppm and straw and fodder (dry) of cereal grains *0.01 ppm.

Assuming residues in cereal forage are present at the MRL, the forage is fed at 100% of the diet and a maximum TF of 0.3[21] would give anticipated residues in fat of 0.2×0.3 = 0.06 mg/kg, below the relevant international MRLs.
The TF for milk is 0.02 giving anticipated residues in milk of 0.2×0.02 = 0.004 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 cereals (wheat, barley, oats and triticale). The application rate is up to 0.4 kg ai/ha with applications made from the three leaf to fully tillered stages of crop growth.
No harvest WHP is required.
Do not graze or cut for stock food for 14 days after application.

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 animal tissues are 0.5 mg/kg for meat, 3.5 mg/kg for mbyp 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 cereal grains is *0.2 mg/kg.

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) [22].

[20] 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
[21] 1992 JMPR - Pesticide Residues in Food – 1992 evaluations. Part II. Toxicology. WHO, WHO/PCS/93.34, Geneva, 1993

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.

	Residue (mg/kg expressed as bromoxynil phenol)	
Sample	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 cereal forage or fodder. The US EPA report[23] 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 9 ppm × 1.4 = 12.6 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

Butafenacil
-is a pyrimidindione selective knock-down herbicide used pre-planting in cereal crops. Application is made pre-planting at rates up to 10 g ai/ha for wheat when butafenacil is co-formulated with triasulfuron and 16 g ai/ha for cereal grains when co-formulated with glyphosate.
No harvest WHP is required.
Do not graze or cut for stock food for 7 weeks (wheat with triasulfuron) or else 6 weeks after application.

There are Australian and US but no Codex MRLs for butafenacil in animal commodities. The Australian MRLs are *0.02 mg/kg for edible offal (mammalian) and *0.01 mg/kg for meat (mammalian) and milk. The Australian MRL for cereal grains (except rice) is *0.02 mg/kg. The US residue definition is the sum of butafenacil and its metabolite CGA-293731 (1-carboxy-1-methylethyl 2- chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2H)- pyrimidinyl] benzoate. The US MRLs are 0.05 mg/kg for cattle kidney and 0.5 mg/kg for cattle liver. The Australian MRLs for forage of cereal grains (dry) [except rice] are *0.01 mg/kg and straw and fodder (dry) of cereal grains [except rice] *0.02 mg/kg.

In a metabolism study, lactating goats were dosed for four consecutive days at a rate equivalent to feeding at 100 ppm butafenacil in the diet[24]. The highest ^{14}C tissue residues were found in the liver and kidney (4.4 and 0.4 mg equiv./kg, respectively). Characterization of the residual radioactivity

[22] 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
[23] 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.
[24] Public Release Summary on Evaluation of the new active BUTAFENACIL in the products LOGRAN B-POWER HERBICIDE & TOUCHDOWN B-POWER HERBICIDE National Registration Authority for Agricultural and Veterinary Chemicals February 2002 Canberra Australia

found in the tissues and milk showed extensive metabolism of butafenacil. The principal metabolite was free acid metabolite accounting for approximately 85 % in the liver and kidney, along with smaller amounts of butafenacil, benzoic acid metabolite, and various conjugates in the other tissues.

If forage and fodder containing butafenacil at the MRL (0.01-0.02 mg/kg) was consumed as the entire cattle diet, then residues in all tissues and milk would be <0.001 mg equiv./kg. There is no reasonable expectation of residues in animal commodities from feeding of stubble/straw/hay derived from treated cereal crops to animals.

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 cereal crops for control of various pests. The application rate is up to 1.1 kg ai/ha.
Do not graze or cut for stock food for 1 day after application.

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-napthol expressed as carbaryl for plant commodities, and the sum of carbaryl, 1-napthol, 5,6-dihydrodihydroxycarbaryl and 5,6-dihydrodihydroxynapthol expressed as carbaryl for animal tissues. The US tolerance for cattle meat is 1, fat 0.5 and that for milk 1 mg/kg.

The Australian MRLs are T5 mg/kg for cereal grains, T100 ppm for forage of cereal grains and T100 ppm for straw and fodder (dry) of cereal grains.

The 2002 JMPR reported residues in maize forage at 14 days after applications at 2.2 kg ai/ha of 1.2-24 ppm and in fodder at 48 days after application of 0.06-7.7 ppm. Residues in barley forage after applications at 1.7 kg ai/ha were 0.9-52 ppm (3-173 ppm on a dry weight basis) at 3 days after the last application while maximum residues in straw were 0.5-113 pm at 14 or more days after the last application. Residues in rice straw at 14 days after 2 applications at 2.2 kg ai/ha were 7.5-102 ppm. Residues in sorghum forage 14 days after the last of 2 applications at 2.2 kg ai/ha were 0.08-14 ppm (0.2-40 ppm on a dry weight basis) while residues in fodder were 0.04-22 ppm. Residues in wheat forage were 4.2-31 ppm (17-124 ppm) at 3 days after 2 applications at 1.7 kg ai/ha while maximum residues in straw were 3.6-54 ppm at 7-21 days after the last application.
The TF for kidney is 0.007 for the Australian/Codex residue definition and 0.012 for the US residue definition[25] giving rise to anticipated maximum residues in kidney from feeding cereal forage at 100% of the diet of 0.007×100 = 0.7 mg/kg and 0.012×100 = 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 cereal forages at 100%

[25] 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

of the diet of 0.0002×100 = 0.02 mg/kg and 0.002×100 = 0.2 mg/kg respectively for the Australian/Codex and USA residue definitions.

It is considered unlikely that a failed crop (forage) would have been sprayed with carbaryl within 2-4 weeks of feeding to animals. At 2-4 weeks after spraying residues in forage would have declined to levels such that residues in grazing animals would be below international tolerances.

Livestock residues may exceed international and/or domestic market standards

Carbofuran
- is a systemic insecticide used for the control of various insects leaf hoppers and stem borer in upland rice. The application rate is up to 1 kg ai/ha with applications at mid-tillering to panicle initiation/emergence. Carbofuran residues decline with typical half-lives of 50 and 2 days for soil and foliage respectively.
There is a harvest WHP of 6 weeks.

There are Australian, Codex and USA (expire on 31/12/09) MRLs for carbofuran in animal tissues. The relevant MRLs for meat are *0.05 mg/kg. Milk MRLs are *0.05, *0.05 and 0.1 mg/kg for Australia, Codex and the USA respectively. The Australian primary animal feed commodity MRL is 2 ppm. The Australian use-pattern is such residues are expected in rice stubble/hay at harvest. This is reflected in the Australian MRL for rice of 0.2 mg/kg.

The US MRL for rice is also 0.2 mg/kg. There is also a US MRL for rice straw at 1 ppm and for various other forage and fodder crops, e.g. alfalfa hay 40 ppm, corn forage and fodder 25 ppm, sorghum forage and fodder 3 ppm and soybean forage and fodder 35 ppm.

In a feeding study with cows carbosulfan (not carbofuran) was fed to lactating dairy cattle for 28 consecutive days at rates equivalent to 1, 3, 10 and 50 ppm in the diet[26]. Carbofuran was not found in any milk, skim milk, cream or tissue samples at any of the 4 feeding concentrations, where the limit of detection was estimated as 0.005 mg/kg for milk and 0.01 mg/kg for tissues and cream. The metabolite 3-keto-carbofuran was detected only in one liver sample at 0.023 mg/kg from the 50 ppm group, and 3-hydroxy-carbofuran was detected in most milk samples from the 50 ppm group, at 0.007-0.030 mg/kg, and in one from the 10 ppm group (day 4, 0.007 mg/kg). Total carbamate residues reached a plateau at about 0.03 mg/kg from days 1 to 21. At the 50 ppm feeding level 3-hydroxy-carbofuran was detected in the kidneys (0.090, 0.13 mg/kg), liver (0.047, 0.060 mg/kg) and muscle (0.020, 0.030 mg/kg), but not in fat. In the 10 ppm group the 7-phenol (0.057 mg/kg) and 3-hydroxy-7-phenol (0.012 mg/kg) were found in the kidneys.

Noting the feeding study, Australian and US MRLs for animal commodities and the US MRLs for animal feeds it is apparent that carbofuran can be fed at levels of at least 45 ppm in the diet and still meet the relevant international MRLs. It is also apparent that residues in rice animal feed commodities are expected to be much less than 45 ppm.

JMPR 1976[27]: Feed containing equal proportions of carbofuran phenol, 3-keto carbofuran phenol and 3-OH-carbofuran phenol at a total of 200 ppm was fed to 4 cows for 28 days. In milk, residues of carbofuran phenol ranged 0.03 to 0.07 mg/kg and of 3-ketocarbofuran phenol ranged 0.4 to 0.8 mg/kg between 2 and 28 days of the study. 3-OH-carbofuran phenol was <0.05 mg/kg during the

[26] 1999 JMPR - Pesticide Residues in Food - 1999 Evaluations, Part I Residues FAO Plant Production and Protection Paper 157. FAO and WHO 2000
[27] 1976 Evaluations of some pesticide residues in food. AGP:1976/M/14, 1977

study. Two cows were slaughtered at the end of the 28 day period; residues of each of the metabolites were <0.1 to 0.4 mg/kg in kidney, residues in muscle, liver and fat were <0.05 mg/kg.

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

Carboxin
-is a fungicide used on wheat, triticale, barley and oats as a seed treatment for the control of fungal smut and bunts. Application is at a maximum rate of 100 g ai/100 kg seed for wheat and barley and 50 g ai/100 kg for oats.
No harvest WHP required.
Do not graze plants grown from treated seed, or cut for stock food, within 4 weeks of sowing. (7 weeks for VitaFlo C Seed Treatment).

There are US but no Australian or Codex MRLs for carboxin in animal tissues. The US residue definition is the sum of carboxin and its metabolite 5,6-dihydro-3-carboxanilide-2-methyl-1,4-oxathiin-4-oxide (calculated as carboxin). The US MRLs for cattle meat and fat is 0.05 mg/kg and milk 0.05, meat byproducts is 0.1 mg/kg. The US MRL for various cereal grains is 0.2 mg/kg. The US also has MRLs of 0.5 mg/kg for wheat and oat forage and 0.2 mg/kg for the straw and of various cereals. The Australian MRL for cereal grains is 0.1 mg/kg.

Carboxin sulfoxide (oxycarboxin) is the main metabolite of carboxin.

In a study where lactating cows were administered [^{14}C-phenyl]carboxin in the diet at feeding levels up to 5.0 ppm for ten days[28], total radioactive residues (expressed as carboxin equivalents) were 0.15 mg equiv./kg for liver (TF 0.03) and 0.039 mg equiv./kg for muscle. Maximum TRR in milk was 0.008 mg equiv./kg.

Carboxin residues may be up to 13.3 ppm in/on barley "whole plants" harvested 2-3 weeks following seed treatment at 187.5-500 g ai/100 kg).
The combined carboxin residues were <0.2-0.5 ppm in/on oat forage (n=12 samples) harvested 6-11 weeks (42-77 days) following seed treatment with the WP/D formulation at 250 and 500 g ai/100 kg.
The combined residues were <0.2-0.7 ppm in/on wheat forage (n=18 samples) harvested 6-12 weeks (42-84 days) following seed treatment with the RTU/FlC formulation at 75-250 g ai/100 kg.
The combined residues were <0.2- 0.5 ppm in/on wheat forage (n=14 samples) harvested 4-11 weeks (28-77 days) following seed treatment with the WP/D formulation at 250 g ai/100 kg. In addition, the registrant reported that carboxin residues may be up to 1.8 ppm in/on wheat forage (n=10 samples) harvested 4 weeks (28 days) following seed treatment with the RTU/FlC formulation at 75-250 g ai/100 kg seed and up to 0.6 ppm in/on wheat forage (n=14 samples) harvested 4-11 weeks (28-77 days) following seed treatment with the WP/D formulation at 500 g ai/100 kg seed.

Assuming residues in forage grown from seed treated at 100 g ai/100 kg do not exceed 0.7 ppm, total residues in grazing animals would be 0.7×0.03 = 0.021 mg/kg for liver.

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

[28] CARBOXIN (Case No. 0012; PC CODE 090201) RED - Reregistration Eligibility Decision, Product Chemistry Considerations, August 2, 2003, Contract No. 68-W-99-053, Submitted to: U.S. Environmental Protection Agency, Arlington, VA, Submitted by: Dynamac Corporation, 20440 Century Boulevard, Suite 100, Germantown, MD 20874

Carfentrazone-ethyl

-is a selective aryl triazolinone herbicide used for the control of certain broad-leafed weeds in winter cereals (wheat, barley, oats, triticale). The maximum application rate is 20 g ai/ha.
No harvest WHP is required.
Do not allow stock to graze treated areas for 14 days after application.

There are Australian and US but no Codex MRLs for carfentrazone ethyl in animal commodities. The Australian residue definition is parent compound while the US residue definition is carfentrazone-ethyl and its metabolite carfentrazone-chloropropionic acid (alpha, 2-dichloro-5-[-4-difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-*1*H-1,2,4-triazol-1-yl]-4-fluorobenzenepropanoicacid). The Australian animal commodity MRLs have all been set at *0.05 mg/kg and milk at *0.025 mg/kg. The US MRLs are 0.1 for meat and meat by-products and 0.05 mg/kg for milk. The MRL for cereal grains and cereal grain forage and fodder is *0.05 mg/kg.

In an animal transfer study, lactating cows were fed at levels equivalent to 1, 3 and 10 ppm in the diet for 28 consecutive days[29]. No detectable residues (<0.005 ppm) of carfentrazone-ethyl, carfentrazone or F8426-propionic acid were found in any of the milk samples taken, except for low concentrations of carfentrazone (0.005 – 0.008 ppm) in three isolated samples from the 10 ppm dose group. No detectable residues (<0.01 ppm) of carfentrazone-ethyl, carfentrazone or F8426-propionic acid were found in any of the tissue or cream samples with the exception of kidney samples where trace amounts of carfentrazone (0.012 – 0.013 ppm) were found in samples from the 10 ppm dose group. There were no detectable residues of carfentrazone in kidney from cows fed clean feed for 7 days after dosing for 28 days, indicating that this residue was readily cleared from the kidney and excreted from the animal over a relatively short period of time.

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

Chlormequat chloride

-is a plant growth regulator applied to wheat at the 5-7 leaf stage to produce shorter leaf internodes. The application rate is up to 308 g ai/ha for dry-land wheat and 800 g ai/ha for irrigated wheat.
No WHP is required when used as directed.

There are Australian and Codex but no US MRLs for animal tissues. The Australian MRLs are 0.5 mg/kg for edible offal and milks and 0.2 mg/kg for meat. The Codex MRLs are 0.5 mg/kg for kidney of cattle, goats, pigs and sheep and milk, 0.1 mg/kg for liver of cattle, goats, pigs and sheep and 0.2 mg/kg for meat of cattle pigs and sheep. The Australian MRL for wheat is 5 mg/kg. There are animal feed MRLs for barley forage (green) T25 mg/kg, barley straw and fodder (dry) T15 mg/kg, wheat forage (green) 25 mg/kg and wheat straw and fodder, dry 15 mg/kg.

The 2000 JMPR reported residues in forage of 0.95-9.8 ppm at 20 or more days after application at 1.4-1.6 kg ai/ha and in straw of 0.2-20 ppm at 42-131 days after application. Maximum residues in forage and straw, scaled for the Australian application rate and in the case of forage corrected for moisture content, are 20 ppm and 10 ppm respectively.
Residues in tissues of dairy cows fed at 36 ppm in the diet for 28 days were 0.11 mg/kg for muscle, 0.05 mg/kg for fat and 0.09-0.46 mg/kg for liver and kidney[30]. Anticipated residues in tissues on

[29] Public Release Summary on Evaluation of the new active CARFENTRAZONE-ETHYL in the product AFFINITY 400 DF HERBICIDE National Registration Authority for Agricultural and Veterinary Chemicals April 2000 Canberra Australia

[30] 2000 JMPR. Pesticide Residues in Food - 2000 Evaluations – Part I, FAO Plant Production and Protection Paper 165. FAO and WHO 2001

feeding cattle forage with residues at 20 ppm at 100% of the diet are 0.05 mg/kg for muscle, <0.05 mg/kg for fat and 0.05-0.23 mg/kg for liver and kidney. Residues in tissues declined with a half-life of <2 days when on "clean feed".
Residues in whole milk were a maximum of 0.04 mg/kg for cows fed at the equivalent of 12 ppm in the diet.

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 maize and sorghum for the control of wireworm and is applied in-furrow at planting at 0.75 kg ai/ha (for 1 m row spacing). It is applied to cereals as a foliar spray at rates up to 0.75 kg ai/ha for the control of various pests including locusts (highest rate).
The harvest WHP is 10 days.
Do not graze or cut for stock food for 2 days after application.

There are Australian, Codex and USA MRLs for chlorpyrifos in animal tissues. 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) respectively. There are Australian MRLs for sorghum at T3 mg/kg and other cereal grains at T0.1 mg/kg.

The Australian use-pattern includes late application for locust control is expected to give rise to the highest residues in forage and stubble/hay. The 2000 JMPR reported residues in maize forage at 6 or more days after application at 1.7 kg ai/ha of 2.1-7.2 ppm and in fodder at ca. 34 days of 1.6-7.2 ppm. For wheat, residues in straw of crops with last application made at 0.56 kg ai/ha and harvested 25-30 days later were 0.09-4.1 ppm. Residues in rice straw at 10 days after application at 0.45 kg ai/ha were 1.3 ppm. Residues in sorghum stover at 14 days after application at 0.56 kg ai/ha were 0.05-2.5 ppm.

The maximum transfer factor for feeding cattle at 10 ppm in the diet was 0.016 for cattle fat[31].
Residues from feeding maize forage with residues of 10 ppm at 100 % of the diet 10×0.016 = 0.16 mg/kg; below the lowest of the Australian, Codex and USA MRLs.
Anticipated residues for milk would be 10×0.0007 = 0.007 mg/kg.

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

Chlorsulfuron
-is a sulfonylurea herbicide applied pre-sowing or up to early post crop emergence to winter cereals (wheat, barley, oats, triticale and cereal rye). The maximum application rate is 18.75 g ai/ha.
No harvest WHP is required.

There are Australian and US but no Codex MRLs for chlorsulfuron in animal commodities. The Australian MRLs are *0.05 mg/kg for edible offal (mammalian) and meat (mammalian) and milk. The US MRLs are 0.3 mg/kg for cattle, sheep and goat meat, mbyp and fat and 0.1 mg/kg for milk.

The Australian MRL for cereal grains is *0.05 mg/kg and there is a PAFC MRL of 10 ppm. The US has a different residue definition for plant commodities (includes a metabolite, 2-chloro-5-hydroxy-

[31] 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

N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)aminocarbonyl] benzenesulfonamide. The US has MRLs of 0.1 mg/kg for grain, 0.5 mg/kg for straw and 20 mg/kg for forage of wheat and oats.

The log P_{OW} for chlorsulfuron is -0.99 indicating no propensity for accumulation in fat.

In an animal transfer study dairy cattle were fed chlorsulfuron at dietary levels of 2, 10, and 50 ppm for 28 days[32]. The chlorsulfuron residue levels in milk rose within 3 days to steady-state plateaus, remaining constant during fortified feeding, and decreased to below the analytical detection limit of 0.010 ppm within 3 days of terminating the fortified feeding. Average steady-state residue levels in the milk during fortified feeding, were 0.064 ppm for cows fed at the 50 ppm dietary rate and 0.013 ppm for cows fed at the 10 ppm dietary rate. Chlorsulfuron was detected in the kidney 0.25 ppm, liver 0.024 ppm, and lean muscle < 0.010 ppm of the cow fed at the 50 ppm dietary level, but was undetected (< 0.01 ppm) in subcutaneous fat. Chlorsulfuron residues in all analysed tissue decreased to< 0.010 ppm for all cows within 8-days of returning to a diet without chlorsulfuron.

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

Clodinafop-propargyl

-is a selective aryloxyphenoxypropionate herbicide used for the control of annual rye grass and other weeds in wheat. Application is made from the two-leaf to late tillering growth stage of the wheat at rates up to 50 g ai/ha.
No harvest WHP is required. Do not graze or cut for stock food for 4 weeks after application.

There are Australian but no Codex or US MRLs for clodinafop-propargyl in animal commodities. The Australian MRLs are all *0.05 mg/kg (residue definition parent compound). The Australian MRL for wheat is *0.05 mg/kg and for wheat straw and fodder (dry) *0.1 ppm. The US MRLs for wheat grain, forage and hay are 0.1 mg/kg and for wheat straw 0.5 mg/kg. The US residue definition is clodinafop-propargyl and its acid metabolite (propanoic acid, 2-[4-[(5-chloro-3-fluoro-2-pyridinyl)oxy]phenoxy]-, (2R)-).

The octanol water partition coefficient log P_{OW} = 3.9 at pH 7 suggesting potential fat solubility. In trials conducted in the USA and Canada at 60 – 70 g ai/ha with analysis of forage at 7-30 days after application and straw and grain at *ca.* 60 days after application, no residues of clodinafop were detected. The US EPA proposed tolerances of 0.1 ppm for clodinafop-propargyl and the acid metabolite, CGA-193469, for wheat grain, forage, and hay and 0.5 ppm for straw and that tolerances for meat, milk and eggs are not required[33].

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

Clomazone

- is an isoxazolidinone herbicide used to control broad-leafed annual weeds in crops. It is registered for use on rice with application made post-planting at inundation of or to permanent water. The application rate is up 288 g ai/ha.
A harvest WHP is not required.
The following grazing restraint appears on the label:

[32] ENVIRONMENTAL PROTECTION AGENCY [PF-1072; FRL-6825-8] Notice of Filing a Pesticide Petition to Establish a Tolerance for a Certain Pesticide Chemical in or on Food [Federal Register: March 8, 2002 (Volume 67, Number 46)] [Notices] [Page 10722-10727])
[33] clodinafop-propargyl Pesticide Petition Filing 5/98 Federal Register: June 5, 1998 (Volume 63, Number 108) Page 30750-30756

Do not graze or cut for stock food for 3 months after application.

There are no Australian, Codex or US MRLs for clomazone in animal commodities. The Australian MRLs for rice (*0.01 mg/kg) and rice forage (green) and straw and fodder (dry) (*0.01 mg/kg).

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 wheat, barley, oats and triticale. Application is made up to late tillering at rates of up to 150 g ai/ha.
Do not apply later than 10 weeks before harvest.
Do not graze or cut treated cereals for stock feed for 4 weeks after application if rate is in excess of 120 g/ha.

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 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 cereal grains is 2 mg/kg. There is also an animal feed MRL of 100 ppm for pasture. The Australian MRL for forage of cereal grains is 25 ppm and straw and fodder dry 10 ppm. The US MRLs for wheat forage and straw are 9 mg/kg and for grain 3 mg/kg.

Residues in field corn, sweet corn, and popcorn grain, forage, and fodder treated at 0.28 kg ai/ha have not exceeded 1 mg/kg in grain, 3 ppm in forage, and 9 ppm in fodder. Residues do not concentrate in the corn milling products of starch, flour, meal, crude or refined oil, and have only slight concentration factors of 1.1 in grits and grain dust. Cannery waste from sweet corn processing contains no detectable residues of clopyralid.

Wheat, barley, and oats treated at 140 g ai/ha contained residues of clopyralid that did not exceed 3 mg/kg in grain or 9 ppm in forage and straw. Residues do not concentrate in flour but do concentrate to some extent in the other milled fractions of wheat and barley.

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 kidney[34]. Anticipated residues in kidney on feeding cereal forage or fodder with residues 9 ppm are 9×0.015 = 0.135 mg/kg.

Two goats were fed radiolabeled clopyralid at rates equivalent to 230 and 69 ppm in feed for 7 days[35]. The 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. Residues in milk are anticipated to be below the limit of quantification for likely regulatory methods of analysis.

[34] 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.
[35] Dow Agrosciences Technical profile: Clopyralid, July 1998

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

Cloquintocet-mexyl
-is a crop safener used with clodinafop-propargyl (a selective herbicide used for the control of annual rye grass and other weeds in wheat). Application is made from the two-leaf to late tillering growth stage of the wheat at rates up to 13 g ai/ha.
No harvest WHP is required. Do not graze or cut for stock food for 4 weeks after application.

There are Australian but no Codex or US MRLs for cloquintocet-mexyl in animal commodities. The Australian MRLs are all *0.1 mg/kg (residue definition parent compound). The Australian MRL for wheat is *0.1 mg/kg and for wheat straw and fodder (dry) *0.1 ppm. The US MRLs for wheat grain, forage and hay/straw are 0.1 mg/kg. The US residue definition for plant commodities is cloquintocet-mexyl and its acid metabolite (5-chloro-8-quinlinoxyacetic acid).

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

Cyfluthrin
- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on sorghum for the control of sorghum midge. The application rate is up to 15 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".
The harvest WHP is 14 days.
Do not graze or cut for stock feed 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 milk fat (1 mg/kg in whole milk) for Australia, Codex and the USA respectively. There are Australian MRLs for cereal grains at 2 mg/kg and straw and fodder (dry) of cereal grains at 5 ppm.

Data on residues in forage and straw were reported by the 1991 JMPR[36]. Residues in barley straw from crops treated at 20 g ai/ha were up to 2.7 ppm at 7 or more days after application. Residues in wheat and barley forage at 7 days after application at 20 g ai/ha were up to 1.1 ppm (ca. 3.7 ppm if expressed on a dry weight basis) and residues in sorghum forage were 0.24 ppm (0.8 ppm if expressed on a dry weight basis). Residues in maize forage on the day of application at 40 g ai/ha were 0.89 ppm (2.2 ppm if expressed on a dry weight basis).

Residues in the animal diet from cereal stubbles would not be expected to lead to exposure of greater than 5 ppm in the diet. TF fat = 0.05[37]. Estimated residues in fat are 5×0.05 = 0.25 mg/kg.

The TF for milk is 0.005 giving anticipated residues of 5×0.005 = 0.025 mg/kg.

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

Cyhalofop-butyl

[36] 1991 JMPR. Pesticide Residues in Food - 1991 Evaluations, Part I Residues FAO Plant Production and Protection Paper 113/1. FAO and WHO 1991
[37] 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

-is a selective aryloxyphenoxypropionate herbicide used for the post-emergentcontrol of barnyard grass and silver top in rice. Application is made at rates up to 285 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stockfood for 8 weeks after application.

There are Australian but no Codex or US MRLs for cyhalofop-butyl in animal commodities. The Australian MRLs are all *0.05 mg/kg (residue definition parent compound). The Australian MRL for rice is *0.01 mg/kg and for rice forage (green) *0.1 ppm and rice straw and fodder (dry) 0.2 ppm. The US MRLs for rice grain and rice wild grain are 0.03 ppm. The US residue definition is the sum of cyhalofop-butyl, cyhalofop acid and the di-acid metabolite.

APVMA TAN: Metabolism studies conducted on laying hens and lactating goats, show that cyhalofop-butyl is rapidly absorbed and eliminated from animals. Following an oral dose of ~10 ppm of radiolabelled cyhalofopbutyl in hens and goats, the majority of the radioactivity (>93% in both species) was eliminated via urine and faeces. Residues in milk were <0.04 mg equiv/kg in all samples from two radiolabelled dosed groups. The highest residues in milk were observed after the 2nd day of dosing, indicating that residues plateau quickly. Analytical methodology has been provided for determining cyhalofop-butyl residues in animal commodities, with an LOQ of 0.05 mg/kg. The low levels of residues (0.001- 0.08 mg/kg) in fat and edible tissues, milk or eggs demonstrate that residues due to cyhalofop-butyl would not accumulate in the animals.

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

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

The application rates for cereals 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)
Winter cereals	34	21	35*
Maize	80	1	-
Sorghum	100	14	-

*unless otherwise stated. Lower application rates have shorter do not graze intervals.

NOTE: ambiguous label directions as winter cereals seems to be only wheat, barley and triticale in one part.

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 0.2 mg/kg for wheat and 1 mg/kg for other cereal grains.

From data presented in the 1981 JMPR evaluation it is apparent that residues in field corn (maize) trash may be as high at 7 ppm. Residues in wheat (green plant and straw) when scaled for the Australian application rate were up to 1.1 ppm in the green plant and 2.1 ppm in straw. Residues in sorghum (whole plants) were 2.1 ppm at 8 days after application at 30 g ai/ha (7 ppm of scaled for

the Australian rate). The TF for fat is 0.1[38,39]. If residues in wheat, maize and sorghum forage/fodder are present at 7 ppm, anticipated residues in fat are 7×0.1 = 0.7 mg/kg if fed at 100% of the diet.

Anticipated residues in whole milk (TF 0.003-0.1) are also 0.7 mg/kg.

Livestock residues may exceed international and/or domestic market standards

Cyproconazole

-is a conazole fungicide registered for the control of powdery mildew and rusts in *barley* and *wheat*.
The application rate is up to 64 g ai/ha.
The harvest WHP is 42 days.
DO NOT graze or cut for stock food for 21 days after application.

There are Australian but no Codex or US MRLs for cyproconazole in animal commodities. The Australian MRLs have been set at 0.03 mg/kg for meat [mammalian], 1 mg/kg for edible offal (mammalian) and *0.01 mg/kg for milk. The MRLs for barley and wheat are *0.02 mg/kg, for forage 10 ppm and for fodder and straw dry 3 ppm.

(The log P_{ow} for cyproconazole is reported to be 2.9 indicating little propensity for transfer to fat.). The relevant TFs for liver and fat are 0.04 and 0.002 (20 ppm feeding level) [40,41]. Feeding at 10 ppm would give rise to residues of 10×0.04 = 0.4 ppm for liver and 10×0.002 = 0.02 ppm for fat.

The APVMA reported[42] that Residue decline in animals removed from dosing was examined in the cyproconazole transfer study. Animals on the 600 mg/animal/day diet (*ca.* 30 ppm in feed) were given clean feed for up to 14 days after the last dose. The data are given below

Residues of cyproconazole (mg/kg) in tissues and milk

Dose level (mg/animal/day)	Liver	Kidney	Muscle	SC fat	Perirenal fat	Milk
600	0.930	0.038	0.005	0.042	0.017	0.014
600 (+7 days)	0.008	0.009	<0.003	<0.003	<0.003	
600 (+14 days)	<0.003	0.012	<0.003	<0.003	<0.003	

Livestock residues are not anticipated to 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 cereals. The application rate is up to 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.

[38] 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.
[39] 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
[40] Evaluation of fully approved or provisionally approved products. Issue 45: Evaluation on SAN 619F (cyproconazole), August 1991, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK
[41] Trade Advice Note on azoxystrobin and cyproconazole in the product Amistar Xtra Fungicide (APVMA Product Number 57949), Australian Pesticides and Veterinary Medicines Authority
[42] Trade Advice Note on azoxystrobin and cyproconazole in the product Amistar Xtra Fungicide (APVMA Product Number 57949), Australian Pesticides and Veterinary Medicines Authority

The harvest WHP is 7 days for cereals
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 Australian MRLs are 2 mg/kg cereal grains. 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.

In residue trials reported by the 2002 JMPR residues in straw of barley, oats and wheat when scaled to an application rate of 13 g ai/ha were up to 0.5 ppm at 28-30 days after the last application. The TF for deltamethrin in fat is roughly 0.03[43]. Feeding of straw/stubble with residues of 0.5 mg/kg at 100% of the diet could result in deltamethrin residues in fat of 0.5×0.03 = 0.015 mg/kg, this is less than the Australian, Codex and USA tolerances.
Anticipated residues in milk (TF 0.009) are 0.5×0.009 = 0.0045 mg/kg.

Feeding of 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 5×0.03 = 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 5×0.009 = 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 cereals for the control of various pests including grasshoppers and locusts. The application rate is up to 0.8 kg ai/ha for cereals and 1.12 kg ai/ha for sorghum.
The harvest WHP is 14 days. The grazing WHP is 2 days.

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 cereal grains is 0.1 mg/kg.

Note the 1993 JMPR[44] reported residues in maize forage and fodder for crops treated at 1.1 kg ai/ha. Residues in forage at 7 days after the last application were 1.1-4.0 ppm (2.8-10 ppm dry weight basis) and in fodder at 43-49 days were 0.3-3.2 ppm. The TF for fat is 0.001[45]. Feeding maize/sorghum forage at 100% of the diet could result in fat residues of 10×0.001 = 0.01 mg/kg.

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

Dicamba
- is a selective herbicide used for the control of broadleaf weeds in cereal crops. The application rate is up to 0.2 kg ai/ha for cereal grains and up to 0.28 kg ai/ha for grain sorghum and maize.
Do not harvest, graze or cut for stock food for 7 days after application.

[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] 1993 JMPR - Pesticide Residues in Food - 1993 Evaluations, Part I Residues FAO Plant Production and Protection Paper 124. FAO and WHO 1994
[45] 1996 JMPR - Pesticide Residues in Food - 1996 Evaluations, Part I: Residues FAO Plant Production and Protection Paper 142. FAO and WHO 1997

There are no Codex MRLs for dicamba. The US (parent + metabolite) and Australian (parent) residue definitions differ. The relevant US MRLs for animal tissues are 0.25 mg/kg for meat, 25 mg/kg for kidney and liver and 0.2 mg/kg for milk. The Australian MRL for meat (mammalian) is 0.05 mg/kg and milks at 0.1 mg/kg. Residues in soil and foliage decline with typical half-lives of 14 and 9 days respectively. The Australian MRL for cereal grains is *0.05 mg/kg.

The APVMA Stockfeed data sheet[46] summarised some residue data for dicamba:

Lactating dairy cattle were fed dicamba in the diet for 30 days at doses equivalent to 40, 120 and 400 ppm in the diet. Residues of dicamba and its DCSA metabolite in tissues of the high dose group were 0.89 mg/kg in kidney, 0.21 mg/kg in liver, 0.037 mg/kg in muscle and 0.059 mg/kg in fat. Maximum milk residues were 0.32 mg/kg.

The Australian use-pattern is such that residues in forage and fodder at harvest are expected to be less than 100 ppm (the US has tolerances of 80 ppm for oat and wheat forage, 20 ppm for oat and wheat hay and 30 ppm for wheat straw). Feeding at this level is not expected to result in significant residues in animals (<LOQ i.e. <0.5 mg/kg with US residue definition). Anticipated residues from feeding pasture at 100% of the diet are 100 ppm × 0.0022 = 0.22 mg/kg for kidney and 100 ppm × 0.00015 = 0.015 mg/kg for fat (US residue definition and below US MRLs).

Livestock residues may exceed international and/or domestic market standards

Diclofop-methyl
-is an aryloxphenoxypropinate herbicide used for control of annual grasses in wheat, barley, oats, triticale and rye. The application rate is up to 562 g ai/ha for barley and 750 g ai/ha for the other cereals.
No harvest WHP is required.
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 Australian MRL for cereal grains is 0.1 mg/kg.

The US EPA reported that for wheat/barley grain, the combined residues of diclofop-methyl and its metabolites, diclofop acid and hydroxy diclofop were nondetectable (< 0.10 ppm) in field trial studies in/on wheat and barley grain. Wheat and barley processing data demonstrate that residues of diclofop-methyl and its metabolites, diclofop acid and hydroxy diclofop do not concentrate in bran, flour, or other processed fractions following postemergence foliar application at 5× the label rate. The US EPA reported that the HAFT for wheat forage at 26 days after application at the US rate of 1.12 kg ai/ha was 1.77 ppm (1.2 ppm when scaled for the Australian rate).

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 ppm in the diet[47]. 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

[46] http://www.apvma.gov.au/residues/stockfeed.shtml
Dicamba September 2004
[47] 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

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 mg/kg 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.

Anticipated maximum residues in kidney are 1.2×0.9 = 1.1 mg/kg.

Livestock residues may exceed international and/or domestic market standards

Difenoconazole
-is a triazole fungicide that is used in apples for the control of various fungal pests in wheat and barley. The application rate is 12 g ai/100 kg seed.
A harvest WHP is not required (seed dressing)
Do not graze or cut for stock food for 6 weeks after sowing treated grain.

There are Australian , US and Codex MRLs for difenoconazole in animal tissues. The Australian and US MRLs have all been set at *0.05 mg/kg for tissues and *0.01 mg/kg for milk. The US MRLs for cattle fat and meat byproduct except liver is 0.1, liver 0.2 , meat 0.05 and milk is 0.01 mg/kg. The Codex MRLs for edible offal are 0.2, meat fat 0.05 and milk *0.005 mg/kg. The Australian cereal grain MRL is 0.01 mg/kg and the wheat and barley forage MRL *0.1 ppm while the wheat and barley straw and fodder (dry) MRL is *0.05 ppm.

The US EPA reported "*two metabolism studies were performed on ruminants (lactating goats) in a 10-day study with a dose rate of 4.17 ppm (14 × the 0.30 ppm estimated dietary burden) and a 3-day study with a dose rate of 100 ppm (333 × the 0.30 ppm estimated dietary burden)*[48]*. The total radioactive residue (TRR) in the goat tissues was used to estimate the expected residues in a feeding study with a dose rate of 0.30 ppm. The maximum residue observed was in liver, estimated to be at a level of 0.02 ppm from both metabolism studies. This value is 2.5 × below the LOQ of the proposed analytical enforcement method (0.05 ppm)*."

It is considered unlikely that feeding grain, forage, fodder or straw derived from difenoconazole treated barley or wheat seed would give rise to residues at levels of concern in animal tissues.

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

Diflufenican
-is a nicotinanalide herbicide used to control various weeds in cereals (wheat, barley, triticale, oats, rye). Application is at rates of up to 25 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 7 days after application.

There are Australian but no Codex or US MRLs for diflufenican 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 cereal grains are 0.05 mg/kg for barley, oats, rye and triticale and 0.02 mg/kg for wheat. The MRL for straw and fodder (dry) of cereals is 0.2 mg/kg.

EFSA DAR - In a metabolism study lactating cows were dosed at 1 and 20 ppm feed with [difluorophenyl-^{14}C]-diflufenican and 5 and 50 ppm feed with [pyridine-^{14}C]-diflufenican for 7

[48] Difenoconazole Pesticide Tolerance Federal Register: September 15, 2000 (Volume 65, Number 180) Page 55911-55921

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 *maize*. It is registered on maize at application rates of up to 720 g ai/ha.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 4 weeks 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 *0.02 mg/kg for maize and for forage and fodder of maize and sweet corn at *0.02 mg/kg.

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 cereals at application rates of up to 300 g ai/ha.
The harvest WHP is 28 days.

There are Australian, Codex and 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 *0.05 mg/kg for cereal grains.

The 1998 JMPR reported residues in barley forage or 0.1-2.8 ppm at 14 days after applications at 340 g ai/ha and residues in straw at 21-28 days after the last application of 0.02-1.7 ppm. Residues in maize forage from crops treated at 320 g ai/ha were 0.02-0.24 at 16 days after the last application. Residues in wheat forage and straw of crops treated at 320 g ai/ha were 0.82-5.32 and 0.3-6.9 ppm respectively at 14 and 21-28 days after the last application.

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 tissues[49].

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 rice, sorghum and winter cereals with application rates up to 0.6 kg ai/ha and as a salvage treatment at rates up to 0.345 kg ai/ha.

[49] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

The harvest WHPs are 5 days for rice and not required for other cereals.
Do not graze or cut sprayed vegetation for stock food for at least 1 day after application.

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. The MRLs for diquat are 5 mg/kg for barley, oats and rice, 2 mg/kg for rye, triticale, wheat and sorghum and 0.1 mg/kg for maize. There is a legume animal feeds MRL of 100 mg/kg.

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)[50]. Residues in hay/stubble/forage would be expected to be less than 100 ppm. This suggests that no residues would be detected in animal tissues if fed forage, stubble, hay/straw from cereals.

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

Diuron
- is a herbicide used for the control of weeds in crop. It is applied early post-emergent from the 2 to 5 leaf growth stage. The application rate is up to 0.85 kg ai/ha for wheat and barley and up to 0.25 kg ai/ha for triticale, oats and rye.
No harvest or grazing WHP is required.

There are no Codex MRLs for diuron. The US and Australian residue definitions differ with the Australian definition including a metabolite in addition to the parent compound. The relevant US MRL for animal tissues is 1 mg/kg for cattle mbyp while the Australian MRL for edible offal of cattle is 3 mg/kg (the higher value probably reflecting the inclusion of the metabolite in the residue definition). The Australian MRL for milk is 0.1 mg/kg. Residues in soil and foliage decline with typical half-lives of 90 and 30 days respectively. Australia has a primary animal feed commodity MRL of 50 mg/kg. The MRL for cereal grains is 0.1 mg/kg.

The US EPA reported: The ^{14}C-containing residues that were identified in lactating goats were as follows. The principal residue identified was DCPU which comprised 10% of TRR in milk, 27% of TRR in fat, 35% of TRR in kidney, 23% of TRR in liver, and 22% of TRR in muscle. The parent and other dichloroaniline-containing metabolites (i.e., 3,4-DCA and DCPMU) were detected in trace quantities (0.01 ppm each) except in liver (0.12 ppm). Four minor (each 6% of TRR) hydroxylated metabolites (2-OH-DCA; 2-OH-DCPU; 2-OHDCPMU; and N-acetyl-2-OH-DCA) were also detected; these metabolites were not observed in plants and would not be determined by the enforcement method. The major portion of radioactive residues in milk was comprised of several conjugated polar components which collectively accounted for 56% of TRR. These polar components also accounted for substantial portions of the total radioactivity in liver (collectively 25% of TRR) and kidney (collectively 23% of TRR). Attempts to further elucidate the nature of these polar materials using various techniques (e.g., enzyme digestions, heat treatment) were not successful.

NOTE: US MRLs have been established for animal feed items (including alfalfa forage and hay at 2 ppm and citrus pulp dry at 4 ppm) as well as for animal commodities. If the US MRLs are used to

[50] 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

estimate the dietary burden using the US EPA Guideline, a dietary burden of *ca.* 4.8 ppm is estimated. An anticipated TF is the 1 ppm (animal commodity tolerances) ÷ 4.8 ppm (dietary burden) = 0.2 (crude estimate).

Anticipated residues would 2×0.2 = 0.4 mg/kg if the US MRL for alfalfa forage is used as no data were located for residues in cereal forage.

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

Endosulfan
- is an organochlorine insecticide used for the control of various pests in a variety of crops. The application rate for barley, oats, wheat, rye and triticale is up to 0.35 kg ai/ha to bare earth prior to crop emergence.
DO NOT graze or cut for stockfood for 10 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 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 cereal grains set at 0.1 mg/kg, cerial forage (green) of 0.3 and straw and fodders (dry) of cerial grains of 0.4 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 APVMA reported residues in barley and wheat forage of <0.09 mg/kg dry weight basis 55-70 days after a pre-emergent application of endosulfan at 0.35 kg ai/ha.
The TF for fat is 0.3-0.4[51]. Residues in fat would be 0.09×0.4 = 0.036 mg/kg.
The TF for milk is 0.02. Residues in milk would be 0.09×0.02 = 0.0018 mg/kg. The TF for cream is 0.12. Residues in cream would be 0.09×0.12 = 0.108 mg/kg.

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

Epoxiconazole
- is a fungicide used for the control of various diseases of *barley* and *wheat*. The application rate is up to 62.5 g ai/ha.
DO NOT harvest for 6 weeks after application.
DO NOT graze or cut for stockfood for 6 weeks after application.

There are Australian, but no Codex or USA MRLs for animal commodities. The Australian and MRLs are 0.05 for edible offal, *0.01 mg/kg for meat and *0.005 mg/kg for milk. There are Australian MRLs for barley and wheat at 0.05 mg/kg. There are Australian MRLs for barley forage, green 5 ppm, barley straw and fodder, dry 7 ppm, wheat forage, green 5 ppm and wheat straw and fodder, dry 7 ppm.

Lactating dairy cattle were dosed at 4 ppm (0.12 mg/kg bw) and 41 ppm (1.2 mg/kg bw) for 28 days. Residues in milk for the 4 ppm dose group were <0.001 mg/kg for 20 of 27 daily samples,

[51] 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

with a maximum observable residue of 0.002 mg/kg. Residues in tissues at slaughter were <LOD except for liver for which the maximum residue was 0.04 mg/kg. For the 41 ppm dose group a detectable residue in fat of 0.02 mg/kg was observed in a single animal.

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

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 crops. It is used on cereals at 3.96 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 Australian MRLs for cereal grains is *0.04 mg/kg.

The US EPA determined that[52] "*residues of EPTC in animal commodities to be a Category 3 situation under 40 CFR §180.6(a), in which it is not possible to establish with certainty whether finite residues will be incurred, but there is no reasonable expectation of finite residues in animal commodities. No tolerances on animal commodities are warranted.*"

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 cereals 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)
Cereals	3.5	7	7
Maize	25	7	7
Sorghum	22.5	7	7
Wheat, oats, barley	16.5	7	7
Winter cereals (wheat, barley, triticale)	15	7	7

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

There are Australian, Codex and USA (expire on 2/4/2010) MRLs for fenvalerate in animal tissues as well as Codex and US MRLs for esfenvalerate. 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 F mg/kg and 0.3 mg/kg (7 mg/kg for milk fat) for Australia, Codex and the USA respectively. There are Australian MRLs of 2 mg/kg for cereal grains. There are also MRLs of 10 ppm for primary feed commodities other than from alfalfa.

Esfenvalerate residues in wheat straw at harvest were reported by the 2002 JMPR to be range from 0.19-0.91 ppm for straw at 21-28 days after application at 7.5-18 g ai/ha. Residues in forage were 0.18-0.89 ppm at 0-21 days after the last application.

[52] US EPA RED (Reregistration Eligibility Decision EPTC (S-Ethyl dipropylthiocarbamate) CASE # 0064EPA 738-R-99-006 December 1999 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division)

Residues in cereal 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 MRL[53]. Residues of esfenvalerate from feeding these products are unlikely to present a trade risk.

The dairy cow feeding study with [^{14}C]fenvalerate was designed to provide residue transfer information as well as metabolism information[54]. The level of fenvalerate in the animal diet was 79 ppm. Approximate levels of ^{14}C and % as fenvalerate were: fat 1-3 mg/kg (90%+), milk 0.47 mg/kg (90%+), muscle 0.25 mg/kg (90%), liver 2 mg/kg (<1%) and kidney 1.4 mg/kg (17%).

Anticipated residues in fat from feeding cereal forage with residues at the MRL are 5×0.04 = 0.2 mg/kg.
Anticipated residues in milk from feeding cereal forage with residues at the MRL are 5×0.006 = 0.03 mg/kg.

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

Ethephon
- is a plant growth regulator used on barley for anti-lodging. The application rate is up to 0.36 kg ai/ha.
A harvest WHP of 1 day applies.

The Codex and Australian MRLs for ethephon in edible offal are *0.2 and 0.2 mg/kg respectively. The US tolerance for cattle kidney is 1, meat and meat fat is 0.02 and milk is 0.01 mg/kg. The Codex and Australian milk MRLs are *0.05 and 0.1 mg/kg. Residues in soil and foliage decline with typical half-lives of 10 and 5 days respectively. Australia has a primary animal feed commodity MRL of 10 mg/kg. The MRL for barley is 1 mg/kg.

The 1994 JMPR reported residues of up to 14 ppm in leaves of wheat on the day of application at 0.36 kg ai/ha and 9.3 ppm in leaves of oats on the day of application at 0.31 kg ai/ha. In a study where dairy cows were fed at up to 150 ppm in the diet for 28 days, residues in tissues were <0.1 mg/kg for muscle, <0.2 mg/kg for fat, liver and kidney[55]. It is considered unlikely that feeding of cereal forage/fodder/straw/hay/stubble would lead to residues in animal tissues that are above likely LOQs of regulatory methods.

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

Fenitrothion
-is an OP insecticide used to control Australian plague locust in *cereals*. The application rate is up to 500 g ai/ha.
No harvest WHP required.
Do not graze or cut for stock food for 14 days after application.

There are Australian and Codex but no US MRLs for fenitrothion in animal tissues. The relevant Australian and Codex MRLs for cattle fat are T*0.05 and *0.05 mg/kg respectively. The Australian

[53] APVMA Animal Residue Data Sheet for Fenvalerate & Esfenvalerate, May 2004.
[54] 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
[55] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

MRL for milks is T*0.05 [in the fat] mg/kg and the Codex MRL is *0.1 mg/kg. The Australian MRL for cereal grains is 10 mg/kg. There is an animal feed commodity MRL of T10 ppm for straw, fodder (dry) and hay of cereal grass and other grass-like plants.

Residues in tissues were <0.05 mg/kg in a 28 day lactating cow feeding study conducted at a feeding level equivalent to 100 ppm in the feed[56]. There is no reasonable expectation of finite residues in milk or cattle tissues as a result of the feeding of cereals or their waste.

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

Fenoxaprop-ethyl
-is an aryloxyphenoxypropionate herbicide used for control of certain weeds in wheat, barley, triticale, oats and rye. The application rate is up to 50 g ai/ha with application up to 10 weeks after sowing.
The harvest WHP is 10 weeks.

There are Australian and US but no Codex MRLs for fenoxaprop-ethyl in animal commodities. The Australian MRLs are 0.2 mg/kg for edible offal and 0.05 mg/kg for meat (mammalian) and 0.02 mg/kg for milk. The MRL for barley, rye, triticale and wheat is *0.01 mg/kg. There is an MRL of 0.5 ppm for straw and fodder (dry) of cereal grains. The US MRLs are 0.05 mg/kg for animal commodities and 0.02 mg/kg for milk.

The Australian and US residue definitions are the same and are the sum of fenoxaprop-ethyl and its metabolites [2-[4-](6-chloro-2-benzoxazoly)oxy]phenoxy]propanoic acid and 6-chloro-2,3-dihydrobenzoxazol-2-one], each expressed as fenoxaprop-ethyl.

The log P_{ow} is 4.58. Fenoxaprop-ethyl (chlorophenyl-U-^{14}C) was administered to a lactating cow for 3 consecutive days at a rate of 50 mg/day[57]. At sacrifice (24 hours after the 3rd dose) ^{14}C residues in tissues were: 0.005 mg equiv/kg muscle, 0.018 mg equiv/kg fat, 0.2 mg equiv/kg kidney and 0.11 mg equiv/kg liver. Maximum milk residues were 0.06 mg equiv/kg. Significant residues are not expected in animal tissues or milk.

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

Fipronil
- is a phenylpyrazole insecticide used for control of locusts. Application to sorghum is at 1.25 g ai/ha.
The harvest WHP is 14 days.
Do not graze or cut for stock food for 14 days after application.

It is also registered as a seed treatment for rice and sorghum. The application rate is 10 g ai/100 kg seed or 12.5 g ai/ha for rice and 75 g ai/100 kg seed for sorghum.
Sorghum: Do not graze plants grown from treated seed or cut for stock food within 3 weeks of sowing.

[56] The NRA Review of Fenitrothion Interim Report Volume 2, June 1999, Existing Chemicals Review Program National Registration Authority for Agricultural and Veterinary Chemicals – Residues Assessment
[57] Evaluation of fully approved or provisionally approved products. Issue 18: Evaluation on Fenoxaprop-ethyl, January 1990, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK

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 milkfat (representing 0.05 mg/kg in whole milk). There are animal feed MRLs of 0.005 ppm 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 rice is *0.005 mg/kg and for sorghum 0.01 mg/kg.

If maximum residues in cereal 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) [58], anticipated maximum residues in cattle fat are ≈ 0.02×1.2 = 0.024 mg/kg. The TF for milk is 0.1 giving anticipated residues in milk of ≈ 0.02×0.1 = 0.002 mg/kg.

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

Flamprop-methyl

-is a herbicide used for the control of wild oats in wheat and triticale. The application rate is up to 225 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 6 weeks after application.

There are Australian but no Codex or US MRLs for flamprop-methyl in animal commodities. The Australian MRLs are all *0.01 mg/kg. The MRLs for wheat and triticale are 0.05 mg/kg. There are animal feed MRLs of 0.1 ppm for straw and fodder (dry) of wheat and triticale.

In a study where flamprop-methyl was administered to lactating cows[59] at low dose levels (0.3-3 mg/kg in total diet,) and the excretion of total metabolites in milk, urine and faeces were measured as well as residues in tissues, residues in milk in most cases were well below 0.001 mg/kg; in muscle samples <0.003 mg/kg. Elimination of the herbicide from the animals was rapid in every case and this, together with the low residue levels, was attributed to very efficient metabolic de-esterification to the parent carboxylic acid metabolites (flamprop). This metabolite possess physical properties suited for excretion via the kidneys and bile into urine and faeces and, conversely, unsuited for transport into milk.

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

Fludioxonil

-is a fungicide used for the control of damping off caused by *Fusarium* spp. and *Penicillin* spp. in maize and sweet corn. It is applied as a seed treatment at an application rate of 5 g ai/100 kg seed.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 4 weeks after application (probably should read planting treated seed)

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 maize and sweet corn (corn-on-the-cob) are *0.02 mg/kg. The animal feed MRLs are *0.02 ppm for maize fodder, maize forage and sweet corn forage and fodder.

[58] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002
[59] Crayford,-J-V; Harthoorn,-P-A; Hutson,-D-H (1976) Excretion and residues of the herbicide benzoylprop-ethyl, flamprop-isopropyl and flamprop-methyl in cows, pigs and hens. *Pesticide-Science*. 1976; 7(6): 559-570

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 cattle[60]. 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

Flurasulam

is a herbicide used on *wheat, barley, oats, triticale* for the control of various weeds. The application rate is up to 5 g ai/ha.
No harvest WHP is required.
DO NOT graze or cut for stock feed for 7 days after application.

There are Australian but no Codex or US MRLs for florasulam in animal commodities. The Australian MRLs for edible offal, meat and milk of *0.01 mg/kg and for cereal grain at *0.01 mg/kg. The MRLs for forage of cereal grains [fresh weight] and straw and fodder of cereal grains (dry) are both *0.05 ppm.

Goat metabolism: Florasulam, radiolabelled as either [UL-aniline-^{14}C]XDE-570 (A-label) or [triazolopyrimidine-9- ^{14}C]XDE-570 (TP-label), was administered daily to two lactating goats (one per treatment) at a dose level of approximately 0.48 mg/kg bw/day five consecutive days (using a bolus gun) and was equivalent to a dietary burden of approximately 11 ppm florasulam at an average feed consumption of 2 kg/day. Approximately 24 hours after the final dose, the animals were sacrificed and samples of tissues (liver, kidney, muscle and fat), blood, gastrointestinal contents and urine from the bladder were collected.

Recoveries of the administered dose (AD) were 89% for the A-label and 83% for the TP-label. The majority of the radioactivity was excreted in the urine and faeces, accounting for a total of 99.8% of the recovered radioactivity. Residues in milk and tissues each represented <0.1% AD, and totalled 0.123% AD and 0.139% AD for the A- and TP-labels, respectively.
The highest concentration of residues in tissues was found in the kidney (0.039–0.069 ppm), followed by liver (0.023–0.033 ppm), milk (0.016–0.033 ppm), fat (0.0016–0.0017 ppm), and muscle (0.0009–0.0016 ppm). Greater than 90% of the TRRs in urine, milk, and kidney were extractable; however only 22.4–23.2% of the TRRs in liver were extracted. Unextracted residues in liver were treated with protease, which released an additional 41.8 and 56.5% of the TRRs (0.0138 and 0.013 ppm) of the A- and TP-labels, respectively. However, 32.5–43.1% of the TRRs (0.0075–0.014 ppm) in liver remained bound, and were not further analyzed.
The predominant metabolite identified in all extracts was the parent compound, representing 87.6–98.3% of the TRRs in urine, milk, and kidney, and 15.2–15.3% of the TRRs in liver. A minor metabolite representing up to 1.5% of the TRRs was tentatively identified as 5-OH-florasulam in urine, liver and kidney samples. No other metabolites were identified.

The results obtained with the two different labels indicate that no bridge cleavage occurred. The low tissue burden and high excretion rate of unmetabolized florasulam, as well as the low log Kow (1.00 at pH 4.00 and -1.22 at pH 7.0) indicate a low potential for sequestration in fatty tissues.

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

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

Flumetsulam
is a triazolopyrimidine sulfoanilide herbicide used on wheat, barley, oats, triticale and cereal rye for the control of various weeds. The application rate is up to 40 g ai/ha.
No harvest WHP is required for maize. A 4 week harvest WHP applies to winter cereals.
The grazing/cut for stock food WHPs are 14 days for maize and 8 weeks for winter cereals.

There are Australian but no Codex or US MRLs for flumetsulam in animal commodities. The Australian MRLs are 0.3 for edible offal and *0.1 mg/kg for meat and milk. The MRLs for maize, wheat, barley, oats, rye and triticale are *0.05 mg/kg. There are animal feed MRLs of *0.1 ppm for triticale forage (fresh weight) and 2 ppm for forage of cereals (green), *0.05 ppm for maize forage (green) and fodder and 0.05 ppm for oat and rye straw and fodder (dry) and 2 ppm for straw and fodder dry of cereal grains.

The APVMA reported that: When used according to the proposed use pattern residues in pastures (grasses/leguminous) had a highest residue (HR) of 10.16 mg/kg. A cattle feeding study at the feeding level of 11.6-16.7 mg/kg showed highest residues of 0.15 mg/kg in kidney, 0.023 mg/kg in liver and 0.011 mg/kg in renal fat. No residues greater than the LOQ were found in muscle or milk.

Sample	Flumetsulam residues after dosing at 11.6-16.7 (avg 13.5; mg/kg)	Calculated residues when 10.16 mg/kg flumetsulam is in feed	Required MRLs (mg/kg)
Kidney	0.15	0.15	0.3#
Liver	0.023	0.02	
Renal fat	0.011	0.0096	Not established
Muscle	LOQ	<LOQ	*0.1

#Proposed

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 wheat, barley and oats. The application rate is 15 g ai/ha.
A harvest WHP is not required.
DO NOT crop or graze treated vegetation for 6 weeks after application.

There are Australia MRLs set at *0.01 mg/kg for animal commodities including milk. The cereal grain MRL is *0.05 mg/kg. The MRLs for animal feed commodities are *0.05 mg/kg for forage of cereal grains and for straw and fodder (dry) of cereal grains.

Goats were orally dosed with 0.5 mg/kg bw ^{14}C-flumioxazin for 5 days (equivalent to a nominal dose rate of 12 ppm)[61]. 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)

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

Fluquinconazole

[61] 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

-is a triazole fungicide used as a seed treatment for wheat for the control of bunts, smuts etc. It is applied at an application rate of 0.75 kg ai/tonne of seed.
No harvest WHP required.
Do not graze plants grown from treated seed or cut for stock food within 12 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 wheat is *0.02 mg/kg. The animal feed MRLs are 2 ppm for wheat forage and 0.5 ppm for wheat straw and fodder (dry).

The TF for fat is 0.6[62]. 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.
The TF for milk is 0.04. Anticipated residues are 0.5 ppm × 0.04 = 0.02 mg/kg.

Livestock residues may exceed international and/or domestic market standards

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 these crops at application rates of up to 0.3 kg ai/ha.
No harvest WHP is required.
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. 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
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Flutriafol
-is a conazole fungicide used for the control of stripe and wheat rust in wheat and powdery mildew in barley at application rates up to 125 g ai/ha.
For in furrow application:
Harvest WHP not required. Do not graze or cut for stock food for 4 weeks after application.
For foliar application:
The harvest WHP is 10 weeks for barley and 7 weeks for wheat.
Do not graze or cut for stock food for 10 weeks (barley) or 7 weeks (wheat) after application.

[62] 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 Australian MRLs are *0.05 mg/kg for meat mammalian and milks and 0.5 mg/kg for edible offal. There are no Codex or USA MRLs for animal commodities. The Australian tolerances for barley is 0.2 mg/kg and for other cereal grains *0.02 mg/kg. The MRLs for forage, straw and fodder are 2 ppm.

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	-	-

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

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 pastures. It is applied prior to sowing at application rates up to 1.08 kg ai/ha and as a salvage treatment at rates up to 2L/ha.
A 7 day grazing WHPs applies to the salvage use.

The relevant Australian and Codex MRLs are the same at 2 mg/kg for offal. MRL for milk is *0.1 and *0.05 mg/kg for milk. The relevant USA MRL is 5 mg/kg for cattle meat byproducts. The primary animal feed commodity MRL for glyphosate is 150 mg/kg.

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 acid[63]. The highest residues were

[63] 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

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

Halosulfuron-methyl
-is a selective post-emergent herbicide used for the control of nutgrass in maize and sorghum crops. It is applied post-emergent to crops at an application rate of up to 0.0975 kg ai/ha.
No harvest WHP is required.
Sorghum: Do not graze livestock or cut for fodder or forage for 4 weeks after treatment.

There are no Codex MRLs for halosulfuron. The US (parent + metabolite) and Australian (parent) residue definitions differ. The relevant US MRLs for animal tissues are 0.1 mg/kg for offal while the Australian MRL for edible offal (mammalian) is 0.2 mg/kg. The Australian MRL for milk is *0.01 mg/kg. There are animal feed MRLs of 2 ppm for maize forage and fodder, 0.1 ppm for sorghum fodder and *0.05 ppm for sorghum forage (fresh weight). The Australian MRLs for maize and sorghum are *0.05 mg/kg

The US EPA reported[64] the details of goat and hen metabolism studies on halosulfuron-methyl. As with plants, the residue of concern in animals is halosulfuron-methyl *per se*. The current US EPA approved method for enforcement of tolerances for halosulfuron-methyl in animal commodities is based on analysis of the chlorosulfonamide half of the halosulfuron- methyl molecule; thus, it quantitates residues of parent halosulfuron- methyl as well as those metabolites containing the chlorosulfonamide acid moiety (*i.e.,* it is not specific to halosulfuron-methyl *per se*). The US EPA decided that animal tolerances will still be expressed as halosulfuron-methyl and its metabolites determined as 3-chlorsulfonic acid, expressed as parent equivalent.

The US EPA also reported a study where MON 12000 (halosulfuron) was administered in gelatine capsules to lactating dairy cattle at levels roughly equivalent to 0.5, 1.5 and 5 ppm of the diet. Animals were sacrificed within 12 hours of the last dose. Maximum residues were:

Dose (ppm)	Whole molk	Raw cream	Raw skim milkl	Muscle	Fat	Liver	Kidney
0.5	Na	Na	Na	Na	Na	0.01	0.02
1.5	Na	Na	Na	<0.01	<0.01	0.04	0.11
5	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	0.24

No residues are expected in milk, muscle or fat. Low levels may be found in liver and kidney though it is anticipated that if animals are not exposed for the last 24 hours before slaughter, residues will be close to or below typical methods LOQs.

Imazapic
-is a imidazolinone herbicide used for the control of weeds in the fallow prior to sowing of winter crops. It is applied at an application rate of up to 48 g ai/ha.
No harvest WHP is required.
Wheat, barley: Do not graze treated stubble or weeds for 4 weeks after application.

September-8 October 1986. Rome, Food and Agriculture Organization of the United Nations (FAO Plant Production and Protection Paper 78/1).

[64] halosulfuron-methyl Pesticide Tolerance 4/99 Environmental Protection Agency 40 CFR Part 180 [OPP-300854; FRL-6078-5] RIN 2070-AB78

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 and for meat (mammalian (in the fat) *0.05 mg/kg and for milk *0.01 mg/kg. There are animal feed MRLs of *0.05 ppm for forage of cereal grains (fresh weight) and wheat straw and fodder (dry). 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 ^{14}C-imazapic at doses of 0, 3.76 and 15.1 mg in gelatin capsules for seven consecutive days[65]. 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 maize with Clearfield® technology. It is applied at an application rate of up to 21.8 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 4 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) and 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. There are animal feed MRLs of *0.05 ppm for maize forage (green) (fresh weight). Feeding at this level is not expected to result in significant residues in animals (<LOQ or 0.05 mg/kg).

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

Imazethapyr

[65] 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

-is a imidazolinone herbicide used for the control of weeds in maize with Clearfield® technology. It is applied at an application rate of up to 65.6 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 4 weeks after application.

There are no Codex MRLs for imazethapyr in animal tissues. The relevant Australian MRLs are *0.1 mg/kg for edible offal (mammalian), meat (mammalian) and milk while the US MRL for cattle meat byproducts is 0.1 mg/kg. There are animal feed MRLs of *0.05 ppm for maize forage (green) (fresh weight) and maize fodder (dry). 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, parent ^{14}C-imazethapyr was dosed to lactating goats at 0.25 ppm and 1.25 ppm[66]. Results showed ^{14}C-residues of <0.01 mg/kg in milk, and <0.05 mg/kg in leg muscle, loin muscle, fat, liver, and kidney. Additional animal metabolism studies have been conducted with CL 288511 (main metabolite in treated crops fed to livestock) in lactating goats. In these studies, lactating goats dosed at 42 ppm of ^{14}C-CL 288511 showed ^{14}C-residues of <0.01 mg/kg in milk, leg muscle, loin muscle, and omental fat. ^{14}C-residue levels in the liver, and kidney were 0.02 and 0.09 mg/kg, respectively. These studies indicate that parent imazethapyr and CL 288511-related residues do not accumulate in milk or edible tissues of the ruminant.

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

Imidacloprid
- is a chloronicotinyl (pyridylmethylamine) insecticide. Application to cereals is as a seed treatment.

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

Crop	Rate	Harvest WHP (days)	Grazing WHP (days)
Maize	0.84 g ai/1000 seeds	-	4 weeks
Sorghum	258 g ai/100 kg seed	-	4 weeks
Cereals	14 g ai/100 kg seed	-	9 weeks

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 MRLs are 0.05 mg/kg for edible offal and *0.02 mg/kg for meat and milk. The Australian MRLs are 0.05 mg/kg for maize, *0.02 mg/kg for sorghum and *0.05 mg/kg for other cereals. There is an animal feed MRL of 10 ppm for cereal fodder and forage.

The TF for liver is 0.01[67]. Assuming residues in forage at 10 ppm and feeding at 100% of the diet, residues in liver would be 10×0.01 = 0.1 mg/kg.
The TF for milk is 0.003. Anticipated maximum residues in milk are 10×0.003 = 0.03 mg/kg.

The $t_{½}$ in forage/fodder is about 7 to 10 days.

Livestock residues may exceed international and/or domestic market standards

[66] Imazethapyr; Notice of Filing a Pesticide Petition to Establish a Tolerance for a Certain Pesticide Chemical in or on Food [Federal Register: January 3, 2003 (Volume 68, Number 2)] Page 370-374
[67] 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

Iodosulfuron-methyl
is a sulfonylurea herbicide used for the control of various weeds in cereals. Application is at rates up to 10 g ai/ha.
A harvest WHP is not required.
Do not graze or cut for stock food for 4 weeks after application.

There Australian but no Codex or US MRLs for iodosulfuron-methyl in animal commodities. The Australian MRLs for animal commodities have all been set at *0.01 mg/kg. The MRL for wheat is *0.01 mg/kg while for feed commodities are *0.05 ppm for wheat forage (fresh weight) and straw and fodder (dry).

In a dairy cow metabolism study with dosing at a rate equivalent to feeding at 14 ppm in the diet the maximum residues in fat (omental, renal and subcutaneous), milk and offal (kidney and liver) were 0.037, 0.017 and 0.16 mg equiv./kg respectively[68]. Residues in muscle, fat, milk and offal would be undetectable as a result of feeding 100% wheat grain or 100% wheat forage containing iodosulfuron- methyl at the MRL.

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 *Barley, wheat and sorghum crops* for the control of various pests. The application rate is up to 10 g ai/ha for barley and wheat and up to 17.5 g ai/ha for sorghum. 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 7-14 days when animals are on "clean feed".
The harvest WHP is 14 days for the cereal crops listed above.
Do not graze or cut for stock food for 14 days after application.

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. There are Australian MRLs for barley (0.2 mg/kg), sorghum (0.5 mg/kg) and wheat (*0.05 mg/kg) and an animal feed MRL for cereal forage (green) (1 ppm).

If residues in cereal forage are fed to animals are assumed to be at the same level as the MRL, residues in fat (TF 0.3-0.5)[69] would be $1 \times 0.5 = 0.5$ mg/kg.
The TF for milk is 0.02 giving anticipated maximum residues of $1 \times 0.02 = 0.02$ mg/kg for whole milk.

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

Linuron

[68] Public Release Summary on Evaluation of the new active IODOSULFURON-METHYL-SODIUM in the product HUSSAR SELECTIVE HERBICIDE National Registration Authority for Agricultural and Veterinary Chemicals March 20001 Canberra Australia
[69] 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

-is a selective urea herbicide used for the control of various weeds in wheat, barley, oats and maize crops. The application rate is 0.427 kg ai/ha for wheat, barley and oats with application 3-5 weeks after sowing. For maize, application is up to 2.7 kg ai/ha and is applied soon after planting or as a directed spray.
No harvest WHP is required.

There are Australian and US but no Codex MRLs for linuron in animal commodities. The Australian MRLs are all *0.05 mg/kg, except for edible offal (mammalian) which is 1 mg/kg, while the US MRL for cattle fat is 0.2, liver and kidney 2 and milk is 0.05 mg/kg. . The MRL for cereal grains is *0.05 mg/kg.

No information was located on residues of linuron in cereal forage however, the US has set tolerances of 1 ppm for cereal forage and fodder crops. In UK trials, residues in pasture treated at 0.48 kg ai/ha were 0.36-7.7 ppm at 14 days after application and 0.07-2.07 at 28 days after application (common moiety method)[70].

The UK PSD and US EPA reported several animal feeding studies[71,72]. In study were two dairy cows (Guernsey) were fed at 1 ppm for 30 days, residues were not found in milk, lean meat or fat (<0.05 mg/kg); liver and kidney residues ranged from 0.4-0.7 mg/kg (common moiety method = linuron and its metabolites convertible to 3,4-dichloroaniline, calculated as linuron). In a separate study, 2 dairy cows (Guernsey) were fed at 50 ppm for 30 days. Residues in milk were 0.3-0.35 mg/kg. Lean meat and fat contained ca. 0.5 mg linuron/kg and liver and kidney 13 mg/kg (common moiety method).

Anticipated residues in liver and kidney tissues using the maximum UK pasture residues at 28 days of 2.07 ppm are 2.07×0.3-0.7 = 0.6-1.4 mg/kg if measured using the common moiety residue. No residues of intact linuron are expected in any tissues and residues would be expected to be below regulatory LOQs for countries monitoring the parent compound.

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

Maldison (malathion)
- is an organophosphate insecticide used for the control of various insects and in cereals. The application rate is up to 1.1 kg ai/ha for cereals and 0.8 kg ai/ha for rice.
The harvest WHP is 1 day for rice.
Cereals: Do not graze or cut for stock food for 1 day after application.

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). The MRL for cereal grains is 8 mg/kg.

[70] Evaluation of fully approved or provisionally approved products. Issue 132: Evaluation on Linuron, May 1995, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK
[71] Evaluation of fully approved or provisionally approved products. Issue 132: Evaluation on Linuron, May 1995, Department of Environment Food and Rural Affairs, Pesticide Safety Directorate. UK
[72] Linuron Tolerance Reassessment Eligibility Decision Residue Chemistry Considerations PC Code 035506; Case 0047 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

No residues of malathion were detected in tissues in a goat metabolism study conducted at a nominal feeding level of 115 ppm[73]. There is no expectation of residues of malathion in tissues arising from the feeding of cereal grains, forage, straw/fodder/hay derived from treated crops.

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

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 sugarcane, cereals (barley, rye, oats, triticale, wheat) and pastures etc. It is applied at an application rate of up to 1.05 kg ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 7 days 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. The Australian MRL for cereal grains is *0.02 mg/kg.

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/kg[74]. 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).

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 feeing level[75]. 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 mg/kg ÷ 500 ppm = <0.0002 and for offal (kidney) is 2.3 mg/kg ÷ 500 ppm = 0.005. No residues are expected in milk of animals fed at up to 300 ppm in the diet.

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

MCPB (4-(2-Methyl-4-chlorophenoxy) butyric acid)
-is a selective herbicide used for the control of broadleaf weeds in and pastures etc. It is applied at an application rate of up to 1.68 kg ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 7 days after application.

There are no Codex or US MRLs for MCPB in animal tissues. The Australian MRL for meat (mammalian) and milk are *0.05 mg/kg. The Australian MRL for cereal grains is *0.02 mg/kg. No

[73] 1999 JMPR - Pesticide Residues in Food - 1999 Evaluations, Part I Residues FAO Plant Production and Protection Paper 157. FAO and WHO 2000
[74] 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
[75] 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.

MCPB was detected in the milk of cows fed MCPB in the ration at 50 ppm for four days (LOD 0.1 ppm)[76].

Metabolism in animals: MCPB is extensively metabolised (> 95 %); main metabolite MCPA (>30% of administered dose, about 50% of urinary activity within 12 hours); also HMCPA, HMCPB unconjugated and conjugated. Bache et al 1964 added the daily amount of 50 ppm MCPB to the fodder of lactating cows for 4 days. The milk did not contain a detectable quantity (0.1 ppm) of MCPB. Of the MCPB administered 7.2-9.2% was metabolised by β-oxidation to MCPA and excreted on the 1st day in the urine. No data are given on the quantity of unchanged MCPB in the urine or metabolites. See also MCPA.

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

Mefenpyr-diethyl (HOE–107892)
-is a herbicide safener used in conjunction with fenoxaprop-methyl for control of certain weeds in wheat, barley, triticale, oats and rye. The application rate is up to 13.5 g ai/ha with application up to 10 weeks after sowing.
The harvest WHP is 10 weeks.
In wheat, mefenpyr-diethyl can also be used at rates of up to 30 g ai/ha, applied up until the 5 tiller growth stage, with no harvest WHP being required when used as directed.

There are Australian and US but no Codex MRLs for mefenpyr-diethyl in animal commodities. The Australian MRLs are *0.05 mg/kg for edible offal, meat (mammalian) and *0.01 mg/kg for milk. The US MRL is 0.1 mg/kg for meat byproducts. The MRL for cereal grains is *0.01 mg/kg. There is an MRL of *0.1 ppm for straw and fodder (dry) of cereal grains and for cereal forage (fresh weight). The Australian residue definition is parent compound. There are US MRLs for barley (0.05, 0.1 and 0.5 mg/kg for grain, straw and hay) and wheat (0.05 and 0.1 mg/kg for grain and straw). The US residue definition for plant commodities is the sum of mefenpyr-diethyl and its 2,4-dichlorophenyl-pyrazoline metabolites (HOE–094270 and HOE–113225).

The US EPA reported that the metabolism of mefenpyr-diethyl in ruminants is adequately understood. A lactating goat was dosed with the compound at a level approximately 56-times the worst case dietary burden for 7-days[77]. Low levels of residues of mefenpyr-diethyl and/or its 2,4-dichlorophenyl-pyrazoline containing metabolites were detected in liver.

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

Mesosulfuron-methyl
-is a pirimidylsulfonylurea herbicide used for weed control in wheat. The application rate is 9.9 g ai/ha.
Do not harvest for 8 weeks after application.
Do not graze or cut for stock food for 4 weeks after application.

The Australian MRLs for animal commodities are all *0.01 mg/kg (including milk). The US MRL for meat by-products is 0.01 mg/kg. The MRL for wheat is *0.02 mg/kg and for wheat forage and

[76] Bache, C.A., Lisk, D.J., Wagner, D.G. and Warner, R.G. 1964. Elimination of [(4-chloro-o-tolyl)oxy] butyric acid in urine from cows. J Dairy Sci. 47, 93-95.
[77] Notice of Filing of Pesticide Petitions, Federal Register: September 26, 1997 (Volume 62, Number 187) Page 50610-50613

straw and fodder dry *0.02 mg/kg. The US MRL for grain is 0.03 mg/kg and for wheat forage 0.6 mg/kg.

The APVMA Gazette[78] noted that Metabolism studies indicate that the excretion of mesosulfuron-methyl in animals is rapid and extensive. Metabolism was less extensive in wheat with very low terminal residues observed in grain and straw. Residue trials conducted in Europe and Australia show residues are not expected to exceed the limit of analytical quantitation in any crop fraction (wheat grain, forage and straw) or in any animal tissues and milk.

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

Metalaxyl

- is a fungicide used on a variety of crops. It is used on *maize, barley* and *wheat* as a seed treatment and is applied at rates up to 175 g ai/100 kg seed for maize and as metalaxyl-M at 3 g ai/100 kg seed for barley and wheat.
A WHP is not required.

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. The MRL for cereal grain is *0.05 mg/kg.

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/kg[79]. It is considered unlikely that feeding of maize derived from plants grown from metalaxyl treated maize seed would generate milk or tissue residues above regulatory LODs.

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

Methabenzthiazuron

-is a urea herbicide that is used for the control of various annual broad leafed weeds in wheat, barley and oats. The application rate is up to 0.6 kg ai/ha for barley and oats and 1.05 kg ai/ha for wheat.
No harvest WHP is required.
Do not graze or cut for stock food for 14 days after application.

There are no Australian, Codex or US MRLs for animal commodities. The Australian MRL for cereal grains is *0.05 mg/kg indicating that residues should not occur in the harvested crop.

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

Methidathion

[78] NRA Gazette 2, 4 February 2003 page 24 NOTICE Mesosulfuron-methyl in the product: ATLANTIS SELECTIVE HERBICIDE

[79] 1982 JMPR Pesticide Residues in Food - 1982 Evaluations, FAO Plant Production and Protection Paper 49. FAO and WHO 1983

- is an organophosphate insecticide used for the control of insects and mites in cereal and forage crops. The maximum application rate is 0.56 kg ai/ha.
The harvest WHP is 6 weeks when harvesting grain for human consumption, else not required.
Do not graze or cut for stock food for 7 days after application at rates exceeding 36 g ai/ha.

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.

The Australian MRL for cereal grains is *0.01 mg/kg.

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 definitions[80]. 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 cereals 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 are no Australian, Codex or US MRLs for methiocarb residues in animal commodities.

There is no Australian MRL for cereal grains.

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 days[81]. 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 cereal 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 and loopers in winter cereals (wheat, oats and barley), sorghum and maize. The application rate is up to 0.45 kg ai/ha.
The harvest WHP is 14 days for the crops listed above.
Winter cereals, sorghum: Do not graze or cut for stock food for 14 days after application.

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

[80] 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
[81] 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982

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 cereal grains is *0.1 mg/kg.

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 definitions[82].

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 maize, winter cereals (wheat, barley, oats and triticale) and sorghum. It is applied at an application rate of up to 2.88 kg ai/ha for maize and sorghum and at up to 0.36 kg ai/ha for wheat, barley, oats and triticale. No harvest or grazing WHPs are required.

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 MRL 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. The Australian MRL for cereal grains (except maize and sorghum) is *0.02 mg/kg, for maize 0.1 mg/kg and for sorghum *0.05 mg/kg. Metolachlor has a primary animal feed commodity MRL of 5 ppm and MRLs of *0.02 ppm for maize forage, 0.1 ppm for maize fodder and 0.2 ppm for sorghum forage (green) and sorghum straw and fodder (dry).

The US EPA reported residues[83] of <0.11-3.19 ppm in sorghum fodder and <0.12-3.02 ppm in field corn fodder with post-emergent application rates of up to 1.8 kg ai/ha for corn.

The US EPA also reported that "*in the available ruminant feeding study, dairy cows were administered metolachlor at a level equivalent to 60 ppm in the feed for up to 28 consecutive days. Animals were dosed by: 1) mixing the compound in the feed; 2) orally via gelatin capsules; and 3) intra-rumen injections. There were no detectable residues of CGA-37913 (<0.006 ppm) or CGA-49751 (<0.01 ppm) in any of the milk samples, and there were no detectable residues of CGA-37913 (<0.02 ppm) and CGA-49751 (<0.02 ppm) in any tissues except liver or kidney. If residues in beef muscle are corrected for decline of CGA-37913 residues during storage, the maximum combined residues in beef muscle would be <0.06 ppm. At each sampling interval, residues in liver were comprised of CGA-37913 at 0.11 ppm and CGA-49751 at 0.02 ppm, for combined residues of 0.13 ppm. In kidney, residues of CGA-37913 were 0.14-0.36 ppm and residues of CGA-49751 were 0.05-0.06 ppm, for combined residues of 0.20-0.42 ppm*." The TF for kidney is estimated to be 0.42/60 = 0.007.

Anticipated residues in kidney if animals are fed forage/fodder with residues at the PAFC MRL of 5 ppm are 5×0.007 = 0.035 mg/kg.

Livestock residues may exceed international and/or domestic market standards

[82] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002
[83] 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

Metosulam
-is a triazolopyrimidine sulfonanilide herbicide used for the control of broad-leafed weeds in winter cereals (*barley*, *oats*, *rye*, *triticale* and *wheat*). It is applied at an application rate of up to 5 g ai/ha.

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 cereal grains is *0.02 mg/kg and for forage, straw and fodder (dry) of cereal grains and other grass like plants *0.1 ppm.

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

Metribuzin
- is a herbicide used on a variety of crops. It is used on wheat, barley and oats for the control of various weeds. The application rate is up to 72 g ai/ha for oats, 278 g ai/ha for barley and 149 g ai/ha for wheat (blade wheat WA only).
A harvest WHP is not required.
Wheat, barley: Do not graze or cut for stock food for 14 days after application.

There are Australian and US but no Codex tolerances for metribuzin in animal tissues. The Australian and US residue definitions differ with the Australian one being parent compound and the US one including the triazinone metabolites of metribuzin. The Australian animal commodity MRLs have all been set at *0.05 mg/kg while the US MRLs for animal tissues have all been set at 0.7 mg/kg and 0.05 mg/kg for milk.
The Australian MRL for cereal grains is *0.05 mg/kg. There is a PAFC MRL of 0.2 ppm.

The US EPA reported beef and diary cattle feeding studies where animals were fed at 3 or 10 ppm in the diet for up to 30 days[84]. Residues were less than the limit of detection in muscle. The TF for fat (10 ppm feed level) was 0.11 while at the 3 ppm feed level it was 0.02. It is unclear why the TF calculated for the 10 ppm feed level should be so much higher than the 3 ppm (also noting the octanol water partition coefficient) but may indicate saturation of excretion pathways. The 3 ppm transfer factor was used to estimate residues as it is closer to the exposure level. The TF for milk at the 3 ppm feed level was 0.0002.

Feeding at the levels expected to arise in straw/hay/stubble from treated crops should not lead to residues of concern in animals, anticipated residues 0.2×0.02 = 0.004 mg/kg for fat and 0.0002×0.2 = 0.0004 mg/kg for milk.

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

Metsulfuron-methyl
is a sulfonylurea herbicide used for the control of various weeds in wheat, barley, triticale and rye. Application is at rates up to 4.2 g ai/ha.
A harvest WHP is not required.

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.

[84] Reregistration Eligibility Decision Metribuzin LIST A CASE 0181EPA 738-R-97-006 February 1998. Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

The MRL for cereal grains is *0.02 mg/kg while 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 US EPA reported that "*the results of an analyses of sorghum grain, fodder and stover (at seed maturity), forage and hay (30 days), after application of metsulfuron methyl at the maximum proposed label rate and twice the rate, show that all residues of metsulfuron methyl and its metabolites (4-hydroxy metsulfuron methyl and its glucose conjugate) were below the limit of quantitation (0.05 or 0.1 ppm)*."

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 (0.008-0.009%) of the parent 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 glucoronide 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: 5, 20 or 100 ppm in the diet for 4 weeks) [85]. 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 reported[86] 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

Molinate

-is a thiocarbamate herbicide used for weed control in rice crops. Application is at rates up to 5 kg ai/ha (crop salvage).
A harvest WHP is not required.

There are no Australian, Codex or US MRLs for molinate in animal commodities. The Australian MRL for rice is *0.05 mg/kg.

[85] Pest Management Regulatory Agency Decision Document E95-04 Tribenuron methyl 8 December 1995
[86] Metsulfuron methyl; Pesticide Tolerances for Emergency Exemptions [Federal Register: December 16, 1999 (Volume 64, Number 241)] [Page 70184-70191]

The US EPA reported[87] that the "*tolerance for residues in/on rice grain should be increased to 0.75 ppm based on combined residues of <0.73 ppm in/on grain from field trials. The tolerance for residues in/on rice straw should be increased to 7.0 ppm based on combined residues of <6.27 ppm in/on straw from field trials. Molinate per se was <0.05 ppm (<LOQ) in/on rice grain and straw from all field trials. An adequate processing study indicated that residues concentrated in hulls and bran processed from molinate-treated rice grain; tolerances of 3.0 and 2.0 ppm, respectively, are required. The livestock metabolism studies indicate that molinate residues of concern are not present in tissues, milk, or eggs from animals dosed with molinate at levels greater than the theoretical maximum dietary exposure. These diets are exaggerated and represent the maximum dietary exposure assuming all rice is treated and bares residues at the tolerance level. Tolerances for molinate residues in livestock commodities are not required based on current uses*".

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 cereal crops. The maximum application rate is 34.8 g ai/ha.
No harvest WHP is required.
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 have been set at *0.05 mg/kg. There is an Australian MRL for cereal grains *0.05 mg/kg and one at 20 ppm for a series of miscellaneous forage and fodder crops including cereals.

A metabolism study with lactating goats dosed orally with dimethoate suggests that residues of omethoate are not expected in animal tissues[88].

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

Oryzalin
- is a herbicide used for the control of various weeds in *barley* and *wheat*. The maximum application rate is 287.5 g ai/ha.
No harvest WHP is required.

There are no Australian, Codex or US MRLs for oryzalin in animal tissues. There is an Australian MRL for cereal grains *0.01 mg/kg.

EFSA reported: When administered orally to a steer at a dose of 168.3 mg/day (equivalent to approximately 49 ppm in the feed), phenyl-labelled [^{14}C]-oryzalin was rpidly eliminated during the first 72 h then slowly for the following 8 days. The main route of elimination was the faeces (84%); about 8.5% was excreted via urine. Parent comprised 95% of the radioactivity in faeces but was not detected in urine. Radioactive residues in the milk of a cow treated with [^{14}C]-oryzalin at the dietary concentration of 10 ppm in the feed remained low (≤0.012 mg eq/kg). The day after the last dose, the level of residues began to decrease. Residues were low in all sampled tissues of a steer treated

[87] Molinate - Revised Human Health Risk Assessment DP Barcode: D271384 PC Code: 041402 Case: 818845 Submission: S589909 19 December 2000. Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[88] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

with radiolabelled oryzalin at the dietary concentration of 10 ppm for 3 days, principally kidney and liver where the maximum radioactive residues at 24 hours after the last dose were observed (0.067 mg eq/kg) while residues inmuscle and fat were much lower (≤0.002 mg eq/kg). In the tissues, oryzalin was not detected.

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

Oxyfluorfen
- is a diphenyl ether herbicide used for the control of weeds in various crops. It is applied prior to sowing winter cereals at a maximum application rate of 14 g ai/ha.
There is no harvest WHP.
Do not graze treated weeds

There are Australian and US but no Codex MRLs for oxyfluorfen in animal commodities. The Australian MRLs have all been set at *0.01 and the US ones at 0.01 mg/kg. The Australian MRL for cereal grains is *0.05 mg/kg. The interval between application and harvest is such that residues are not expected in cereal straw/hay/stubble.

The TF for fat is 0.035 and for milk 0.003[89]. There is no expectation of residues in milk or animal tissues including fat.

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

Paraquat
- is a herbicide used for the control of weeds in various crops. The application rate is up to 0.6 kg ai/ha with application in the fallow period or prior to sowing.
There is no harvest WHP. 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 mg/kg and 0.05 mg/kg respectively, while *0.01 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 MRL for cereal grains (except rice and maize) is *0.05 mg/kg. The MRL for maize is 0.1 mg/kg and for rice 10 mg/kg. The Australian PAFC MRL is 500 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. Note the half-life for paraquat decline in tissues is <3 days.

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

Pendimethalin
-is a selective herbicide used for the control of annual ryegrass and certain broadleaf weeds in sugarcane, cereals etc. It is applied at an application rate of up to 0.59 kg ai/ha (pre-plant) for wheat and barley and at 1.49 kg ai/ha for maize (post-planting, pre-emergent) and rice (post-plant and flushing).
No harvest or grazing WHPs are required.

[89] Reregistration Eligibility Decision (RED) Oxyfluorfen List A Case 2490, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

There are Australian MRLs 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 the cereal grains listed is *0.05 mg/kg.

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 tissues[90].

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

Permethrin
- is a synthetic pyrethroid insecticide used for the control of various insects in crops. It is registered on wheat, barley and oats with application at rates of up to 0.1 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. The Australian MRL for cereal grains 2 mg/kg.

The 1980 JMPR[91] reported residues of permethrin in corn stover of 0.99-18 ppm (mean 7.2 ppm) at 0-4 days after 8 applications at 0.11 kg ai/ha.

The 1983 JMPR[92] reported residues in sorghum forage and stover from application at 0.22 kg ai/ha. Residues in fodder at 14-15 days after the last application were 0.95-5.6 ppm while those in stover at 28-31 days were 3.7-24 ppm.

The TF for fat is 0.04[93]. Residues in fat from feeding at 18 ppm could be as high as 0.7 ppm. The residues in fat were reported to decline with an initial half-life of < 7 days.
The TF for milk is 0.002 and if fed at 18 ppm would give rise to residues in whole milk of 0.036 mg/kg, less than the relevant international standards.

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

Phosmet
-is an organophosphous acaricide used for the control of mites in cereal crops. Application is at rates up to 52.5 g ai/ha.
There is no harvest WHP

[90] Reregistration Eligibility Decision Pendimethalin List A Case 0187, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[91] 1980 JMPR Pesticide Residues in Food - 1980 Evaluations, FAO Plant Production and Protection Paper 26 Sup. FAO and WHO 1981
[92] 1983 JMPR Pesticide Residues in Food - 1983 Evaluations, FAO Plant Production and Protection Paper 61. FAO and WHO 1985
[93] 1981 JMPR Pesticide Residues in Food - 1981 Evaluations, FAO Plant Production and Protection Paper 42. FAO and WHO 1982

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

There are Australian but no Codex or US MRLs for phosmet in animal commodities. The Australian MRLs are 1 mg/kg for cattle edible offal and meat (in the fat) and *0.05 mg/kg for sheep edible offal and meat and 0.2 mg/kg for milks [in the fat]. The Australian MRL for cereal grains is *0.05 mg/kg.

Combined residues of phosmet and its oxon in dairy cows dosed at the equivalent of 100 ppm in the feed for 21 days were 0.03-0.19 mg/kg in fat and <0.05 mg/kg in kidney, liver and muscle as well as milk[94].

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

Picloram
- 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. The application rate for barley, wheat, canary grass, oats and triticale is 26g ai/ha.
A harvest WHP is not required.
Do not graze or cut for stock food for 7 days after application

There are no Codex MRLs for picloram. The residue definition for the US and Australia is parent compound. The Australian MRL for edible offal (mammalian) is 5 mg/kg while the US tolerance for cattle kidney is 5 mg/kg. The corresponding milk MRLs are *0.05 and 0.05 mg/kg. The Australian MRL for cereal grain is 0.2 mg/kg. Picloram does not accumulate in fat.

The TF for kidney is 0.01[95] and milk 0.0003[96]. Picloram residues decline rapidly upon withdrawal of picloram from the diet when fed at 1600 ppm for 28 days such that after 3 days residues are less than the limit of analytical quantitation (0.05 mg/kg) for all tissues except kidney which had residues of 0.06 mg/kg.

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

Picolinafen
-is an aryloxypicolinamide herbicide for the post-emergent control of various weeds in cereal crops. It is registered for use on winter cereals (wheat, barley, oats, triticale and rye) at an application rate of up to 25 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 8 weeks after application.

There are Australian but no Codex or US MRLs for picolinafen in animal commodities. The Australian MRLs are 0.05 mg/kg for edible offal (mammalian), *0.02 mg/kg for meat (mammalian) (in the fat)) and *0.0.1 mg/kg for milks.

The MRL for cereal grains is *0.02 mg/kg and the animal feed MRLs are 0.5 ppm for forage of cereal grains (green) and *0.02 ppm for straw and fodder (dry) of cereal grains.

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[94] 1976 JMPR. Evaluations of some pesticide residues in food. AGP:1976/M/14, 1977
[95] Kutchinski, A.H. and Riley, V. (1969) Residues in various tissues of steers fed 4-amino-3,5,6-trichloropicolinic acid, *J. Agr. Food Chem*. 17 (2) 283-287.
[96] Kutchinski, A.H. (1969) Residues in milk from cows fed 4-amino-3,5,6-trichloropicolinic acid, *J. Agr. Food Chem*. 17 (2) 288-290.

In a goat metabolism study where animals were dosed at the equivalent of 5 ppm in the feed, no residues were detected in milk or tissues[97].

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

Pinoxaden
-is a selective herbicide used for the control of various grass weeds in *barley* and *wheat*. The application rate is up to 30 g ai/ha.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 3 weeks after application.

There are Australian and US but no Codex MRLs for pinoxaden in animal commodities. The Australian MRLs for meat and offal are *0.02 mg/kg and for milk *0.01 mg/kg. The US tolerances are only for cattle and are 0.04 mg/kg for fat, meat and offal and 0.02 mg/kg for milk.

The Australian MRL for barley and wheat are 0.1 mg/kg. There are also MRLs for barley forage (green) 3 ppm, barley straw and fodder, dry 1 ppm, wheat forage (green) 3 ppm and wheat straw and fodder, dry 1 ppm.

The PMRA reported: Two goat metabolism studies were performed; the first one was carried out with the parent compound, pinoxaden, and the second one with a predominant plant metabolite, M4. In the first study, pinoxaden (phenyl radiolabel) was administered orally to two lactating goats (Alpine breed) at dose levels of 120.6 ppm (mg/kg feed/day) for four consecutive days. Approximately 83% of the administered dose (AD) was eliminated in excreta (feces, urine, gastrointestinal tract and rumen), 0.009% of the AD was transferred to milk and 0.260% of the AD was recovered in tissues, demonstrating low tissue burden. The highest concentrations of ^{14}C-residues were detected in kidney (2.953 ppm) and liver (1.160 ppm). The parent compound, pinoxaden, was not detected in any of the matrices, indicating its rapid and complete metabolism in the lactating goat. The predominant metabolite detected in all the goat matrices was M2, which is the hydrolysis product of the parent molecule pinoxaden. Several minor metabolites (M3, M4, M6, M12, M13, M19, M20, M22, M23, M24, M26, M27 and M28), each representing less than 10% TRRs, were detected in feces and in some tissues and milk. In the second study, metabolite M4 was administered orally to two lactating goats (Alpine breed) at dose levels of 9.8 ppm (mg/kg feed/day) for four consecutive days. Approximately 93% of the AD was eliminated in excreta (feces, urine, gastrointestinal tract and rumen). ^{14}C-residues in milk, muscle, fat and blood were below the LOQ (0.002 ppm in milk and 0.011 ppm in tissues). Only minor fractions of the total AD were transferred to the remaining tissues (<0.1% of the AD). The highest concentrations of 14C-residues were detected in kidney (0.044 ppm) and liver (0.025 ppm). The predominant metabolite, identified in all tissues containing detectable residues, was unchanged M4. The only other metabolite identified was M10, which is the hydroxylation product of M4. M10 represented only a minor fraction of the TRRs in liver and kidney, and represented less than 10% of TRRs in feces. These results indicate that residues of pinoxaden and the major plant metabolite M4 (and by inference all metabolites sharing a similar structure) have a very low transfer into the edible tissues and milk of lactating goats.

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

[97] PMRA Regulatory Note REG2003-Picolinafen, 17 February 2003

Pirimicarb
-is a carbamate aphicide used for the control of aphids in winter cereals. The application rate is up to 0.15 g ai/ha.
The harvest WHP is 6 weeks.
Do not graze or cut for stock food for 6 weeks 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.

The Australian MRL for cereal grains is *0.02 mg/kg. There is also 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 diet, a level of exposure much greater than would be anticipated to arise from cereal straw/hay/stubble[98]. 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

Profoxydim
-is a herbicide used for the control of certain grasses in *rice* crops. The application rate is 75 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 Codex or US MRLs for profoxydim in animal commodities. The Australian MRLs are 0.5 mg/kg for edible offal and *0.05 mg/kg for other tissues and *0.01 mg/kg for milk. The Australian MRL for rice of 0.05 mg/kg. There are MRLs of 5 ppm for rice forage and *0.02 ppm for rice straw and fodder, dry.

The APVMA reported: When lactating goats were administered 2 forms of radiolabelled profoxydim at 10 ppm per day for 6 consecutive days, maximum radioactivity in milk was 0.01 ppm. However, none of the radioactive components in milk corresponded to profoxydim or its main metabolites. The total radioactive residue found in goat liver after 6 days was 0.31 and 0.43 ppm for ^{14}C cyclohexenone and phenyl labelled compound respectively. Of this 0.053 and 0.086 ppm corresponded to unchanged parent compound. The total radioactive residues found in kidneys after 6 days were 0.13 and 0.15 ppm. Of this 0.002 and 0.001 ppm corresponded to unchanged parent compound. Residues were lower in muscle and in fat, at ≤0.006 and ≤0.009 ppm respectively.

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

Propachlor
-is a herbicide used for the control of certain grasses and broad-leafed weeds in *maize, sorghum* and *sweet corn* crops. The application rate is 3.36 kg ai/ha.
A harvest WHP is not required.

There are Australian and US but no Codex MRLs for propachlor in animal commodities. The Australian MRLs are 0.1 mg/kg for edible offal and *0.02 mg/kg for other commodities including

[98] 1978 JMPR - Pesticide Residues in Food - 1978 Evaluations, FAO Plant Production and Protection Paper 15 Suppl. FAO and WHO 1979

milk. The US MRLs for cattle fat and meat byproducts except kidney is 0.05, kidney 0.2 and for meat and milk 0.02 mg/kg. The Australian MRLs for sorghum of 0.2 mg/kg and for other cereal grains 0.05 mg/kg. The animal feed commodity MRLs are 1 ppm for maize fodder, 5 ppm for maize forage and sorghum straw and fodder (dry) and 15 ppm for sorghum forage (green).

In an animal transfer study, dairy cattle were fed propachlor metabolites at rates of up to 50 ppm for 28 days, residues were detected in kidney (target tissue), liver, muscle, fat and milk[99]. A transfer factor of 0.01 was calculated for kidney. Anticipated residues on feeding sorghum forage (green) with residues at the level of the MRL and at 100% of the diet are 15×0.01 = 0.15 mg/kg for kidney.

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

Propanil

-is an acetamide herbicide used for the control of Barnyard grass in rice. The maximum application rate is 5.9 kg ai/ha.
A harvest WHP is not required.

There are Australian and US but no Codex MRLs for propanil. The Australian (parent compound) and US (sum of propanil and its metabolites expressed as propanil) residue definitions differ. The Australian MRLs are *0.1 mg/kg for cattle and sheep edible offal and meat and *0.01 mg/kg for milk. The US MRLs are 0.1 mg/kg for cattle fat, 0.05 for meat and milk and 1 mg/kg for meat bypr.

The MRL for rice is 2 mg/kg. (Note US revised rice straw MRL to be 75 ppm, rice MRL from 2 ppm to be 10 ppm).

Maximum residues of propanil and metabolites convertible to 3,4-dichloroaniline (US residue) in cows dosed at the equivalent of 15 ppm in the diet were 0.31 mg/kg in liver, 0.77 mg/kg in kidney, <0.05 mg/kg in muscle and 0.1 mg/kg in fat[100]. Based on the results from a lactating goat metabolism study it is expected that propanil *per se* accounts for <10% of the residue measured as 3,4-DCA.

In field trials conducted in the states of AR, CA, LA, and TX propoanil was applied at 4.5-9.0 kg ai/ha. Rice straw samples were collected at a 60 day PHI. Propanil residues (determined as base-releasable 3,4-DCA) ranged from 0.08 ppm to 19 ppm. In another study where field trials were conducted in AR, LA, and TX, propanil residues (determined as base-releasable 3,4-DCA) ranged from 0.23 ppm to 30 ppm in/on rice straw harvested either 67 to 80 days following the last of two postemergence applications at 4.5 kg ai/ha/application or 56 to 58 days following a single postemergence application at 6.7 kg ai/ha.

Anticipated residues in kidney from feeding propanil with residues in rice straw of 30 ppm are 30×0.05 = 1.5 mg/kg (US residue definition). In order to refine the risk assessment, more information is required regarding likely residues in forage and straw for the Australian use pattern.

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

[99] Reregistration Eligibility Decision, Propachlor List A Case 0177, Environmental Protection Agency, Office Of Pesticide Programs, Special Review And Reregistration Division, EPA 738-R-015
November 1998
[100] Propanil Revised Chronic Dietary Exposure Assessment (PC Code 028201); DP Barcode D281060; Case 0226. Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

Propiconazole
is a DMI fungicide used for the control of various fungal rust, scald and mildew diseases in barley and wheat. Application is at a maximum rate of 0.125 kg ai/ha.
The harvest WHP is 28 days.

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 and 0.05 mg/kg for fat and meat by-products (except liver and kidney) and 0.05 mg/kg for milk. The Australian MRLs for forage of cereals (green) are 10 ppm and for straw and fodder (dry) of cereal grains 5 ppm.

Residues of propiconazole in forage were reported by the JMPR to be 0.4-0.9 ppm for parent compound and 1.12-1.7 for total residues at 7-8 days after application at 125 g ai/ha and <0.04-0.11 ppm for parent compound and 0.24-0.76 for total residues at 28 days.

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 parent residues in milk and tissues (<0.05 mg/kg) [101]. After feeding cows for 14 days at 15 ppm the total residues were undetectable in milk and 0.63 mg/kg in kidney (TF = 0.042).
Anticipated total residues in kidney on feeding forage with residues at the MRL are 10×0.042 = 0.42 mg/kg.

Livestock residues are anticipated to be below typical method LOQs when assessed against the Australian and Codex residue definitions. However, if residues are assessed against the US residue definition they may exceed international and/or domestic market standards.

Prosulfocarb
-is a herbicide used for the control of certain grasses in *barley* and *wheat* crops. The application rate is 2 kg ai/ha.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 10 weeks after application.

There are Australian but no Codex or US MRLs for prosulfocarb in animal commodities. The Australian MRLs are *0.02 mg/kg for edible offal and 0.02 mg/kg for other commodities including milk. The Australian MRLs for barley and wheat are *0.01 mg/kg. MRLs for barley and wheat, forage, fodder and straw are *0.01 mg/kg.

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

Prothioconazole
-is a fungicide used for the control of various diseases in *barley* and *wheat* crops. The application rate is 63 g ai/ha.
DO NOT harvest for 5 weeks after application.

[101] 1987 JMPR Pesticide Residues in Food - 1987 Evaluations, Part I Residues FAO Plant Production and Protection Paper 86/1. FAO and WHO 1988

DO NOT graze or cut for stock food for 14 days after application.

There are Australian, Codex or US MRLs for prothioconazole in animal commodities. The Australian MRLs are 0.1 mg/kg for edible offal and *0.01 mg/kg for other tissues and *0.004 mg/kg for milk. The Codex MRLs are 0.2 mg/kg for edible offal and 0.01 mg/kg for other tissues and *0.004 mg/kg for milk. The US tolerances are 0.1 mg/kg for fat, 0.2 mg/kg for edible offal and 0.02 mg/kg for meat and milk. The Australian residue definition for animal commodities is sum of prothioconazole, prothioconazole desthio, prothioconazole-3-hydroxy-desthio and prothioconazole-4-hydroxy-desthio, expressed as prothioconazole. The Codex residue definition for animal commoditoies is prothioconazole-desthio. The Australian MRLs for barley and wheat are 0.3 mg/kg. Feed commodity MRLs are : barley forage and fodder 7 ppm, barley straw 3 ppm, oat forage (green)[fresh weight] *0.05 ppm, oat straw and fodder, dry *0.05 ppm, wheat forage and fodder 7 ppm and wheat straw 3 ppm.

The cattle feeding studies were conducted with the parent compound prothioconazole and JAU 6476-desthio, which is the predominant metabolite in plant materials. Ten lactating German dairy cattle (breed: Holstein Friesian; three cows/dose group and one control cow) were dosed orally (Heinemann, O, Auer, S, 2001), via capsule, for 28 consecutive days with JAU6 476-desthio at dose rates of either 0 mg/kg feed (control), 4 mg/kg feed, 25 mg/kg feed or 100 mg/kg feed. At the end of the 28-day dosing period, the cows were sacrificed within 24 hours after the last capsule treatment.

Table 85 Average residue concentrations (mg/kg) in the edible tissues of dairy cattle after 28 days of dosing with JAU 6476-desthio

Dose group (mg/kg feed)	M14a	M15a	M04a	Total b	M14a	M15a	M04a	Totalb
	Liver				Kidney			
4	0.01	0.01	0.02	0.04	0.01	0.01	< 0.01	0.02
25	0.05	0.03	0.15	0.22	0.06	0.06	0.03	0.14
100	0.18	0.11	0.93	0.95	0.28	0.25	0.13	0.65
	Muscle				Fat			
4	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
25	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01
100	< 0.01	< 0.01	< 0.01	0.02	0.01	0.01	0.05	0.07

a M14: JAU 6476-3-hydroxy-desthio, M15: JAU 6476-4-hydroxy-desthio, M04: JAU 6476-desthio
b Sum of M14, M15, and M04, expressed as mg/kg JAU 6476-desthio equivalents

JAU6476-desthio total residues in milk at the 4 and 25 ppm feeding levels were below the LOQ (0.004 mg/kg), whereas at the 100 ppm feeding level, total residues increased from < 0.004 mg/kg (day 1) to a plateau level (day 4 to day 29) of 0.006 to 0.010 mg/kg for two animals and of 0.013 to 0.021 mg/kg for one animal. Liquid-liquid partitioning of whole milk against n-hexane showed that M04 was in milk fat and the metabolites M14 and M15 remained in the aqueous phase. However, the total residues remained preferentially in the aqueous phase, i.e., 0.015 mg/kg with only 0.004 mg/kg in the n-hexane phase, indicating no accumulation in milk fat.

It is anticipated that animal product residues will be below international limits.

Pyraflufen-ethyl
-is a herbicide used for the control of certain annual broadleaf weeds in winter cereal (*wheat, barley, triticale*) crops. The application rate is 8 g ai/ha.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 14 days after application.

There are Australian and US but no Codex MRLs for pyraflufen-ethyl in animal commodities. The Australian MRLs are *0.02 mg/kg for edible offal, meat and milk. The US tolerances are 0.02 mg/kg for edible offal and milk. The Australian MRLs for cereal grains *0.02 mg/kg and for straw and fodder (dry) of cereal grains of 1 mg/kg.

The APVMA-PRS reported: A lactating goat was orally administered [^{14}C-pyrazole]-pyraflufen-ethyl by capsule once daily for 3 days at a dose rate was equivalent to 10 mg pyraflufen-ethyl/kg feed (0.6 mg/kg bw/day). Milk was collected twice daily. Slaughter occurred 23 hours following cessation of the final dose. Following the course of administration the TRR recovered from all sources accounted for 79.8% of the administered dose. Within 23 hours of oral administration, absorbed pyraflufen-ethyl was quantitatively hydrolysed to metabolite E1 in liver, kidney and milk. Two other minor metabolites (E-2 and E-9) where observed in liver and kidney at less than 10% of the total. In milk no significant metabolite was observed and only E-9 was detected at any significant concentration (<10% total). No significant residues were observed in muscle or fat. Residues had declined to a maximum of 0.08 mg/kg in kidney at slaughter.

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

Pyrasulfotole

-is a herbicide used for the control of certain annual broadleaf weeds in *wheat, barley, triticale and cereal rye* crops. The application rate is 50 g ai/ha when applied with MCPA.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 5 weeks after application.

There are Australian and US but no Codex MRLs for pyrasulfotole in animal commodities. The Australian MRLs are 0.5 mg/kg for edible offal, *0.01 mg/kg for meat and milk. The US tolerances are 0.35 mg/kg for liver, 0.06 mg/kg for other edible offal, 0.02 mg/kg for fat and meat and 0.01 mg/kg for milk. The Australian MRLs for cereal grains is *0.02 mg/kg and straw and fodder (dry) of cereal grains *0.02 ppm and forage of cereal grains 0.5 ppm.

Pyrasulfotole was administered orally via gelatin capsule to 10 lactating Holstein cows (Bos taurus) for 29 consecutive days. There were 3 animals per treatment group and a single control animal, which were dosed at 0 ppm (control), 3 ppm, 9 ppm or 30 ppm in the feed (dry weight basis).

Matrix	Feeding Level (ppm/d)	n	LOD	Min	Max	Median	Mean	Standard Deviation
Milk	30a	30	0.0015	0.0042	0.0134	0.0103	0.0096	0.0024
Milk Fat	30	3	0.0003	0.0061	0.0085	0.0074	0.0073	0.0012
Milk Skim	30	3	0.0002	0.0086	0.0105	0.0090	0.0094	0.0010
Fat	3	3	0.0007	0.0017	0.0062	0.0040	0.0040	0.0022
	9	3	0.0007	<LOD	0.0033	——	——	——
	30	3	0.0007	0.0024	0.0143	0.0046	0.0071	0.0064
Kidney	3	3	0.0004	0.1748	0.2224	0.1973	0.1982	0.0238
	9	4	0.0004	0.1232	0.4240	0.2420	0.2631	0.1515
	30	3	0.0004	0.3778	0.4144	0.3811	0.3911	0.0202
Liver	3	3	0.0005	1.019	1.230	1.187	1.145	0.1113
	9	3	0.0005	0.6922	1.594	1.577	1.288	0.5159
	30	3	0.0005	1.642	1.939	1.795	1.792	0.1488
Muscle	3	3	0.0006	<LOD	0.0010	——	——	——
	9	3	0.0006	<LOD	0.0007	——	——	——
	30	3	0.0006	0.0013	0.0039	0.0025	0.0026	0.0013

It is anticipated that animal product residues will be below typical method LOQs for muscle and fat but may exceed those for liver and kidney. Anticipated liver residues are ca. 0.2 mg/kg.

Livestock residues may exceed international and/or domestic market standards

Pyroxsulam

-is a herbicide used for the control of certain grass and annual broadleaf weeds in *wheat* (excluding certain durum varieties) crops. The application rate is 15 g ai/ha.
A harvest WHP is not required.
DO NOT graze or cut for stock food for 6 weeks after application.

There are Australian no Codex or US MRLs for pyroxsulam in animal commodities. The Australian MRLs are *0.01 mg/kg for edible offal, meat and milk. There US tolerances for wheat but tolerances for anoimal commodities were determined not necessary (negligible residues). The Australian MRLs for wheat grain is *0.01 mg/kg and for wheat straw, fodder and forage 0.1 ppm.

The US EPA reported a goat metabolism study where goats were dosed with [^{14}C]-pyroxsulam labeled in either the pyridine-ring (PY) or triazolopyrimidine-ring (TP). Doses were orally administered for 7 consecutive days, corresponding to a dose level of 0.4 mg/kg body weight or the equivalent of 12 ppm in the feed. The animals were sacrificed within 24 hours of administration of the final dose. A total of 84% and 93% of the administered radioactivity was recovered following administration of the TP and PY labeled doses, respectively. The majority of the radioactivity was excreted in the urine and feces: 83% for the TP-dosed goat, and 91% for the PY-dosed goat. For both labels, the percentages of eliminated radioactivity in urine and feces were similar, i.e., 37% in urine for both labels and approximately 45% or 54% in feces for the TP and PY labels, respectively. The only tissues containing sufficient radioactivity for characterization and identification were the liver and kidney. Residues in these tissues were comprised largely of unchanged pyroxsulam which comprised 42-63% of the TRR (0.008-0.010 mg equiv/kg) in kidney samples and 41-64% of the TRR (0.008-0.009 mg equiv/kg) in the liver. Small amounts of 5,7-di-OH- pyroxsulam (up to 1.2% TRR, ≤0.001 mg equiv/kg) were identified in PY labeled liver and kidney samples. The remainder of extractable residues in samples from both labels was comprised of at least two unidentified metabolites, which accounted for ≤14.2% of the TRR (0.004 mg equiv/kg) in liver and kidney.
The results indicate that there was no significant metabolism or transformation of pyroxsulam, with the majority of administered dose being excreted rapidly in the urine and feces as unchanged pyroxsulam. The metabolites 5,7-di-OH- pyroxsulam and 7-OH- pyroxsulam were identified in the urine, and 7-OH- pyroxsulam in the feces as minor components of the residue. The proportion of pyroxsulam and its metabolites were similar in samples for both labels, indicating that there was no significant cleavage of the molecule across the sulfonamide nitrogen between the pyridine and triazolo-pyrimidinyl ring.
Pyroxsulam residues are not readily transferred into milk or edible tissues of ruminants following oral administration. The only radioactive component identified in milk, accounting for ≥95% of the residue was unchanged pyroxsulam. Of the edible tissues, only liver and kidney contained TRR levels greater than 0.01 mg/kg. Other than parent, the only identifiable component of the residue was 5,7-di-OH- pyroxsulam, present at 0.001 mg equiv/kg.

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 approved for use on wheat at rates up to 20 g ai/ha (3-6 weeks after sowing).
A harvest WHP is not required.
Do not cut or graze for stock food for 7 weeks after application.

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-hydroxycyclohexe-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. The Australian MRL for wheat is *0.1 mg/kg and for wheat forage green and also straw and fodder dry of *0.1 mg/kg.

Note: The USA also has tolerances for several major animal feeds including alfalfa forage and hay (40 ppm), bean hay and clover hay (50 ppm). The tolerances suggest that sethoxydim may be fed at up to 50 ppm in the diet without exceeding the USA animal commodity MRLs. Noting the application rates for wheat and the respective MRLs it is considered unlikely that feeding wheat grain of derived feeds would lead to residues in animals above the USA MRLs.

The US EPA reported[102] 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.

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

S-metolachlor
see metolachlor

Spinosad
-is an antibiotic insecticide used for the control of heliothis and loopers in sorghum. The application rate is up to 72 g ai/ha.
Do not harvest for 14 days after application.
Do not graze or cut for stock food for 14 days after application.

There are Australian, Codex and USA MRLs for spinosad in animal commodities. The Australian and US MRLs applicable to cattle meat (fat) are 2 and 50 mg/kg respectively. The respective milk MRLs are T0.1 and 7 (85 mg/kg for whole milk fat) mg/kg. The Codex MRL is 3 mg/kg for cattle

[102] 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

fat and 2 mg/kg for fat of other mammals and 1 mg/kg for cattle milk (5 m/kg for milk fat). There is an Australian MRLs of 1 mg/kg for cereal grain and of 0.5 ppm for sorghum forage, straw and fodder.

The TF for cattle fat is 0.5-0.6[103] giving an anticipated maximum residue in cattle fat from feeding of sorghum fodder at 100% of the diet of 0.5×0.6 = 0.3 mg/kg.
The TF for milk is 0.05 giving an anticipated maximum residue in milk from feeding of sorghum fodder at 100% of the diet of 0.5×0.05 = 0.025 mg/kg.

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

Sulfosulfuron
-is a sulfonylurea herbicide used for the control of various weeds in wheat and triticale crops.
Application is made prior to sowing at rates up to 18.75 g ai/ha.
No harvest WHP is required.

There are Australian and US but no Codex MRLS for animal commodities. The Australian MRLs have all been set at *0.005 mg/kg. The US MRLs are 0.3 mg/kg for cattle meat by-products and 0.01 mg/kg for cattle meat and 0.02 mg/kg for fat (same MRLs for sheep).

The Australian MRL for triticale and wheat is *0.01 mg/kg. The animal feed MRLs are 0.1 ppm for triticale and wheat straw and fodder (dry).

In a goat metabolism study, unchanged sulfosulfuron was the major terminal residue identified in liver, kidney, muscle and milk, accounting for 13 to 89 % of the total radioactive residue (0.0019 – 0.15 ppm) [104]. Total radioactive residues in individual tissues were as follows: kidney and liver; 0.14 - 0.18 ppm, muscle; 0.0079 -0.021 ppm, fat; < 0.0022 - 0.0079 ppm, while the levels in milk ranged from 0.027 - 0.030 ppm. Parent sulfosulfuron was the major terminal residue identified in kidney, liver, muscle and milk accounting for 73 – 98 %, 81 – 86 %, 72 – 89 % and 19 – 37 %, respectively, of the extractable residues. The residues in fat were not characterized based of their low content. The low level of apparent bioaccumulation was consistent with the log Pow value of < 1 for parent sulfosulfuron (range of pH 5-9).

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

Tebuconazole
-is a DMI fungicide used for the control of rust and powdery mildew etc in wheat oats and barley.
The application rate is up to 125 g ai/ha.
The harvest WHP is 5 weeks.
Do not graze or cut for stock food for 14 days after application.

There are Australian, Codex and US MRLs for tebuconazole in animal tissues. The Australian and Codex residue definition is tebuconazole while the USA residue definition is the sum of tebuconazole and its 1-(4- chlorophenyl)-4,4-dimethyl-3-(*1*H-1,2,4-triazole-1-yl-methyl)-pentane-3,5-diol metabolite. The Australian MRLs 0.5 mg/kg for edible offal mammalian, 0.1 mg/kg for meat (mammalian), and 0.05 mg/kg for milk. The Codex MRLs are *0.05 mg/kg for both cattle

[103] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002
[104] Public Release Summary on Evaluation of the new active SULFOSULFURON in the product MONZA HERBICIDE National Registration Authority for Agricultural and Veterinary Chemicals 1998 Canberra Australia

meat and cattle edible offal, and *0.01 mg/kg for milk. The US MRLs are 0.2 mg/kg for cattle and sheep mbyp and 0.1 mg/kg for milk.

The Australian MRL for cereal grains is 0.2 mg/kg. There is a PAFC MRL of 50 ppm.

Residues in forage following application at the Australian rate were <2 ppm in trials reported by JMPR. Residues of tebuconazole were not detected (<0.05 mg/kg) in muscle and fat of dairy cattle dosed at the equivalent of 250 ppm in the diet for 28 days[105]. The residues in liver were 0.2 mg/kg. The TF for liver is 0.0008. There is no reasonable expectation of residues of tebuconazole in meat and fat arising from feeding of straw/hay/stubble from treated cereal crops.

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

Terbufos
-is a organophosphorous insecticide/nematicide used on maize and sorghum for the control of wireworm. Application is at rates up to 0.3 kg ai/ha.
A 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.

The Australian MRL for cereal grains is *0.01 mg/kg. The animal feed MRLs are *0.05 mg/kg for forage of cereal grains and straw and fodder (dry) of cereal grains.

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

Terbutryn
- is a selective herbicide used for the control of seedling broadleaf weeds in cereals, pasture and sugarcane. In wheat, barley, triticale and oats it is applied at rates up to 0.425 kg ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 7 days after application.

There are no Codex or US MRLs for terbutryn. The Australian MRL for meat (mammalian) (fat) and milks are 0.1 mg/kg and for edible offal (mammalian) 3 mg/kg. The Australian cereal grain MRL is *0.1 mg/kg. Animal feed commodity MRLs of 30 ppm have been set for straw, fodder and hay of cereal grains and other grass-like plants.

The APVMA Animal Residue Data Sheet (July 2003) notes that the Australian animal MRLs were based on a feeding and/or metabolism study where animals were dosed at the equivalent of 60 ppm in the diet.

Livestock residues may exceed international and/or domestic market standards

Thiamethoxam
- is a nitroguanidine insecticide used as a seed dressing for the control of wireworms in sorghum and maize. The application rate is up to 140 g ai/100 kg seed for sorghum and 0.49 g ai/1000 seeds for maize.

[105] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

No harvest WHP required as it is a seed dressing.
Maize: Do not cut graze or for stock food for 6 weeks after planting
Sorghum: Do not cut graze or for stock food for 8 weeks after planting

There are Australian and USA but no Codex MRLs for thiamethoxam in animal commodities. The Australian MRLs are all *0.02 mg/kg except milk which is *0.005 mg/kg. The US MRLs applicable to cattle are 0.02 and meat byproducts 0.04 mg/kg. There are Australian MRLs of *0.02 mg/kg for sweet corn (corn-on-the-cob), 0.5 ppm for maize fodder and forage and sorghum forage and 0.1 ppm for sorghum straw and fodder (dry).

Metabolism studies in animals demonstrated that parent thiamethoxam was a major residue in all tissues, with the exception of liver[106]. A dose level equivalent to 100 ppm in the feed was used in these studies. For animal feed commodities, an MRL of 0.5 ppm was recommended for dry straw, forage, fodder and trash of maize, sweet corn, sorghum and cotton. If we assume that treated produce contains residues at the MRL of 0.5 ppm and comprises 100% of the animal diet, then scaling the residue results from the metabolism study (goats) gives an estimate of the likely residues in tissues from normal feeding of treated produce. Anticipated residues in muscle, fat, liver, kidney and milk are < 0.008 mg/kg. Parent compound is estimated in muscle, fat, kidney and milk at 0.0006, 0.0014, 0.008 and 0.002 mg/kg, respectively. These values are considered to be an overestimate of residues in tissues from consumption of treated produce. Residue trials provided for various crops demonstrated that thiamethoxam residues will be present below the analytical limit of quantitation in crop parts after the appropriate grazing / stock food restraints of 6 and 8 weeks for maize/corn and sorghum, respectively. The estimates of residues in tissue and milk are therefore considered to be conservative and much higher than would be expected from normal consumption of treated produce.

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

Thifensulfuron-methyl
-is a sulfonylurea herbicide used for the control of various weeds in wheat, barley and triticale crops. Application is made at rates up to 30.7 g ai/ha.
The harvest WHP is 8 weeks.
Do not graze or cut for stock food for 14 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 MRL for cereal grains (except maize and rice) is *0.02 mg/kg. The animal feed MRL for straw and fodder (dry) of cereal grains is 5 ppm.

The PMRA stated that[107] "Extensive residue studies show that, when applied during early growth stages at recommended application rates (two-leaf stage but before flag-leaf or shot-blade stage), no residues of parent compound are detected above the sensitivity of the analytical method (0.02 ppm) in wheat, oats and barley grain at harvest. No residues are detected in cereal straw (<0.05 ppm). A residue decline study indicates that even at 4 times the maximum proposed rate, residues in green cereal foliage will be very low (<0.1 ppm) 7 days after application."

[106] Public Release Summary on Evaluation of the new active THIAMETHOXAM in the product CRUISER 350 FS INSECTICIDE SEED TREATMENT National Registration Authority for Agricultural and Veterinary Chemicals January 2001 Canberra Australia
[107] PMRA Decision Document E90-01 Thifensulfuron

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

Thiobencarb
-is a thiocarbamate herbicide used for the control of Barnyard grass and dirty dora in rice. Application is at rates of up to 4 kg ai/ha.
A harvest WHP is not required.

There are US but no Australian or Codex MRLs for thiobencarb in animal commodities. The Australian residue definition is parent compound while the US one is the sum of thiobencarb and its chlorobenzyl and chloro-phenyl moiety-containing metabolites. The US MRLs are 0.2 mg/kg for cattle, sheep and goat meat, fat and meat by-products products and 0.05 mg/kg for milk.

The Australian MRL for rice is *0.05 mg/kg.

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

Thiodicarb
see methomyl

Thiram
- is a dithiocarbamate fungicide used on a variety of crops. It is used sorghum seed at 240 g ai/100 kg seed (QDPI board approval), on barley at 510 g ai/1000 kg seed (APVMA permit 5256).
A harvest WHP is not required.
Barley: Do not graze plants grown from treated seed or cut for stock food within 7 weeks of sowing

There are Australian and Codex but no US MRLs for thiram in animal commodities. The Australian MRL for edible offal is 2 mg/kg while the Codex MRL is 0.1 mg/kg, both as CS_2.
The Australian PAFC MRL is 50 ppm and the relevant MRL for grain are 0.5 mg/kg. Residues in straw/hay/stubble would be expected to be much less than 50 ppm. The target tissue is liver. The TF for liver (45 ppm feeding study for mancozeb) [108] was 0.003 giving an anticipated maximum residue from the feeding of straw/hay/stubble at 100% of the diet of $<50\times0.003 = <0.15$ mg/kg, less than the relevant international MRLs.

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

Tralkoxydim
-is a cyclohexanedione herbicide used for the control of wild oats, annual rye grass etc in wheat, barley, rye and triticale crops. The application rate is up to 0.2 kg ai/ha.
A harvest WHP is not required.
Do not graze or cut for stock food for 14 days after application.

There are no Australian, Codex or US MRLs for tralkoxydim in animal commodities. The Australian MRL for cereal grains is *0.02 mg/kg. The US MRLs are 0.02 mg/kg for grain and hay of barley and wheat and 0.05 mg/kg for wheat forage and straw.

[108] 1993 JMPR - Pesticide Residues in Food - 1993 Evaluations, Part I Residues FAO Plant Production and Protection Paper 124. FAO and WHO 1994

The US EPA in its evaluation of tralkoxydim noted that[109,110] "*Based on the results of the ruminant metabolism studies, the extensive metabolism and rapid excretion of either tralkoxydim or any of its metabolites, and ruminant consumption of commodities used in animal feed, there are no expected residues of tralkoxydim in meat or milk.*"

The US also reported that residue data are available for tralkoxydim applied postemergence on wheat at the maximum label rate of 0.28 kg ai/ha (0.25 lb ai/A). Application was made from full tillering to first detectable node growth stage. In 1995, a total of 20 magnitude of the residue trials were conducted on spring wheat. There were no detectable residues (<0.02 ppm LOD) on wheat grain or straw in any of the trials at the pre-harvest interval of 60 days. There were no detectable residues on hay at the pre-harvest interval of 45 days. There were no detectable residues on immature forage at the pre-harvest interval of 30 days. Two (2) winter wheat trials were conducted in 1995 to determine forage residues of tralkoxydim in winter wheat, using ACHIEVE DG, 80% concentration (ACHIEVE 80DG). The product was applied at the maximum label rate at growth stages from advanced tillering to full tillering. The winter wheat forage data showed no detectable residues at either 16 or 18 days after treatment. These results fall well within the proposed forage pre-harvest interval of 30 days. There were 3 magnitude of the residue trials conducted on spring wheat in 1994 and one trial was conducted in 1993. In addition, 6 trials were conducted in Canada during 1986 and 1987. (Note: The Canadian trials were conducted using a 50% concentration of tralkoxydim at a higher use rate of 0.34-0.68 kg ai/ha (0.3 - 0.6 lb ai/A)). There were no detectable residues (<0.02 ppm LOD) on wheat grain or straw in any of the trials at the pre-harvest interval of 60 days. There were no detectable residues on hay at the pre-harvest interval of 45 days. There were no detectable residues on immature forage at the pre-harvest interval of 30 days. Despite having no detectable residues of tralkoxydim at 0.02 ppm, it is proposed that the tolerance level be based on the limit of quantification (LOQ) of the tolerance enforcement method, which has been validated to 0.1 ppm for tralkoxydim. The proposed tolerance of 0.1 ppm for wheat grain, forage, straw and hay is five (5) times greater than any residue that would result from the application of tralkoxydim arising from the proposed use pattern.

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

Triadimefon

-is a fungicide used for the control of fungal diseases in barley and wheat. It is applied as a foliar spray at a maximum application rate of 125 g ai/ha.
The harvest WHP is 4 weeks.

There are Australian and Codex but no US MRLs for animal tissues. The Australian/Codex residue definition is the sum of triadimefon and triadimenol. The MRLs are *0.05 mg/kg for edible offal and meat. The Australian and Codex MRLs for milk are *0.1 and *0.01 mg/kg respectively. The Australian MRL for cereal grains is 0.5 mg/kg and 10 mg/kg for primary animal feed commodities.

In a lactating cow feeding studies were carried out with 1:1 mixture of triadimefon and triadimenol and at dose levels equivalent to feeding at 625, 1875 and 6250 ppm, fat contained residues up to

[109] Tralkoxydim; Notice of Filing a Pesticide Petition to Establish a Tolerance for a Certain Pesticide Chemical in or on Food [Federal Register: March 21, 2003 (Volume 68, Number 55)] [Page 13920-13924
[110] Notice of Filing and Withdrawal of Pesticide Petitions [Federal Register: July 2, 1997 (Volume 62, Number 127)] [Page 35804-35812]

0.029 mg/kg at the 6250 mg/kg level and 0.016 ppm at the 1875 ppm dose level, whereas the residue level in the fat was less than 0.01 mg/kg at the 625 mg/kg feeding level[111].

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

Triadimenol
-is a fungicide used as a seed treatment for wheat, barley and oats (22.5 g ai/100 kg seed) and a foliar spray for sorghum (62.5 g ai/ha).
Sorghum: Do not graze or cut for stock food.
Wheat, Barley, Oats: Do not graze plants from treated seed, or cut for stock food within 5 weeks of sowing.

There are Australian and Codex but no US MRLs for animal tissues. The Australian/Codex residue definition is the sum of triadimefon and triadimenol. The MRLs are *0.01 mg/kg for animal commodities. The Codex MRL for edible offal and milk is *0.01 while meat is 0.02 mg/kg. The Australian MRL for cereal grains except sorghum is *0.01 mg/kg while the MRL for sorghum is 0.5 mg/kg and 0.5 mg/kg for forage of cereal grains. The MRL for sorghum straw and fodder (dry) is 10 ppm.

See triadimefon above.

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

Triallate
-is a thiocarbamate herbicide used for the control of various weeds in barley, wheat and triticale.
The maximum application rate if 0.8 kg ai/ha with application occurring prior to sowing.
No harvest WHP is 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 cereal grains 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[112]. Residues in milk were <0.01 mg/kg.

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

Triasulfuron-methyl
-is a sulfonylurea herbicide used for the control of various weeds in wheat, barley, oats and triticale crops. Post-emergent applications are made at rates up to 11.25 g ai/ha.
No harvest WHP is required.
Do not graze or cut for stock food for 14 days after application.

[111] 1983 JMPR Pesticide Residues in Food - 1983 Evaluations, FAO Plant Production and Protection Paper 61. FAO and WHO 1985
[112] 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

There are Australian and US but no Codex MRLs for animal commodities. The Australian MRLs have all been set at *0.05 mg/kg for tissues and *0.01 mg/kg for milk. The US MRLs for cattle and sheep are 0.5 mg/kg for kidney and 0.1 mg/kg for meat, fat and meat by-products (except kidney) and 0.02 mg/kg for milk.

The Australian MRL for cereal grains is *0.02 mg/kg. The PAFC MRL is 5 ppm.

The US EPA reported that[113] "an acceptable feeding study in dairy cattle conducted at 15, 75, and 150 ppm has previously been reviewed and various animal commodity tolerances were subsequently established (milk, 0.02 ppm; meat, fat, and meat by-products of cattle, goats, hogs, horses, and sheep at 0.1 ppm)". The existing [US] tolerances for triasulfuron in animal commodities are adequate to cover the use of triasulfuron on grasses [7 ppm for forage and 2 ppm for hay] with the exception of the tolerances on kidneys. Accordingly, higher triasulfuron tolerances of 0.5 ppm for the kidneys of cattle, goats, horses, and sheep are required to support the tolerances on grasses. At the 15 ppm feeding level residues in kidney were 0.12-0.18 mg/kg with residues in other tissues and milk <LOD (<0.05 or <0.01 mg/kg).

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 MRL for barley, oats, sorghum and wheat is *0.01 mg/kg and for maize *0.05mg/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[114].

The Canadian PMRA noted in their evaluation of tribenuron-methyl that "*large animal metabolism studies were not performed for tribenuron methyl, however metsulfuron-methyl (^{14}C-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*"[115].

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

[113] Triasulfuron; Pesticide Tolerance Federal Register: August 18, 1998 (Volume 63, Number 159) Page 44146-44152
[114] PMRA Decision Document E95-04 Tribenuron methyl
[115] PMRA Decision Document E95-04 Tribenuron methyl

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.

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

Trichlorfon
- is an organophosphate insecticide used for the control of various insects in crops. It is registered on cereal crops for the control of various pests. The application rate is up to 0.85 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 cereal grains 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 period[116].

Residues in cereal straw/hay/stubble are expected to be less than 20 ppm. No detectable residues are expected in tissues of animals fed cereal straw/hay/stubble.

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

Triclopyr
-is a herbicide used for the control of various weeds, including woody weeds in fallow crops, stubble and sorghum. The application rate is up to 96 g ai/ha in fallow and stubble and up to 48 g ai/ha in sorghum crops.
A harvest WHP is not required.

There are Australian and US but no Codex MRLs for triclopyr in animal commodities. The Australian and US residue definitions differ. The Australian definition is parent compound. The US definition is the sum of triclopyr and its metabolite 3,5,6-trichloro-2-pyridinol (NOTE the later is also in the US residue definition for chlorpyrifos and chlorpyrifos-methyl). The Australian MRLs are 5 mg/kg for edible offal of sheep and cattle, 0.2 mg/kg for meat (in the fat) and 0.1 mg/kg for milk [in the fat]. The US MRLs are 0.5 mg/kg for liver and kidney and 0.05 mg/kg for meat, fat and meat by-products (except liver and kidney) and 0.01 mg/kg for milk.

The Australian MRL for sorghum straw and fodder (dry) is *0.1 ppm.

NOTE: the US EPA RED suggests that feeding at 200 ppm (hay tolerance) will not lead to residues in animal commodities that exceed the US MRLs[117].

[116] 1971 JMPR. Evaluations of some pesticide residues in food. AGP/1971/M/9/1; WHO Pesticide Residues Series No. 1, 1972

NOTE: US MRLs have been established for animal feed items (grass forage and hay at 500 ppm) as well as for animal commodities. If the US MRLs are used to estimate the dietary burden using the US EPA Guideline, a dietary burden of 1427 ppm is estimated (500 ppm grass forage, 25% DM, 60% diet + 500 ppm hay, 88% DM 40% diet). An anticipated TF is the 0.05 ppm (animal commodity tolerances, fat, meat) ÷ 1427 ppm (dietary burden) = 0.00004 (crude estimate). An anticipated TF is the 0.5 ppm (animal commodity tolerances, liver, kidney) ÷ 1427 ppm (dietary burden) = 0.0004 (crude estimate).

In a study where lactating goats were given radiolabeled triclopyr equivalent to 2000 ppm in the feed, tissue residues were highest in the kidney, about 8 ppm 24 hours after ingestion of the herbicide[118]. Liver and muscle contained about 0.3 ppm. Milk contained less than 0.2 ppm. The half time for excretion was about 24 hours.

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

Triflumuron
-is an insecticide used as a seed treatment for wheat, barley and oats (0.6 g ai/100 kg seed.
Wheat, Barley, Oats: Do not graze plants from treated seed, or cut for stock food within 5 weeks of sowing.

There are Australian but no Codex or US MRLs for triflumuron in animal commodities. The Australian MRLs are *0.05 mg/kg. The Australian MRL for cereal grains and for straw and fodder (dry) of cereal grains is *0.05 mg/kg and for forage of cereal grains is 0.2 ppm.

EFSA reported a study where lactating Holstein dairy cows were dosed with triflumuron equivalent to 6 and 12 ppm in the diet for 28 days. Animals were sacrificed 4-8 h after last dosing. No residues above LOQ were detected in tissues (<0.05 mg/kg) or milk (<0.01 mg/kg).

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-leafed weeds in wheat, barley, triticale and rye crops. Application is at a maximum rate of 0.384 kg ai/ha for wheat, rye and triticale and 0.6 kg ai/ha for barley.
No harvest 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). The Australian MRLs for meat (mammalian) and milk are *0.05 mg/kg. The Australian MRL cereal grains 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

[117] Reregistration Eligibility Decision Triclopyr List B CASE 2710 EPA 738-R-98-011 October 1998 Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division
[118] Dost, Frank N. Toxicology and potential health risk of chemicals that may be encountered by workers using forest vegetation management options. Part VI, Risk to workers using triclopyr formulations (Release™ or Garlon™) ISBN 0-7726-4987-1

tissues[119]. Therefore no residues are expected to result from the feeding of cereal straw/hay/stubble to animals. Residues decline in soil and foliage with typical half-lives of 60 and 3 days respectively.

EFSA reported a study where a lactating Holstein cow was fed a diet containing trifluralin at 1 ppm for 39 days followed by 1000 ppm for 13 days. Residues (mg/kg) were <LOD in milk and serum and in tissues were:

Tissue	Trifluralin	TR-2	TR-3	TR-4	TR-5	TR-6
Rumen content	3.8	0.0007	0.016	2.3	0.04	0.2
Tripe	1.3	0.007	<LOD	2.3	0.02	<LOD
Reticulum tissue	0.71	<LOD	0.008	0.97	<LOD	<LOD
Omasum tissue	0.14	<LOD	<LOD	0.16	<LOD	<LOD
Omasum content	3.4	<LOD	0.007	2.7	<LOD	0.28
Abomasum tissue	2.1	<LOD	0.009	1.1	<LOD	<LOD
Fat	0.032	<LOD	<LOD	0.06	0.02	0.06
Lung	0.036	<LOD	<LOD	0.029	<LOD	<LOD

Residues in muscle, heart, liver, kidney, bladder, spleen and bone were all <LOD. The LODs were 0.005-0.01 mg/kg for trifluralin, TR-2, TR-3 and TR-4 and 0.02-0.03 mg/kg for TR-5 and TR-6.

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

Triticonazole

is a DMI fungicide used as a seed treatment for barley and wheat to aid in the control of various fungal diseases. The application rate is 30 g ai/100 kg seed.
No harvest WHP required.

There are Australian but no Codex or US tolerances for triticonazole in animal commodities. The Australian MRLs are *0.05 mg/kg for animal tissues and *0.01 mg/kg for milk. The MRL for cereal grains is *0.05 mg/kg. The animal feed MRLs are 0.1 ppm for forage of cereal grains and *0.05 ppm for straw and fodder (dry) of cereal grains.

In field trials conducted in the US[120], where wheat seeds were treated with a triticonazole formulation at a rate of approximately 10 g ai/100 kg wheat seed. Generally the level of triticonazole residues observed in the samples were very low. For wheat forage, the residue of triticonazole found in or on the samples did not exceed 0.02 ppm; whereas, the residues for wheat hay did not exceed 0.008 ppm and the residues for wheat straw did not exceed 0.007 ppm. Triticonazole was not detected (0.002 ppm) in or on the wheat grain samples, except in one of the two replicate samples from one trial site where the residue level was determined to be 0.0055 ppm. Residues of the metabolites were not detected (MDL = 0.002 ppm) in any forage, hay grain or straw samples, except at one site where residues of RPA 406341 in the straw were just above the LOD but less than the LOQ. In trials where barley seeds were treated as described above for wheat, no residues of triticonazole or metabolites were detected (0.002 ppm) in or on the barley grain samples.

[119] 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
[120] [Federal Register: March 14, 2002 (Volume 67, Number 50)] [Notices] [Page 11476-11480] From the Federal Register Online via GPO Access [wais.access.gpo.gov] [DOCID:fr14mr02-51] ENVIRONMENTAL PROTECTION AGENCY [PF-1071; FRL-6825-1] Notice of Filing a Pesticide Petition to Establish a Tolerance for a Certain Pesticide Chemical in or on Food .AGENCY: Environmental Protection Agency (EPA). ACTION: Notice.

In the barley hay samples, no residues of triticonazole or metabolites were detected above the LOQ (0.005 ppm), except at one site where the mean level of triticonazole in the duplicate samples was 0.0058 ppm. Similarly, in the straw, no residues of triticonazole or metabolites were detected above the LOQ of the method except in one replicate at one site where triticonazole was found at 0.0067 ppm.

Studies were conducted to determine if triticonazole residues concentrated upon processing wheat or barley grain. The wheat or barley seeds used for these studies were treated at a nominal rate of 50 g ai/100kg wheat seed. Grain samples were collected at normal commercial maturity. Using procedures that simulate commercial practices, wheat grain was processed into bran, flour, middlings, shorts, and germ; whereas barley grain was processed into bran, flour, or pearled barley. Triticonazole-related residues were below the LOD (0.002 ppm) for all grain and processed fraction samples. Based on these results, residues of triticonazole and metabolites do not concentrate in wheat or barley processed fractions following a triticonazole seed treatment application.

Metabolism studies show that triticonazole residues are not expected in livestock tissues from animals fed at levels found in treated seed feed items.

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