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Pesticide risk profile for the grazing of peanut forage and/or cutting of hay and feeding 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 residues in cattle and sheep fed peanut forage and hay

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

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

The aim of the current report is to profile the risk of violative residues in export meat and edible offal posed by the presence of pesticide residues in peanut animal feed commodities fed to cattle and sheep.

Assessment of currently registered chemicals that may be used on peanut 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].

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

[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)

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 fodder included in animal feed as 100% and value was used in the current evaluation. Estimates of residues in fodder were obtained from scaling of literature studies, MRLs or based on conservative assumptions. The dietary burden is then the residue in crop × maximum proportion in the diet. To overcome errors that may result from differences in moisture contents of feed items it is accepted practice to calculate dietary burdens for a ration on a dry matter basis. Peanut fodder is reported to typically contain 85% dry matter a correction for dry matter content was not deemed necessary.

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 peanuts are harvested at maturity and that the fodder/straw/hay is derived at this time.
- The crop has been treated at the maximum rate and with the shortest interval between application and harvest permitted by the product 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 forage, fodder, hay and straw will not pose an unacceptable risk.

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

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

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

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

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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..

Pesticide	Tissue	Residue (mg/kg)		Decline information located	
		Estimated[1]	Target[2]	Crop	Animal
Chlorpyrifos	Fat	0.38	0.3	No	Yes
Chlorothalonil	Kidney	5.85	0.5	Yes	Yes
Haloxyfop	Kidney	0.95	0.01	Yes	Yes
Iprodione	Fat	0.6	0.01	No	No
Methamidophos	Kidney	0.17	0.01	No	Yes

[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: bentazone, fluazifop and MCPB.

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

2,4-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 peanuts prior to crop emergence at rates up to 2.25 kg ai/ha.
No harvest WHP is required.
All crops have the following grazing restraint:
DO NOT graze or cut for stock food for 7 days after application

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

In an animal transfer study cows were dosed at the equivalent of 1446, 2890, 5779 and 8585 ppm in the diet for 28 days[6]. 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.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm[7] and scale for application rate, forage residues are expected to be 2.25×50 = 112.5 ppm).

Assuming forage has residues of 112.5 ppm and using TFs from the 1446 ppm feeding study, anticipated residues in kidney and fat from feeding at 100% of the diet are 112.5×0.0045 = 0.5 mg/kg and 112.5×0.00035 = 0.05 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.

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, lucerne, medics and clover. Application to peanuts is at rates up to 0.88 kg ai/ha with applications made 1-12 weeks after emergence.
No harvest WHP is required.
Cereals, pasture and forage crops: 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. There is no Australian MRL for peanuts.

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

[6] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999
[7] The highest residue on the day of application in three trials reported by the JMPR in 1998-2002 was 50 ppm.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.88×50 = 44 ppm). Maximum residues in peanut hay at 53 days after application at 0.9 kg ai/ha were 0.55 ppm[8].

The US EPA reported that residues of 2,4-DB ≤0.01 mg/kg for all milk samples from the 1×, 3×, and 10× (the [US] 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.

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

Acifluorfen

-is a diphenyl ether herbicide used for the control of various weeds in peanut crops at 0.448 kg ai/ha. When used pre-emergent application may be at rates of up to 0.896 kg ai/ha.
A grazing WHP is not required.
When used for crop salvage at rates of up to 0.896 kg ai/ha. Do not harvest for 50 days after application.

There are Australian but no Codex or US MRLs for animal commodities. The Australian and US residue definitions differ, parent for Australia and sum of acifluorfen and its metabolites (the corresponding acid, methyl ester, and amino analogues) for the US. The Australian MRLs are 0.1 mg/kg for edible offal and *0.01 mg/kg for meat and milk. The Australian MRL for peanuts is 0.05 mg/kg.

In peanuts treated with [^{14}C]sodium acifluorfen, labeled in the chlorophenyl ring, at 1.1× the maximum seasonal use rate, TRR were 0.18 ppm in nutmeats, 1.9 ppm in fodder, and 0.72 ppm in hulls. Acifluorfen was the major identified metabolite, accounting for 4.9% TRR in nutmeats, 11% TRR in hulls, and 13% TRR in peanut fodder. In peanut hulls two additional conjugate metabolites, 3-carboxy-4-nitrophenyl thio-beta-D-glucopyranoside and S-(3-carboxy-4-nitrophenyl)-cysteine, accounted for 26% TRR and 6.4% TRR, respectively. Numerous remaining residues in peanut matrices were characterized as being polar and present at <10% TRR.

In peanuts treated at 0.56 to 1.68 kg ai/ha residues of sodium acifluorfen and its regulated metabolites were below the LOQ (<0.10 ppm) at 75 to 140 days after application.

In a goat metabolism study where goats were dosed at the equivalent of 10 ppm in the feed, total radioactive residues in tissues and milk ranged from 0.008 mg equiv./kg in milk to 0.40 mg equiv./kg in kidney[9]. The US EPA determined that there is no reasonable expectation of acifluorfen being detected in animal tissues on feeding at levels of up to 0.1 ppm in the diet (tissue LOQs of 0.01-0.02 mg/kg).

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

Azoxystrobin

[8] US EPA RED 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.
[9] US EPA HED Metabolism Committee Memorandum: Sodium Acifluorfen (PC Code: 114402): HED Metabolism Assessment, Review Committee Decision Document (DP Barcode: D265602 http://www.epa.gov/pesticides/reregistration/acifluorfen/metabolism_committee_report.pdf

Is registered for the control of stem rot/white mould and rhizoctonia peg and pod rot in peanuts with application at up to 447 g ai/ha (APVMA permit 4583).
The harvest WHP is 14 days.
Do not graze or cut for stock food for 14 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. There are Australian MRLs of 25 ppm for peanut fodder and 1 ppm for peanut hulls and 0.05 mg/kg for peanuts.

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[10].

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

Bentazone
- is a post-emergent herbicide and may be applied to peanuts at rates of up to 960 g ai/ha.
The harvest WHP is 21 days.

The Australian MRLs for tissues and milk are *0.05 mg/kg. The Codex MRL for milk is *0.05 mg/kg. The Australian MRL for peanuts is 0.1 mg/kg. The EU MRL for milk and cream is *0.02 mg/kg.

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[11]. (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[12].

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

Butroxydim (p)
-is a cyclohexanedione herbicide used for the control of grass weeds in various crops. The application rate for peanuts is up to 45 g ai/ha, lower than the maximum rate for other legumes.
Do not graze or cut for stock food for 14 days after application.

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

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

Captan

[10] APVMA Animal Residue Data Sheet – Azoxystrobin (October 2002)
http://www.apvma.gov.au/residues/stockfeed.shtml
[11] 1995 JMPR - Pesticide Residues in Food - 1995 Evaluations, Part I Residues FAO Plant Production and Protection Paper 137. FAO and WHO 1996
[12] 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

-is applied as a seed treatment at 120 g ai/100 kg seed for control of pre-emergence rot and seedling blight.
A harvest WHP is not required.
Do not allow stock to graze in any treated area, or cut for stock food.

There are Australian and USA but no Codex MRLs for captan in animal tissues. The relevant MRLs for edible offal and meat in Australia are set at 0.05 mg/kg and milk at *0.01 mg/kg. The US MRL for cattle meat is 0.2 and milk is 0.01 mg/kg. No MRL has been set for peanuts as no residues are expected.

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

Chlorothalonil
Is registered for use on peanuts for control of leaf spot and rusts at rates of up to 1.3 kg ai/ha.
Do not graze treated crops.

There are Australian and US but no Codex MRLs for chlorothalonil. The Australian residue definition is the sum of chlorothalonil and 4-hydroxy-2,5,6-trichloroisophthalonitrile metabolite expressed as chlorothalonil. The Australian MRLs are 7 mg/kg for edible offal, 2 mg/kg for meat in the fat and 0.05 mg/kg for milk. The US residue definition for animal commodities is 4-hydroxy-2,5,6-trichloroisophthalonitrile. The relevant MRLs for cattle commodities are 0.1, 0.5, 0.05 and 0.03 mg/kg for fat, kidney, meat by-products (except kidney) and meat respectively. The Australian MRL for peanuts is T0.2 mg/kg

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 1.3×50 = 65 ppm).

The TF for kidney (target tissue, US residue definition) is 0.09[13]. Assuming residues of chlorothalonil in forage are 65 ppm, anticipated residues in kidney would be 65×0.09 = 5.9 mg/kg if fed at 100% of the diet. Residues were not detected in tissues after a period of 32 days on clean feed (earliest clean-feed slaughter period, feed level 250 ppm chlorothalonil + 2 ppm metabolite). Other countries would be expected to utilise parent compound in any monitoring and no residues of parent compound are expected in animal tissues from feeding peanut forage, fodder/straw/hay.
The TF for milk (US def) is 0.03. Assuming residues of chlorothalonil in forage are 65 ppm, anticipated residues in milk are 65×0.03 = 1.95 mg/kg from feeding peanut forage, fodder/straw/hay.

Chlorothalonil can contain up to 100 mg/kg hexachlorobenzene (HCB), an application rate of 1.3 kg ai/ha corresponds to application of HCB at 0.13 g/ha. Estimates of the potential for transfer of HCB residues are given below:
(a) Uptake from soil. Noting the half-life for HCB in soil is 3-6 years. Uptake of HCB by various crops was such that the ratio of soil to crop residues ranges from 0.03 – 2.4 for aerial parts. The contribution from previous years applications (assumed 12 years of additions 1 spray per year at the maximum rate = 0.13 g HCB/ha = 1.56 g HCB/ha), distributed in the top 20 cm soil with density 1 g/mL would be 1560 mg/2000000 kg = 0.00078 ppm. Assuming a ratio of 0.1 for crop to soil, residues in aerial plant parts would account for no more than 0.000078 mg/kg.
The TF for fat and milk fat are assumed to be 8 and 8.4 respectively. Feeding peanut forage/hay with HCB residues of 0.000078 ppm at 100% of the diet would give rise to residues of 0.000078×8 = 0.00062 mg/kg in fat and 0.000078×8.4 = 0.00066 mg/kg in milk fat.

[13] Pesticide Residues in Food - 1997 evaluations, FAO Plant Production and Protection Paper 146. FAO and WHO 1998

(b) Foliar residues. If assume residues in peanut forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.00013×50 = 0.0065 ppm for HCB. Residues in cattle fat and milk would be 0.0065×8 = 0.052 mg/kg for fat and 0.0065×8.4 = 0.055 mg/kg in milk fat.

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 lucerne, medic, pasture and peanuts as a foliar spray at rates up to 0.75 kg ai/ha for the control of various pests including locusts (highest rate).
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 Australian and Codex residue definition is chlorpyrifos while the USA definition includes the metabolite TCP. The MRLs for cattle fat are T0.5, 1 and 0.3 mg/kg for Australia, Codex and the USA respectively. The MRLs for milk are T0.2 [milk in the fat] mg/kg, 0.02 mg/kg and 0.01 mg/kg (0.25 mg/kg for milk fat). The MRL for peanuts (oilseed) is T*0.01 mg/kg., for peanut forage (green) T10 ppm and peanut hay T2 ppm.

The maximum transfer factor for feeding cattle at 10 ppm in the diet was 0.016 for cattle fat[14]. The 2000 JMPR reported residues of 21-74 ppm in forage 0 days after application at 2.2 kg ai/ha and 8.8-20 ppm at 6-8 days after application. Residues in hay at 15-36 days after application were <0.01-6.3 ppm. Scaling for application rate residues in forage are expected to be 7-24 ppm while those in hay are expected to be <0.01-2.1 ppm. Residues from feeding peanut forage/hay/straw with residues of 24 ppm at 100 % of the diet 24×0.016 = 0.38 mg/kg; below the Australian and Codex MRLs and slightly above the USA MRL.
Anticipated residues for milk would be 24×0.0007 = 0.02 mg/kg.

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

Clethodim (Sethoxydim)
-is registered for use on peanuts at rates of up to 90 g ai/ha.
Do not apply later than 7 weeks before harvest.

There are Australian, Codex and US MRLs for clethodim. The Australian and Codex residue definition is clethodim and its metabolites containing 5-(2-ethylthiopropyl)cyclohexane-3-one and 5-(2-ethylthiopropyl)-5-hydroxycyclohexe-3-one moieties and their sulphoxides and sulphones, expressed as clethodim. The US residue definition is clethodim and its metabolites containing the 2-cyclohexen-1-one moiety. The Australian MRLs for animal commodities have been set at *0.05 mg/kg. The Codex MRLs are *0.2 mg/kg for edible offal and meat and *0.05 mg/kg for milk. The US MRLs for cattle tissues are all 0.2 mg/kg.

The MRL for peanuts is 3 mg/kg. The MRLs for peanut fodder and forage (green) are both 10 ppm.

[14] 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

The TF for the US residue definition is 0.006[15] for offal giving an anticipated residue when using the forage/fodder MRL as the maximum feed level of 10×0.006 = 0.06 mg/kg for liver and kidney, below the US MRL.
Anticipated residues in milk (TF 0.0011) are 10×0.0011 = 0.011 mg/kg.

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

Cyproconazole
Is registered for the control of leaf spot and rusts in peanuts. The application rate is up to 60 g ai/ha. The harvest WHP is 14 days.
Do not graze or cut for stock food for 14 days after application.

There are Australian but no Codex or US MRLs for cyproconazole in animal commodities. The Australian MRLs have all been set at *0.01 mg/kg. The MRL for peanut fodder is 20 ppm and for peanuts 0.02 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.06×50 = 3 ppm at 0 days. The foliar half-life is 3-7 days. Residues at 14 days after application are expected to be 0.09-0.75 ppm). The Australian MRL for peanut fodder is 0.05 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). Anticipated maximum residues are 0.05×0.04 = 0.002 mg/kg for liver and 0.05×0.002 = 0.0001 ppm for fat.

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 peanuts at application rates of up to 300 g ai/ha.
The harvest WHP is 14 days (7 days is used at 140 g ai/ha)
The WHP statements are not clear, 7 days for peanuts but 14 days for oilseeds (which includes peanuts).

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 peanuts.

A metabolism study with lactating goats dosed orally with dimethoate at a rate equivalent to feeding at 30 ppm in the diet suggests that residues are not expected in animal tissues[16].

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 15 ppm).

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

[15] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995
[16] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999

Diquat
- is a herbicide used for the control of weeds in various crops. It is applied to peanuts with application rates up to 0.276 kg ai/ha.
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. There is a legume animal feed MRL of T100 ppm. No residues were detected in tissues of cows fed diquat for 28 days at 100 ppm in the diet and slaughtered on the last day of dosing (LOD 0.01 mg/kg) [17]. Residues in hay/ forage would be expected to be less than 100 ppm. This suggests that no residues would be detected in animal tissues if fed forage or hay and straw from treated peanut crops.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.276×50 = 13.8 ppm).

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

Fluazifop-p
-is an aryloxyphenoxypropionate (fop) herbicide used for the control of certain grasses in various crops. It is used in peanuts at rates up to 212 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 USA but no Codex animal tissue MRLs for fluazifop. The relevant Australian MRLs are *0.05 for edible offal and meat and 0.1 for milk. The US tolerances for animal commodities have all been set at 0.05 mg/kg (fluazifop-butyl). The relevant Australian MRL is 0.5 mg/kg for oilseed.

The TFs for kidney, fat and milk are 0.01, 0.05 and 0.012 respectively (12 ppm feeding level)[18].

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

Flumetsulam
is a triazolopyrimidine sulfoanilide herbicide used on peanuts with an application rate of up to 40 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 flumetsulam in animal commodities. The Australian MRLs are 0.3 for edible offal and *0.1 for meat and milk. There is an animal feed MRL of 15 ppm for legume pasture. The MRL for peanuts is *0.05 mg/kg and for peanut forage (green) and fodder is *0.05 ppm.

[17] 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
[18] UK PSD Evaluation of fully approved or provisionally approved products. Issue No. 10 Evaluation on: Fluazifop-P-butyl, October 1988

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

Glyphosate
-is a non-selective foliar herbicide used for the control of broadleaf weeds and grasses in crops such as sugarcane, maize, sorghum and winter cereals as well as peanuts. It is applied prior to sowing of crops at application rates up to 2.16 kg ai/ha or post emergent via the use of selective applicators. No harvest or grazing WHPs are required.

The relevant Australian and Codex MRLs are the same at 2 mg/kg for cattle offal. The MRL for milk is *0.1 and *0.05 mg/kg for milk respectively. The relevant USA MRL is 4 mg/kg for cattle meat byproducts. The primary animal feed commodity MRL for glyphosate is 150 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 2.16×50 = 108 ppm at day 0. Residues in forage from pre-emergence applications would be much less.)

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[19]. The highest residues were in pig liver and kidney (up to 0.16 and 0.91 mg/kg, respectively) and cattle kidney (up to 1.4 mg/kg).

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

Haloxyfop
-is an aryloxyphenoxypropionate (fop) herbicide used for the control of certain grasses in various crops. It is registered for weed control in peanuts at an application rate of up to 78 g ai/ha.
A harvest WHP is not required.
Do not graze or cut for stock food for 28 days after application.

There are Australian but no USA or Codex animal tissue MRLs for haloxyfop. The relevant Australian MRLs are 0.5 mg/kg for edible offal, 0.02 mg/kg for meat (fat) and 0.02 mg/kg for milk. There are Australian MRLs of 3 ppm for peanut forage (green) and 5 ppm for peanut fodder.
(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 50×0.078 = 3.9 ppm at day 0. The foliar t½ is 14-24 days, assuming one t½ gives and estimated residue of 1.95 ppm at 28 days after application).

The TF for cattle fat is 0.05 and cattle kidney 0.19[20]. If it is assumed residues are present at the same level as the MRL residues in cattle tissues would be 5×0.05 = 0.25 mg/kg in fat and 5×0.19 = 0.95 mg/kg in kidney if fodder is included at 100% of the diet. Maximum residues of haloxyfop in fat of cows dosed at the equivalent of 10 ppm in the diet were 0.53 mg/kg at the end of the 28 day feeding period and 0.21 mg/kg after 7 days on clean feed and 0.22 mg/kg after 14 days on clean feed. More information is required on the depletion of residues.

[19] FAO/WHO (1986a) Pesticide residues in food - Evaluations 1986. Part I - Residues. Joint Meeting of the FAO Panel of Experts Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, Rome, 29 September-8 October 1986. Rome, Food and Agriculture Organization of the United Nations (FAO Plant Production and Protection Paper 78/1).
[20] Pesticide Residues in Food - 1995 Evaluations, Part I Residues FAO Plant Production and Protection Paper 137. FAO and WHO 1996

The TFs for milk and cream are 0.016 and 0.15. If it is assumed residues are present at the same level as the MRL, residues in milk and cream would be 5×0.016 = 0.08 mg/kg in milk and 5×0.15 = 0.75 mg/kg in cream.

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

Imazamox
-is a imidazolinone herbicide used for the control of broad leaf and grass weeds in peanuts. It is applied at an application rate of up to 35 g ai/ha.
Do not graze or cut for stock food for 28 days after application.

There are Australian but no Codex or US MRLs for imazamox in animal commodities. In the US imazamox is exempt from the requirement of a tolerance on all food commodities when applied as a herbicide in accordance with good agricultural practices. The Australian MRLs have all been set at *0.05 mg/kg. The MRLs for peanuts and peanut forage (green) [fresh weight] are *0.05 ppm.

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

Imazapic
-is a imidazolinone herbicide used for the control of broad leaf and grass weeds in peanuts. It is applied at an application rate of up to 96 g ai/ha.
Do not graze or cut for stock food for 28 days after application.

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

In the goat metabolism study 3 goats were exposed to ^{14}C-imazapic at doses of 0, 3.76 and 15.1 mg in gelatin capsules for seven consecutive days[21]. 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.

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

Imazethapyr
-is a imidazolinone herbicide used for the control of weeds in peanuts at an application rate of up to 96 g ai/ha.
Do not graze or cut for stock food for 14 days after application.

[21] 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

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 US MRL for cattle meat byproducts is 0.1 mg/kg. There is a PAFC MRL of *0.1 ppm and peanuts at *0.1 mg/kg. 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[22]. Results showed ^{14}C-residues of <0.01 ppm in milk, and <0.05 ppm in leg muscle, loin muscle, blood, fat, liver, and kidney. Laying hens dosed at 0.5 ppm and 2.5 ppm with ^{14}C-imazethapyr showed ^{14}C-residues of <0.05 ppm in eggs and all tissues (blood, muscle, skin/fat, liver, and kidney). Additional animal metabolism studies have been conducted with CL 288511 (main metabolite in treated crops fed to livestock) in both laying hens and lactating goats. These studies have been repeated to support subsequent use extensions on crops used as livestock feed items which would theoretically result in a higher dosing of imazethapyr- derived residues to livestock (i.e., corn, alfalfa). In these studies, lactating goats dosed at 42 ppm of ^{14}C-CL 288511 showed ^{14}C-residues of <0.01 ppm in milk, leg muscle, loin muscle, and omental fat. ^{14}C-residues in blood were mostly <0.01 ppm but reached 0.01 ppm on 2 of the treatment days. ^{14}C-residue levels in the liver, and kidney were 0.02 and 0.09 ppm, 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

Iprodione
-is used on peanuts for the control of sclerotinia rot with application at rates of up to 500 g ai/ha. The harvest WHP is 12 days.

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

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.5×50 = 25 ppm at day 0).

The TF for fat (US residue definition) is 0.03 (at 15 ppm feeding level)[23]. Assuming residues in forage are at the MRL (20 ppm) and feeding at 100% of the diet the anticipated residues in fat are 20×0.03 = 0.6 mg/kg, just above the US tolerance. Anticipated residues in milk are 20×0.007 = 0.14 mg/kg. If parent compound is monitored in tissues in other countries, as in Australia, residues in tissues are expected to be below the method LOQ.

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

Mancozeb (Dithiocarbamates)

[22] 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
[23] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

-is registered for use on peanuts for the control of rust and leaf spot at a maximum rate of 1.36 kg ai/ha.
The harvest WHP is 14 days.
Do not graze livestock on peanut crops treated with mancozeb or feed treated crops and/or trash to livestock.

There are Australian, Codex and US MRLs for mancozeb in animal commodities. The Australian MRL for edible offal is 2 mg/kg while the Codex MRL is 0.1 mg/kg, both as CS_2. The USA residue definition is zinc ethylenebisdithiocarbamate and the MRL 0.5 mg/kg for liver and kidney. The MRLs for milk are *0.05 mg/kg for both Australia and Codex.

The peanut MRL is 0.2 mg/kg. The Australian PAFC MRL is 50 ppm. (If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 1.36×50 = 68 ppm).

Residues in forage would be expected to be *ca.* 68 ppm. The target tissue is liver. The TF for liver (45 ppm feeding study) was 0.003[24] giving an anticipated maximum residue from the feeding of forage of 68×0.003 = 0.2 mg/kg, less than the relevant international MRLs. The TF for milk was <0.008.

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

MCPB (4-(2-Methyl-4-chlorophenoxy) butyric acid)
-is a selective herbicide used for the control of broadleaf weeds in peanuts. It is applied at an application rate of up to 1.12 kg ai/ha.
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 MRLs for meat (mammalian) and milk are *0.05 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 1.12×50 = 56 ppm).

Glastonbury *et al.* sprayed Na-MCPB at a rate of 2.24 kg ai/ha on "Onward" peas[25]. The half-life of the MCPB was about 3 days in peas but was not detectable after 9 days in one experiment and 14 days in another. No MCPB was detected in the milk of cows fed MCPB in the ration at 50 ppm for four days (LOD 0.1 ppm) [26].

The log P_{ow} for MCPB is 1.32. Using an empirical relationship between log P_{ow} and TF the following maximum TF are estimated for offal, fat and milk: 0.03 (offal), 0.04 (fat) and 0.01 (milk) using an empirical relationship between TF and log P_{ow}.

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

Methamidophos

[24] 1993 JMPR - Pesticide Residues in Food - 1993 Evaluations, Part I Residues FAO Plant Production and Protection Paper 124. FAO and WHO 1994
[25] Glastonbury, H.A., Stevenson, M.D. and Ball, R.W.E. 1959. The persistence of 4-(2-methyl-4-chlorophenoxy)butyric acid in peas. Weeds 7, 362-363.
[26] 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.

is used for white winged weevil control in peanuts. Application is at rates up to 145 g ai/ha.
The harvest WHP is 12 weeks.

There are Australian and Codex but no US MRLs for methamidophos in animal commodities . The The Australian and Codex MRLs are *0.01 mg/kg for edible offal and meat mammalian, MRL for milk is *0.01 and 0.02 mg/kg respectively. It is assumed that in the US residues of methamidophos in animal tissues are assumed to be covered by the acephate MRLs (acephate residue definition is the sum of acephate and methamidophos). The MRLs for peanut fodder and peanut forage (green) are 10 ppm.

In animal transfer studies with lactating cattle fed mixtures of acephate and methamidophos the transfer factors for muscle and kidney were 0.008 and 0.017 respectively[27]. Anticipated residues in kidney are 10×0.017 = 0.17 mg/kg. The TF for methamidophos in milk is 0.004. Anticipated residues in milk are 10×0.004 = 0.04 mg/kg.

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

Methidathion
- is an organophosphate insecticide used for the control of insects and mites in peanuts. The maximum application rate is 0.08 kg ai/ha.
The harvest WHP is 3 days.

There are Australian and Codex but no USA MRLs for methidathion in animal tissues. The Australian (Codex) and USA residue definitions differ: methidathion (Australia, Codex), sum of methidathion, its oxygen analogue, the sulfoxide and the sulfone (USA). The Australian and Codex that apply to animal tissues are 0.5 and *0.02 mg/kg respectively. The corresponding milk MRLs are 0.5 [in the fat] and 0.001 mg/kg. The MRL for oilseed is 1 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.08×50 = 4 ppm).

No residues of methidathion were observed in tissues of cows fed at up to 50 ppm in the diet when measured by the Australian or USA residue definitions[28]. There is no expectation of residues in animal tissues.

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

Methomyl (also thiodicarb)
- is a carbamate insecticide used for the control of heliothis in peanuts at an application rate of 450 g ai/ha.
The harvest WHP is 14 days.

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

There are Australian and Codex but no USA MRLs for methomyl (as thiodicarb) in animal tissues. The MRLs have all been set at the LOQ.

[27] 2003 JMPR. Pesticide Residues in Food - 2003 Evaluations – Part I: Residues, FAO Plant Production and Protection Paper xxx. FAO and WHO 2004
[28] 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

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

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.45×50 = 22.5 ppm at day 0 and <2.8 ppm at 14 days).

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[29]. There is no expectation of residues in animal tissues.

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

Metolachlor
-is a selective pre emergent herbicide used for the control of annual grasses and broadleaf weeds in peanuts. It is applied at an application rate of up to 2.88 kg ai/ha.
No harvest WHP 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 MRLs for meat (mammalian) and milk are *0.05 mg/kg. Residues decline in soil and foliage with typical half-lives of 90 and 5 days respectively. Metolachlor has a primary animal feed commodity MRL of 5 ppm.

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

In a study cows were fed 60 ppm metolachlor in the diet for up to 28 days (equivalent to 2.4 mg ai/kg bw/day) [30]. Metolachlor residues in meat and fat were all below the LOQ (<0.02 mg/kg); and residues in milk were all <LOQ (<0.01 mg/kg). In contrast, finite residues of ~0.4 mg/kg for kidney and ~0.1 mg/kg for liver were reported.

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

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

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

[29] 2001 JMPR Pesticide Residues in Food - 2001 Evaluations – Part I, FAO Plant Production and Protection Paper 171. FAO and WHO 2002
[30] 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

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.0348×50 = 1.74 ppm).

A metabolism study with lactating goats dosed orally with dimethoate suggests that residues of omethoate are not expected in animal tissues[31].

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

Paraquat
- is a herbicide used for the control of weeds in peanuts (post-emergent). The application rate is up to 0.25 kg ai/ha.
The following grazing restraints apply:
Do not graze or cut sprayed vegetation for stock food for 1 day after application. Remove stock from treated areas at least 3 days before slaughter

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

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.25×50 = 12.5 ppm).

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

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

Pendimethalin
-is a selective dinitroaniline herbicide used for the control of annual ryegrass and certain broadleaf weeds in cotton, cereals etc. It is applied at a maximum rate of 0.99 kg ai/ha at the time of sowing. A harvest WHP is not required.

There are Australian but no Codex or US MRLs for pendimethalin in animal tissues. The Australian MRL for animal commodities all have been set at *0.01 mg/kg. Residues decline in soil and foliage with typical half-lives of 90 and 50 days respectively. The Australian MRL for oilseeds is *0.05 mg/kg. The 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[32].

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

Prometryn
- is a triazine herbicide used for the control of certain grasses in crops such as canola, cotton, sunflower, legumes and pastures. It is used on peanuts as a pre-emergent application at rates of up to 2 kg ai/ha.
No harvest WHP is required.

[31] 1998 JMPR - Pesticide Residues in Food - 1998 Evaluations, Part I Residues FAO Plant Production and Protection Paper 152/1. FAO and WHO 1999
[32] Reregistration Eligibility Decision Pendimethalin List A Case 0187, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division

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

The US EPA considered that there is no reasonable expectation of detectable residues. Animals exposed to residues at levels anticipated in forage/fodder are not expected to have detectable residues (US EPA refer to a feeding study conducted at 50 ppm) [33].

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

Propaquizafop
-is a herbicide used for the control of grass weeds in various crops. It is used on peanuts at rates of up to 90 g ai/ha.
The harvest WHP is 14 weeks for peanuts.
Do not graze or cut for stock food for 14 days after application.

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

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.09×50 = 4.5 ppm, less at 14 days after application). The relevant TFs for propaquizafop are 0.04 for both kidney and fat[34]. Anticipated maximum residues on feeding peanut fodder with residues of 2 ppm are 2×0.004 = 0.008 mg/kg for both kidney and liver, below likely regulatory method LODs (assumed 0.01 mg/kg). The TF for milk is 0.01-0.02 which gives rise to anticipated residues of 2×0.02 = 0.04 mg/kg.

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

Propiconazole
-is a DMI fungicide used for the control of various fungal rust, scald and mildew diseases in crops. It is used for the control of leaf spot and rust in peanuts. Application is at rates of up to 150 g ai/ha. The harvest WHP is 14 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, 0.05 mg/kg for fat and meat by-products (except liver and kidney) and 0.05 mg/kg for milk.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.15×50 = 7.5 ppm).

[33] Reregistration Eligibility Decision Prometryn List A Case 0467, Environmental Protection Agency, Office of Pesticide Programs, Special Review and Reregistration Division, EPA 738-R-95-033 February 1996
[34] Evaluation of fully approved or provisionally approved products: Issue No. 94 propaquizafop February 1994

Animal transfer studies were reported by the 1987 JMPR at feeding levels of 15-100 ppm for cows and 4.5 ppm for goats resulted in undetectable residues of parent compound (Australian and Codex residue definitions) in milk and tissues (<0.05 mg/kg)[35]. After feeding cows for 14 days at 15 ppm the total residues (US residue definition) were undetectable in milk and 0.63 mg/kg in kidney.

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

Quintozene

-is a fungicide used to control soil borne diseases in vegetables and crops. It is applied as a seed treatment at 120 g ai/100 kg seed for control of pre-emergence rot and seedling blight.
A harvest WHP is not required.
Do not allow stock to graze in any treated area, or cut for stock food.
It is also applied to control crown rot with application at pegging time. The maximum application rate is 16.5 kg ai/ha applied to the soil along the rows.
The harvest WHP is 28 days.
Do not feed treated material to animals including poultry

There are no Australian, Codex or US MRLs for animal tissues. The peanut MRL is 0.3 mg/kg.

The 1995 JMPR reported a metabolism study where peanuts were planted in soil that had been treated with [^{14}C]quintozene at a rate of 38 kg ai/ha and grown to maturity. The vines, shells and kernels had ^{14}C residues (expressed as quintozene) ranging from 42 mg/kg in the vines to 5.2 mg/kg in the kernels. No information was available on quintozene as a proportion of the radioactivity though it was stated that many metabolites were present. In hydroponically grown peanuts, quintozene accounted for <30% of the ^{14}C at 4 days after application[36] confirming significant metabolism. A conservative estimate of qintozene residues in vines can be made by scaling the residues observed in the metabolism trial for application rate and adjusting for metabolism. It is estimated that quintozene residues in vines will be <5.5 ppm (16.5/38×42×<0.3).

The TF for fat is *ca.* 0.005 (10 ppm feed level, residue as parent compound)[37]. Anticipated residues in fat would be <5.5×0.005 = <0.0275 mg/kg.

Quintozene can contain up to 100 mg/kg hexachlorobenzene (HCB), an application rate of 16.5 kg ai/ha corresponds to a potential application of HCB at 1.65 g/ha. Noting the half-life for HCB in soil is 3-6 years. Uptake of HCB by various crops was such that the ratio of soil to crop residues ranges from 0.03 – 2.4 for aerial parts. The contribution from previous years applications (assumed 12 years of additions 1 spray per year at the maximum rate = 1.65 g HCB/ha = 19.8 g HCB/ha), distributed in the top 20 cm soil with density 1 g/mL would be 19800 mg/2000000 kg = 0.0099 ppm. Residues in aerial plant parts would account for no more than 0.00099 ppm, assuming a crop to soil ratio of 0.1.
Feeding peanut forage/hay with residues of 0.00099 ppm at 100% diet would give rise to residues of 0.00099×8 = 0.0079 mg/kg in fat and 0.00099×8.4 = 0.0083 mg/kg in milk fat.

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

[35] 1987 JMPR Pesticide Residues in Food - 1987 Evaluations, Part I Residues FAO Plant Production and Protection Paper 86/1. FAO and WHO 1988
[36] Rusness, D.G. and Lamoureux, G.L. (1980) Pentachloronitrobenzene metabolism in peanut. 2. Characterization of chloroform-soluble metabolites produced in vivo. *J Agric Food Chem.* 28(6) 1070-1077.
[37] 1995 JMPR - Pesticide Residues in Food - 1995 Evaluations, Part I Residues FAO Plant Production and Protection Paper 137. FAO and WHO 1996

Quizalofop-P

-is used for the control of certain grass and broad leaf weeds in peanuts. The application rate is up to 100 g ai/ha.
The harvest WHP is 11 weeks.
Do not graze or cut for stock food for 11 weeks after application.

There are Australian and US but no Codex MRLs for animal commodities. The Australian MRL for meat (mammalian) has been set at *0.02 mg/kg and for edible offal (mammalian) 0.2 mg/kg. The US MRLs are 0.05 mg/kg for fat and meat by-products and 0.02 mg/kg for meat. The US MRL for milk is 0.01 mg/kg and for milk fat 0.25 mg/kg. The US residue definition is the sum of quizalofop-ethyl, quizalofop- methyl and quizalofop expressed as quizalofop ethyl. There are MRLs of *0.02 mg/kg for peanuts and 0.5 ppm for peanut forage (green).

In a feeding study, three groups of three lactating dairy cows plus a control group were fed 0.1, 0.5, and 5.0 ppm quizalofop ethyl ester (encapsulated) for 28- consecutive days[38]. Whole milk, skim milk, and cream from the control, and the 0.1 and 0.5 ppm dose groups showed no quizalofop to <0.02 ppm (0.05 ppm in cream). From the 5 ppm dose, quizalofop residues ranged from 0.01 to 0.02 ppm in whole, and when these samples were separated into cream and skim milk, the quizalofop partitioned into the cream with residues plateauing at 0.26 to 0.31 ppm.

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

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

Sethoxydim

- is a cyclohexanedione herbicide used for the control of certain grass weeds in crops. It is used for the control of various weeds in peanuts with application at rates of up to 0.192 kg ai/ha.
A harvest WHP is not required.

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. There are MRLs for peanut fodder and peanut forage (green) at 10 ppm and for peanuts at 3 mg/kg.

(If assume residues in forage at day 0 from application of a pesticide at 1 kg ai/ha are 50 ppm and scale for application rate, forage residues are expected to be 0.192×50 = 9.6 ppm).

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

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.

The US EPA reported[39] 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

Tebuconazole
-is a DMI fungicide used for the control of leaf spot, rust and net blotch in peanuts. The application rate is up to 0.189 kg ai/ha.
The harvest WHP is 21 days.
Do not graze or cut for stock food for 21 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 meat and cattle edible offal and *0.01 mg/kg for milk. The US MRLs are 0.2 mg/kg for meat byp and 0.1 mg/kg for milk. Australian MRL for peanut is 0.1 mg/kg.

In Australian trials reported by JMPR residues in foliage were 6.3-9.2 ppm at 20 days after application at 0.25 kg ai/ha and 8.7-19 ppm after application at 0.5 kg ai/ha. 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[40]. 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 peanut forage/fodder/hay.

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

Terbufos
-is a organophosphorous insecticide/nematicide used for the control of white grubs and white-fringed weevil in peanut crops and is applied to the soil at 8.25 g ai/100 m row at the time of planting.
A harvest WHP is not required.

[39] 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

[40] 1994 JMPR - Pesticide Residues in Food - 1994 Evaluations, Part I Residues FAO Plant Production and Protection Paper 78. FAO and WHO 1995

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 US EPA reported that "based on a goat metabolism study (MRID 42576901) in which a 10× dose resulted in non-detectable (<0.01 ppm) regulated terbufos residues in meat, milk, liver and kidney, it was concluded that terbufos residues in meat and milk can be classified under 40 CFR §180.6(a)(3), i.e. there is no reasonable expectation of finite residues. No tolerances are required."

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 peanuts. Application is at a maximum rate of 0.816 kg ai/ha.
No grazing WHP is required.

There are no Codex or US MRLs for trifluralin in animal tissues although there are registrations in the US including on vegetables (except carrot) MRL 0.05 mg/kg and carrot (MRL 1 mg/kg). The Australian MRL for meat (mammalian) and milk are *0.05 mg/kg. The MRL for the peanuts (oilseed) 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 tissues[41]. 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.

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

[41] 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