Department for Environment, Food and Rural Affairs

The Expert Committee on Pesticide Residues in Food (PRiF)

Report on the pesticide residues monitoring programme: Quarter 3 2018

March 2019

This publication is available at www.gov.uk/government/groups/expert-committee-on-pesticide-residues-in-food-prif

For further details on information contained in this report, previous surveys or information concerning pesticide residues in food, please contact:

Expert Committee on Pesticide Residues in Food
HSE's Chemicals Regulation Division
Mallard House
Kings Pool
Peasholme Green
York
YO1 7PX

prif@hse.gov.uk

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Introduction and summary results

Introduction to the work of the Expert Committee on Pesticide Residues in Food (PRiF)

The PRiFs role is to give Ministers, the Director of the Health and Safety Executive (HSE) and the Chief Executive of the Food Standards Agency (FSA) independent advice on the UK government's national rolling programme of surveys, in particular:

- the planning of surveillance programmes for pesticide residues in the UK food supply and the evaluation of the results;
- Procedures for sampling, sample processing, new methods of analysis, the assessment of variability of pesticide residues in food and related issues.

More information about PRiF

HSE working under Defra's authority has official responsibility to organise a monitoring programme of UK food for pesticide residues. The programme is made up of a risk-based national rolling programme of surveys and also includes participation in EU-wide monitoring. HSE is also responsible for considering the safety to people who eat the food (in co-operation with the Food Standards Agency if necessary) and following up adverse or unexpected results. They are also responsible for determining whether food is compliant with the law, specifically, whether any pesticide residue found is within the Maximum Residue Level. Maximum Residue Levels (MRLs) reflect levels of pesticides that could occur in produce, which has been treated in accordance with good agricultural practice. Where pesticides do not give rise to readily detectable residues, or are not approved for use on particular commodities, MRLs are set at the lowest level which can be identified in routine laboratory analysis. This provides a mechanism for statutory controls on pesticides in produce which is put into circulation and for monitoring the correct use of these chemicals.

Chair's summary of results

This is our third quarterly report for 2018. During this year's surveillance programme, we are looking for a range of up to 373 pesticides in the fruit and vegetable surveys. This quarter's programme surveyed 933 samples of 29 different foods (see contents page for a full list).

74 of the samples contained residues above the legal Maximum Residue Level (the maximum permitted levels by law). These results are in the surveys of beans with pods, beef, berries, cheese (soft), Chinese cabbage, frozen fruits and smoothie mixes, game, ginger, grapes, infant food (cereal based), lentils, melon, okra, peppers, potatoes and vine leaves. A sSummary table of all results can be found on page 6.

However, many of the exceedances were for chlorate findings, we do not think the findings of chlorate residues in cheese, frozen fruits and smoothie mixes and melon should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex. You can read updated information about work currently being done on chlorate residues in section 4.

HSE undertakes a screening risk assessment for every residue found, to determine whether the residues could lead to intakes above the relevant reference (safety) doses. HSE also produces detailed risk assessments for every case where the actual residue level found could lead to an intake above the safety levels. We have looked carefully at all of these findings including the risk assessments. In most cases the presence of the residues found would be unlikely to have had any effect on the health of people who ate the food. In the case of soft citrus and grapefruit, we found residues in some samples where short-lived effects were possible if people ate all of the peel as well as the flesh, but not when the fruit was peeled before eating.

Full details of suppliers and retailers of the food sampled, and full analytical results, are available on data.gov.uk as ODF (Open Document Format) spreadsheet files. There is no change to the level of detail or data structure previously included in our reports, but we hope the new data format is useful for people wanting to look at the individual results in more detail.

We asked suppliers and the authorities of the exporting countries for an explanation of our findings. Any responses we have received are available in section 2 sample details and supplier responses.

Dr Paul Brantom FRSB
Chairman of the Expert Committee on Pesticide Residues in Food

Summary table of all results

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Apples	30	25	0	0	15	4	0
Aubergine	11	6	0	0	2	0	0
Banana	18	11	0	0	11	7	0
Beans with pods	31	13	7	0	15	0	0
Beef	24	2	2	0	0	2	0
Berries	48	34	4	0	27	3	0
Bread	144	122	0	0	28	2	0
Broccoli	24	8	0	0	2	6	0
Cheese (soft)	36	1	10	0	1	4	1
Chinese cabbage	26	14	1	0	5	0	0
Eggs	24	0	0	0	0	5	0

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Fish (white)	24	4	n/a	0	0	0	0
Frozen Fruits and Smoothie Mixes	42	2	13	0	1	0	0
Game	18	2	5	0	2	0	0
Ginger	12	3	5	0	5	0	0
Grapefruit	24	24	0	0	24	0	0
Grapes	36	33	1	0	26	1	0
Infant food (cereal based)	37	0	1	0	0	14	1
Lentils	48	29	3	0	14	5	0
Melon	30	12	1	0	2	3	0
Milk	72	3	0	0	0	17	0
Mushrooms	18	5	0	0	1	6	0

Food	Analysed	With residues at or below the MRL	With residues above the MRL	With residues of non approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Okra	24	6	5	0	4	0	0
Pears	17	12	0	0	11	3	0
Peppers	37	19	1	0	6	2	0
Pineapple	18	10	0	0	1	0	0
Potatoes	17	7	1	0	3	1	0
Soft citrus	18	18	0	0	18	0	0
Vine leaves	24	2	10	0	10	2	0

Summary of samples with residues over the MRL

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Beans with pods						
0098/2018	Speciality Beans	Kenya	acephate	0.1	0.01*	Yes
			methamidophos	0.05	0.01*	Yes
0108/2018	Speciality Beans	Malaysia	chlorfenapyr	0.2	0.01*	Yes
0282/2018	Speciality Beans	India	monocrotophos	0.02	0.01*	Yes
0287/2018	Speciality Beans	Malaysia	chlorfenapyr	0.4	0.01*	Yes
			dithiocarbamates	3.3	1	Yes
			fipronil (sum)	0.06	0.005*	Yes
			lambda-cyhalothrin	0.5	0.2	Yes
0438/2018	Speciality Beans	Malaysia	dimethoate (sum)	0.05	0.01*	Yes
			fenpropathrin	0.07	0.01*	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
			lufenuron	0.07	0.01*	Yes
0632/2018	Speciality Beans	India	dimethoate (sum)	0.1	0.01*	Yes
0650/2018	Speciality Beans	India	acephate	0.2	0.01*	Yes
			flusilazole	0.02	0.01*	Yes
			methamidophos	0.05	0.01*	Yes
Beef						
2233/2018	Popeseye Steak	UK	BAC (sum)	0.2	0.1	Yes
2569/2018	Rump Steak	UK	DDAC (sum)	0.3	0.1	Yes
Berries						
2020/2018	Fresh: Blueberries	Ukraine	fosetyl (sum)	7.1	2*	Yes
2116/2018	Fresh: Blueberries	Ukraine	fosetyl (sum)	7.6	2*	Yes
2624/2018	Fresh: Blueberries	Ukraine	fosetyl (sum)	6.1	2*	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
2627/2018	Fresh: Blueberries	USA	folpet (sum)	0.06	0.03*	No
Cheese (soft)						
2032/2018	Brie	UK	chlorate	0.02	0.01	N/A
4607/2018	Brie	UK	chlorate	0.03	0.01	N/A
4270/2018	Camembert	France	chlorate	0.05	0.01	N/A
4000/2018	Cottage Cheese	UK	chlorate	0.04	0.01	N/A
3785/2018	Feta	Greece	chlorate	0.03	0.01	N/A
3986/2018	Feta	Greece	chlorate	0.02	0.01	N/A
3305/2018	Mozzarella	Italy	chlorate	0.03	0.01	N/A
3333/2018	Mozzarella	Italy	chlorate	0.02	0.01	N/A
2215/2018	Other	UK	chlorate	0.09	0.01	N/A
4659/2018	Ricotta	Italy	chlorate	0.03	0.01	N/A

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Chinese cabbage						
0186/2018	Pak Choi	UK	thiamethoxam	0.03	0.02*	No
Frozen Fruits and Smoothie Mixes						
2731/2018	Blueberries	Chile	chlorate	0.05	0.01	N/A
4144/2018	Blueberries	Chile	chlorate	0.05	0.01	N/A
4098/2018	Mango	UK	chlorate	0.02	0.01	N/A
2170/2018	Mixed Fruits	France	chlorate	0.04	0.01	N/A
3982/2018	Mixed Fruits	Guatemala	chlorate	0.04	0.01	N/A
4605/2018	Mixed Fruits	UK	chlorate	0.02	0.01	N/A
2482/2018	Smoothie Mixes	UK	chlorate	0.07	0.01	N/A
2483/2018	Smoothie Mixes	UK	chlorate	0.1	0.01	N/A
3468/2018	Smoothie Mixes	UK	chlorate	0.07	0.01	N/A

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
3782/2018	Smoothie Mixes	UK	chlorate	0.1	0.01	N/A
3783/2018	Smoothie Mixes	UK	chlorate	0.1	0.01	N/A
4337/2018	Smoothie Mixes	UK	BAC (sum)	0.4	0.1	Yes
			chlorate	0.02	0.01	N/A
2734/2018	Strawberries	Guatemala	chlorate	0.1	0.01	N/A
Game						
2183/2018	Partridge	UK	BAC (sum)	0.3	0.1	Yes
2186/2018	Pheasant	UK	BAC (sum)	1.9	0.1	Yes
2173/2018	Rabbit	China	BAC (sum)	2.2	0.1	Yes
2146/2018	Venison	UK	BAC (sum)	2.4	0.1	Yes
			DDAC (sum)	2.8	0.1	Yes
2179/2018	Venison	UK	BAC (sum)	0.3	0.1	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
			DDAC (sum)	0.3	0.1	Yes
Ginger						
0062/2018	Ginger	China	fosthiazate	0.03	0.02*	No
0112/2018	Ginger	China	clothianidin	0.02	0.01*	No
			fosthiazate	0.04	0.02*	Yes
0184/2018	Ginger	China	thiamethoxam	0.02	0.01*	No
0441/2018	Ginger	China	fosthiazate	0.03	0.02*	No
0557/2018	Ginger	China	clothianidin	0.04	0.01*	Yes
Grapes						
0286/2018	Crimson Seedless Grapes	Chile	captan (sum)	0.08	0.03*	Yes
Infant food (cereal based)						
2715/2018	Toddler Organic Oaty Pillows	Switzerland	chlormequat	0.02	0.01	No

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Lentils						
2666/2018	Brown Lentils	UK	procymidone	0.2	0.01*	Yes
2660/2018	Green Lentils	India	glyphosate	11	10	No
3966/2018	Red Lentils	UK	procymidone	0.08	0.01*	Yes
Melon						
4582/2018	Honeydew	Spain	chlorate	0.02	0.01*	N/A
Okra						
3294/2018	Fresh	Jordan	thiacloprid	0.5	0.01*	Yes
4858/2018	Fresh	Jordan	thiacloprid	0.6	0.01*	Yes
2034/2018	Frozen	India	propargite	0.03	0.01*	Yes
2618/2018	Frozen	India	flonicamid (sum)	0.04	0.03*	No
4628/2018	Frozen	India	flonicamid (sum)	0.1	0.03*	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Peppers						
0745/2018	Fresh	Poland	ethephon	0.1	0.05*	Yes
Potatoes						
5514/2018	Maincrop	Germany	MCPA (sum)	0.06	0.05*	No
Vine leaves						
2242/2018	Dried	Germany	boscalid	0.6	0.01*	Yes
			difenoconazole	0.08	0.05*	No
			flusilazole	0.02	0.01*	No
			iprodione	0.02	0.01*	No
2243/2018	Dried	Germany	boscalid	0.6	0.01*	Yes
			difenoconazole	0.08	0.05*	No
			iprodione	0.02	0.01*	No

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
2107/2018	In Brine	Turkey	dodine	0.6	0.01*	Yes
			lambda-cyhalothrin	0.2	0.02*	Yes
2185/2018	In Brine	Greece	tebuconazole	0.05	0.02*	Yes
4283/2018	In Brine	UK	azoxystrobin	0.02	0.01*	Yes
4537/2018	In Brine	Romania	dimethomorph	0.1	0.01*	Yes
			triadimefon & triadimenol	0.02	0.01*	No
4613/2018	In Brine	Egypt	acetamiprid	0.1	0.01*	Yes
			azoxystrobin	0.03	0.01*	Yes
			boscalid	0.05	0.01*	Yes
			carbendazim (sum)	1.3	0.1*	Yes
			chlorpyrifos	1	0.05*	Yes
			cyfluthrin (sum)	0.07	0.02	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
			dimethomorph	0.08	0.01*	Yes
			fipronil (sum)	0.02	0.005*	Yes
			flusilazole	0.2	0.01*	Yes
			iprodione	0.02	0.01*	Yes
			lambda-cyhalothrin	0.04	0.02*	Yes
			lufenuron	0.1	0.01	Yes
			propiconazole	0.4	0.01*	Yes
			thiophanate-methyl	1.1	0.1*	Yes
4614/2018	In Brine	Egypt	boscalid	0.05	0.01*	Yes
			chlorpyrifos	7.8	0.05*	Yes
			cyflufenamid	0.3	0.02*	Yes
			dithiocarbamates	0.2	0.05*	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
			emamectin	0.02	0.01*	Yes
			fenbutatin oxide	0.08	0.05*	No
			fluopyram	0.1	0.01*	Yes
			iprodione	0.09	0.01*	Yes
			methoxyfenozide	0.02	0.01*	Yes
			metrafenone	0.7	0.01*	Yes
			penconazole	0.2	0.05*	Yes
			proquinazid	0.04	0.02*	No
			pyrimethanil	0.2	0.01*	Yes
			spirotetramat (sum)	1	0.1*	Yes
			tebuconazole	0.06	0.02*	Yes
			tebufenpyrad	0.03	0.01*	Yes

PRIF Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
4735/2018	In Brine	Bulgaria	dimethomorph	0.09	0.01*	Yes
			metrafenone	0.02	0.01*	No
4818/2018	In Brine	UK	ametoctradin	0.3	0.01*	Yes
			dimethomorph	0.02	0.01*	No
			dithiocarbamates	0.9	0.05*	Yes

* Maximum Residue Levels set at the LOD (LOD MRL): These MRLs are set at a default level, i.e. at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. Either insufficient trials data are available on which to set a maximum residue level or there may be no use of the pesticide on that crop in the EU. However, they may be permitted elsewhere.

Chlorate residues above the current LOD MRL have not been marked as exceedances see Section 4 for explanation. Suppliers with residues above the MRL have been informed about the findings.

Section 1: findings by food

Apples

Summary of results

In a survey of 30 samples of apples collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

Two of the samples contained a residue of dithiocarbamates at a level within the MRL where a detailed risk assessment was required. Currently it is not possible to determine analytically which specific pesticide in the dithiocarbamate group was present. Therefore, HSE undertook a consumer risk assessment based on the assumption that ziram was used. Based on this worst-case assumption for the highest level it was concluded that some people might experience slight loss of appetite after eating or drinking large portions (97.5th percentile consumption) of apple containing the highest level found in this report. Such effects would be expected to be minor and reversible and we consider the likelihood of an effect on health to be low. In the future it would be valuable if additional cost-effective analytical tests could be developed to enable a more specific risk assessment.

Survey design

The apple samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

30 samples were tested for up to 367 pesticide residues

Cooking

- 11 samples came from the UK

Eating

- 1 samples came from the UK
- 16 samples were imported from outside the EU
- 2 samples came from the EU

Pesticide residues detected from those sought

- 5 samples contained no residues from those sought
- 25 samples contained residues above the reporting level

- None of the samples contained residues above the MRL
- 4 samples were labelled as organic. None contained residues from those sought

Multiple residues

15 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 5 samples contained 3 residues
- 2 samples contained 4 residues
- 3 samples contained 6 residues
- 2 samples contained 8 residues

Risk assessments

Dithiocarbamates

Three samples of apple contained a residue of dithiocarbamate at levels where the effect on health needed to be considered in more detail. The highest level detected was 2.2 mg/kg.

HSE's risk assessment in two cases was based on the assumption that the residue arose from ziram and concluded that some people might experience slight loss of appetite after eating or drinking large portions (97.5th percentile consumption) of apple containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor and reversible. The full risk assessment is at page 98. In the third case HSE received information that the residue did not arise from ziram. Therefore, no risk to health was expected.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Aubergine

Summary of results

In a survey of 11 samples of aubergines collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year aubergines are being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The aubergine samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

11 samples were tested for up to 365 pesticide residues

- 11 samples came from the EU

Pesticide residues detected from those sought

- 5 samples contained no residues from those sought
- 6 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

2 samples contained residues of more than one pesticide

- 1 sample contained 2 residues
- 1 sample contained 3 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Bananas

Summary of results

In a survey of 18 samples of bananas collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year bananas are being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The banana samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

18 samples were tested for up to 366 pesticide residues. Bananas are tested whole, including the peel

- 18 samples were imported from outside the EU

Pesticide residues detected from those sought

- 7 samples contained no residues from those sought
- 11 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 7 samples were labelled as organic. None contained residues from those sought

Multiple residues

11 samples contained residues of more than one pesticide

- 6 samples contained 2 residues
- 4 samples contained 3 residues
- 1 sample contained 4 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Beans with pods

Summary of results

In a survey of 31 samples of beans with pods collected between July and September 2018, 7 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

One of the samples contained a residue of monocrotophos. Monocrotophos is an insecticide that has not been authorised for use in the EU since 2003. There is uncertainty about the potential for monocrotophos to cause genetic damage, therefore, on a precautionary basis we consider any findings of monocrotophos in food as not desirable. However, considering the very low intakes any risks are likely to be low. A more detailed explanation is with the risk assessments on page 97.

Survey design

The bean with pod samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

31 samples were tested for up to 365 pesticide residues

Dwarf Beans

- 1 sample came from the UK

Fine Beans

- 1 sample came from the UK
- 1 sample was imported from outside the EU

Green Beans

- 5 samples came from the UK
- 7 samples were imported from outside the EU

Speciality Beans

- 2 samples came from the UK
- 12 samples were imported from outside the EU
- 2 samples came from the EU

Pesticide residues detected from those sought

- 11 samples contained no residues from those sought
- 20 samples contained residues above the reporting level
- 7 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

15 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 6 samples contained 3 residues
- 2 samples contained 4 residues
- 1 sample contained 5 residues
- 1 sample contained 7 residues
- 1 sample contained 8 residues
- 1 sample contained 10 residues

Residues measured above the MRL

The laboratory detected 15 residues above the MRL in beans with pods

- 1 sample of valor beans from Kenya contained residues of:
    - acephate at 0.1 mg/kg, the MRL is 0.01* mg/kg
    - methamidophos at 0.05 mg/kg, the MRL is 0.01* mg/kg
- 1 sample of yard long beans from Malaysia contained a residue of chlorfenapyr at 0.2 mg/kg, the MRL is 0.01* mg/kg
- 1 sample of guar beans from India contained a residue of monocrotophos at 0.02, the MRL is 0.01* mg/kg
- 1 sample of uri dolols beans from Malaysia contained residues of:
    - chlorfenapyr at 0.4 mg/kg, the MRL is 0.01* mg/kg

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* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

    - dithiocarbamates at 3.3 mg/kg, the MRL is 1 mg/kg
    - fipronil (sum) at 0.06 mg/kg, the MRL is 0.005* mg/kg
    - lambda-cyhalothrin at 0.5 mg/kg, the MRL is 0.2 mg/kg
- 1 sample of yard long beans from Malaysia contained residues of:
    - dimethoate (sum) at 0.05 mg/kg, the MRL is 0.01* mg/kg
    - fenpropathrin at 0.07 mg/kg, the MRL is 0.01* mg/kg
    - lufenuron at 0.07 mg/kg, the MRL is 0.01* mg/kg
- 1 sample of guar beans from India contained a residue of dimethoate (sum) at 0.1 mg/kg, the MRL is 0.01* mg/kg
- 1 sample of guar beans from India contained residues of:
    - acephate at 0.2 mg/kg, the MRL is 0.01* mg/kg
    - flusilazole at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - methamidophos at 0.05 mg/kg, the MRL is 0.01* mg/kg

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

One sample of beans contained a residue of monocrotophos at levels where the effect on health needed to be considered in more detail. The highest level detected was 0.02 mg/kg. Monocrotophos is an insecticide that has not been authorised for use in the EU since 2003. There is uncertainty about the potential for monocrotophos to cause genetic damage, therefore, on a precautionary basis we consider any findings of monocrotophos in food as not desirable. However, considering the very low intakes any risks are likely to be low. A more detailed explanation is with the risk assessments on page

Combined risk assessments

Some samples contained residues of more than one pesticide. Some of these residues are from pesticides which belong to similar chemical groups and may have similar toxicological effects. So, the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Beef

Summary of results

In a survey of 24 samples of beef collected between July and September 2018, 2 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The beef samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 104 pesticide residues

- 21 samples came from the UK
- 3 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the animal was from. It may be where the meat was processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 20 samples contained no residues from those sought
- 4 samples contained residues above the reporting level
- 2 samples contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

None of the samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected 2 residues above the MRL in beef

- 1 sample from UK contained a residue of BAC (sum) at 0.2 mg/kg. The MRL is 0.1 mg/kg.

- 1 sample from UK contained a residue of DDAC (sum) at 0.3 mg/kg. The MRL is 0.1 mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Berries and small fruits

Summary of results

In a survey of 48 samples of berries (blueberries, blackberries and gooseberries) collected between July and September 2018, 4 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Further berries were also collected as part of the frozen fruit and smoothie survey on page 47.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The berry samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

48 samples were tested for up to 364 pesticide residues

Fresh: Blackberries

- 9 samples came from the UK

Fresh: Blueberries

- 8 samples came from the UK
- 5 samples were imported from outside the EU
- 20 samples came from the EU

Fresh: Gooseberries

- 3 samples came from the UK

Frozen: Blackberries

- 1 sample was imported from outside the EU

Frozen: Blueberries

- 1 sample came from the UK
- 1 sample came from the EU

The country of origin on the packaging of frozen berries does not necessarily indicate where the berries were grown. It may be where the berries were processed or where they were packed for consumer purchase.

Pesticide residues detected from those sought

- 10 samples contained no residues from those sought
- 38 samples contained residues above the reporting level
- 4 samples contained residues above the MRL
- 3 samples were labelled as organic. None contained residues from those sought

Multiple residues

27 samples contained residues of more than one pesticide

- 8 samples contained 2 residues
- 6 samples contained 3 residues
- 4 samples contained 4 residues
- 5 samples contained 5 residues
- 3 samples contained 6 residues
- 1 sample contained 9 residues

Residues measured above the MRL

The laboratory detected 4 residues above the MRL in berries

- 1 sample of fresh blueberries from Ukraine contained a residue of fosetyl (sum) at 7.1 mg/kg, the MRL is 2* mg/kg.
- 1 sample of fresh blueberries from Ukraine contained a residue of fosetyl (sum) at 6.1 mg/kg, the MRL is 2* mg/kg.
- 1 sample of fresh blueberries from Ukraine contained a residue of fosetyl (sum) at 7.6 mg/kg, the MRL is 2* mg/kg.
- 1 sample of fresh blueberries from USA contained a residue of folpet (sum) at 0.06 mg/kg, the MRL is 0.03* mg/kg.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Bread

Summary of results

In a survey of 144 samples of bread collected between April and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected by the laboratory would be expected to have an effect on health.

Survey design

The bread samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

144 samples were tested for up to 368 pesticide residues

Ordinary Bread: Brown

- 1 sample came from the UK

Ordinary Bread: Other

- 13 samples came from the UK

Ordinary Bread: White

- 53 samples came from the UK

Ordinary Bread: Wholemeal

- 29 samples came from the UK

Speciality Bread: Bagels

- 12 samples came from the UK

Speciality Bread: Brioche

- 5 samples came from the EU

Speciality Bread: Crumpets

- 21 samples came from the UK

Speciality Bread: Muffins

- 1 sample came from the UK

Speciality Bread: Pancakes

- 5 samples came from the UK

Speciality Bread: Scones

- 3 samples came from the UK

Speciality Bread: Waffles

- 1 sample came from the EU

The country of origin on the packaging does not necessarily indicate where the wheat or other ingredients were produced. It may be where the bread was baked or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 22 samples contained no residues from those sought
- 122 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

28 samples contained residues of more than one pesticide

- 22 samples contained 2 residues
- 5 samples contained 3 residues
- 1 sample contained 4 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. Some of these residues are from pesticides which belong to similar chemical groups and may have similar toxicological effects. So, the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

Broccoli

Summary of results

In a survey of 24 samples of broccoli collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year broccoli is being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The broccoli samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 361 pesticide residues

Fresh

- 23 samples came from the UK
- 1 sample came from the EU

Pesticide residues detected from those sought

- 16 samples contained no residues from those sought
- 8 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 6 samples were labelled as organic. None contained residues from those sought

Multiple residues

2 samples contained residues of more than one pesticide

- 1 sample contained 2 residues
- 1 sample contained 3 residues

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

2 samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Cheese (soft)

Summary of results

In a survey of 36 samples of cheese collected between July and September 2018, 10 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Chlorate

We found chlorate over the default MRL in ten of the samples. However, we do not think that these findings should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex.

We expected to find residues of chlorate above the MRL in dairy products, where disinfection could be used as part of routine processes or where the food is packed in water. We are testing a limited number of foods for chlorate in 2018, as we did in 2017, to provide evidence on consumer safety and confirm that it is necessary to review the existing default MRL in order to take account of non-pesticide sources. Chlorine-based treatments of drinking and irrigation water as well as chlorine-based surface disinfectants are widely used to ensure microbiological safety. We agree with HSE and the FSA that the current MRL does not take account of these often-unavoidable sources.

Following the HSE's risk assessment, we do not expect any of the residues we found to have an effect on health. We do not think any changes in production practice by the brand-owners or manufacturers is needed in response to these findings.

This adds to a growing body of evidence, from both official monitoring across the EU and from the food and farming industries, about the incidence of chlorate residues in food.

More information on work being done on chlorate in the diet is available in Section 4.

Survey design

The cheese samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

36 samples were tested for up to 105 pesticide residues

Brie

- 4 samples came from the UK
- 2 samples came from the EU

Camembert

- 2 samples came from the UK
- 12 samples came from the EU

Cottage Cheese

- 3 samples came from the UK

Cream Cheese

- 1 sample came from the EU

Feta

- 6 samples came from the EU

Mozzarella

- 3 samples came from the EU

Other

- 1 sample came from the UK
- 1 sample came from the EU

Ricotta

- 1 sample came from the EU

The country of origin on the packaging may not be where the milk used to make the cheese was from. It may be where the cheese was made or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 25 samples contained no residues from those sought
- 11 samples contained residues above the reporting level
- 10 samples contained residues above the MRL
- 4 samples were labelled as organic.1 contained residues from those sought

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Residues measured above the MRL

The laboratory detected 10 residues above the MRL in cheese

- 2 samples of brie from the UK contained a residue of chlorate at 0.02 mg/kg and 0.03 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of cottage cheese from the UK contained a residue of chlorate at 0.04 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of cheese from the UK contained a residue of chlorate at 0.09 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of camembert from France contained a residue of chlorate at 0.05 mg/kg, the MRL is 0.01 mg/kg
- 2 samples of feta from Greece contained a residue of chlorate at 0.03 mg/kg and 0.02 mg/kg, the MRL is 0.01 mg/kg
- 2 samples of mozzarella from Italy contained a residue of chlorate at 0.03 mg/kg and 0.02 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of ricotta from Italy contained a residue of chlorate at 0.03 mg/kg, the MRL is 0.01 mg/kg

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Organic sample with a residue

The Secretariat has written to the supplier of the sample of organic feta cheese from Greece with a residue of chlorate. This is not permitted for use as a pesticide in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

Chinese cabbage

Summary of results

In a survey of 26 samples of Chinese cabbages collected between July and September 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The Chinese cabbage samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

26 samples were tested for up to 362 pesticide residues

Bok Choi

- 1 sample came from the UK
- 1 sample came from the EU

Chinese Leaf

- 4 samples came from the UK

Choy Sum

- 1 sample came from the UK
- 1 sample came from the EU

Pak Choi

- 14 samples came from the UK
- 4 samples came from the EU

Pesticide residues detected from those sought

- 11 samples contained no residues from those sought
- 15 samples contained residues above the reporting level

- 1 sample contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

5 samples contained residues of more than one pesticide

- 5 samples contained 2 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in Chinese leaves

- 1 sample of pak choi from UK contained a residue of thiamethoxam at 0.03 mg/kg, the MRL is 0.02* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Eggs

Summary of results

In a survey of 24 samples of eggs collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No residues were detected at or above the reporting limit.

Survey design

The egg samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 104 pesticide residues

Duck

- 2 samples came from the UK

Hens

- 22 samples came from the UK

Pesticide residues detected from those sought

- 24 samples contained no residues from those sought
- None of the samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 5 samples were labelled as organic. None contained residues from those sought

Multiple residues

No samples contained residues of more than one pesticide

Risk assessments

The laboratory did not detect any residues, so we did not carry out a risk assessment.

Fish (white)

Summary of results

In a survey of 24 samples of white fish collected between July and August 2018, 4 samples contained a pesticide residue above the reporting level. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

The EU has not at present set MRLs for any pesticide residues in fish. This means it is legal to trade in fish with pesticide residues at any level, so long as no effects on health are expected.

BAC (sum) and DDAC

4 samples of various fish contained residues of BAC or DDAC. These residues are almost certainly from disinfectants used on surfaces and equipment to ensure microbiological food safety. There are no MRLs for fish. None of the residues detected would be expected to have an effect on health.

Survey design

The white fish samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 38 pesticide residues

Basa

- 1 sample was imported from outside the EU

Cod

- 1 sample came from the UK
- 7 samples were imported from outside the EU

Coley

- 1 sample was imported from outside the EU

Haddock

- 2 samples were imported from outside the EU

Hake

- 2 samples were imported from outside the EU

Plaice

- 1 sample came from the UK
- 2 samples were imported from outside the EU

Pollock

- 2 samples were imported from outside the EU

Sea bass

- 1 sample came from the UK
- 2 samples were imported from outside the EU

Sea bream

- 2 samples were imported from outside the EU

Where no sea area information is available, the country of origin on the packaging does not necessarily indicate where the fish was caught. It could be where it was landed or processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 20 samples contained no residues from those sought
- 4 samples contained residues above the reporting level
- None of the samples were labelled as organic

Multiple residues

None of the samples contained residues of more than one pesticide

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Frozen fruits and smoothie mixes

Summary of results

In a survey of 42 samples of frozen fruits and smoothie mixes collected between July and September 2018, 13 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Further results relevant to this survey can also be found under the berries and small fruits section on page 32.

Comments by the PRiF

We found chlorate over the default MRL in 13 of the samples. However, we do not think that these findings should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex.

We expected to find residues of chlorate above the MRL in frozen products, where disinfection could be used as part of routine processes or where the food is packed in water. We are testing a limited number of foods for chlorate in 2018, as we did in 2017, to provide evidence on consumer safety and confirm that it is necessary to review the existing default MRL in order to take account of non-pesticide sources. Chlorine-based treatments of drinking and irrigation water as well as chlorine-based surface disinfectants which are widely used to ensure microbiological safety. We agree with HSE and the FSA that the current MRL does not take account of these often-unavoidable sources.

Following the HSE's risk assessment, we do not expect any of the residues we found to have an effect on health. We do not think any changes in production practice by the brand-owners or manufacturers is needed in response to these findings.

This adds to a growing body of evidence, from both official monitoring across the EU and from the food and farming industries, about the incidence of chlorate residues in food.

More information on work being done on chlorate in the diet is available in section 4.

Survey design

The frozen fruit and smoothie mix samples were bought by a market research company from retail outlets across the UK. This survey followed on from the frozen vegetables survey in quarters 1 where samples were tested for chlorates and QAC's only.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

42 samples were tested for up to 4 pesticide residues

Blackberries

- 1 sample came from the UK
- 2 samples were imported from outside the EU

Blueberries

- 2 samples came from the UK
- 2 samples were imported from outside the EU

Mango

- 1 sample came from the UK

Mixed Fruits

- 10 samples came from the UK
- 5 samples were imported from outside the EU
- 3 samples came from the EU

Raspberries

- 3 samples came from the UK
- 1 sample was imported from outside the EU
- 1 sample came from the EU

Smoothie Mixes

- 8 samples came from the UK

Strawberries

- 2 samples came from the UK
- 1 sample was imported from outside the EU

The country of origin on the packaging does not necessarily indicate where the fruit was from. It could be where it was processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 27 samples contained no residues from those sought
- 15 samples contained residues above the reporting level
- 13 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Residues measured above the MRL

The laboratory detected 14 residues above the MRL in frozen fruits and smoothie mixes

- 2 samples of blueberries from Chile contained a residue of chlorate at 0.05 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of mango from UK contained a residue of chlorate at 0.02 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of mixed fruits from France contained a residue of chlorate at 0.04 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of mixed fruits from Guatemala contained a residue of chlorate at 0.04 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of mixed fruits from UK contained a residue of chlorate at 0.02 mg/kg, the MRL is 0.01 mg/kg
- 5 samples of smoothie mixes from UK contained a residue of chlorate 0.07 mg/kg, 0.1 mg/kg, 0.07 mg/kg, 0.1 mg/kg and 0.1 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of smoothie mixes from UK contained residues of:
    - BAC (sum) at 0.4 mg/kg, the MRL is 0.01 mg/kg
    - chlorate at 0.02 mg/kg, the MRL is 0.01 mg/kg
- 1 sample of strawberries from Guatemala contained a residue of chlorate at 0.1 mg/kg, the MRL is 0.01 mg/kg

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

One sample contained residues of two pesticides. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Game

Summary of results

In a survey of 18 samples of game collected during August 2018, 5 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health. All the residues we detected were of substances that are widely used as surface disinfectants on surfaces and equipment at butchers' shops. We think it is unlikely that the birds or animals were exposed to the substances we detected, in their environment.

Survey design

The game samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

18 samples were tested for up to 38 pesticide residues

Duck

- 2 samples came from the UK

Guinea fowl

- 1 sample came from the UK
- 2 samples came from the EU

Partridge

- 2 samples came from the UK

Pheasant

- 2 samples came from the UK

Pigeon

- 3 samples came from the UK

Poussin

- 1 sample came from the EU

Quail

- 1 sample came from the UK

Rabbit

- 1 sample was imported from outside the EU

Venison

- 3 samples came from the UK

The country of origin on the packaging does not necessarily indicate where the animal was from. It may be where the meat was processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 11 samples contained no residues from those sought
- 7 samples contained residues above the reporting level
- 5 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

2 samples contained residues of more than one pesticide

- 2 samples contained 2 residues

Residues measured above the MRL

The laboratory detected 7 residues above the MRL in game

- 1 sample of partridge from UK contained a residue of BAC (sum) at 0.3 mg/kg, the MRL is 0.1 mg/kg
- 1 sample of pheasant from UK contained a residue of BAC (sum) at 1.9 mg/kg, the MRL is 0.1 mg/kg
- 1 sample of rabbit from China contained a residue of BAC (sum) at 2.2 mg/kg, the MRL is 0.1 mg/kg
- 2 samples of venison from UK contained residues of:
    - BAC (sum) at 2.4 mg/kg and 0.3 mg/kg, the MRL is 0.1 mg/kg
    - DDAC (sum) at 2.8 mg/kg and 0.3 mg/kg, the MRL is 0.1 mg/kg

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Multiple residues with similar effects but no risk issue.

Two samples contained residues of two pesticides. Both of these residues are from pesticides which belong to similar chemical groups and may have similar toxicological effects. So, the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Ginger

Summary of results

In a survey of 12 samples of ginger collected between July and September 2018, 5 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The ginger samples were collected by the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesale markets, retail depots, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

12 samples were tested for up to 365 pesticide residues

12 samples were imported from outside the EU

Pesticide residues detected from those sought

- 4 samples contained no residues from those sought
- 8 samples contained residues above the reporting level
- 5 samples contained residues above the MRL
- None of the samples were labelled as organic

Multiple residues

5 samples contained residues of more than one pesticide

- 4 samples contained 2 residues
- 1 sample contained 3 residues

Residues measured above the MRL

The laboratory detected 6 residues above the MRL in ginger

- 1 sample from China contained a residue of thiamethoxam at 0.02 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from China contained a residue of fosthiazate at 0.03 mg/kg, the MRL is 0.02* mg/kg
- 1 sample from China contained residues of:
    - clothianidin at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - fosthiazate at 0.04 mg/kg, the MRL is 0.02* mg/kg
- 1 sample from China contained a residue of clothianidin at 0.04 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from China contained a residue of fosthiazate at 0.03 mg/kg, the MRL is 0.02* mg/kg

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Grapefruit

Summary of results

In a survey of 24 samples of grapefruit collected between July and September 2018, none of the sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year grapefruit is being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

Several samples contained residues that required a detailed risk assessment. We have presented the risk assessments in full. Based on HSE's risk assessment of the residues detected, we consider an effect on health is not expected for residues of chlorpyrifos and unlikely for imazalil.

Survey design

The grapefruit samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 364 pesticide residues

- 22 samples were imported from outside the EU
- 2 samples came from the EU

Pesticide residues detected from those sought

- All samples contained residues
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

24 samples contained residues of more than one pesticide

- 2 samples contained 3 residues
- 8 samples contained 4 residues
- 3 samples contained 5 residues
- 7 samples contained 6 residues

- 3 samples contained 7 residues

Risk assessments

Chlorpyrifos

Two samples of grapefruit contained a residue of chlorpyrifos at a level where the effect on health needed to be considered in more detail. The highest level detected was 0.2 mg/kg. HSE conducted risk assessments using toxicological values derived from data which examined impacts upon animals and on humans. HSE accepts that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment does not expect an effect on health. The full risk assessment is on page 99.

Imazalil

4 samples of grapefruit contained a residue of imazalil at levels where the effect on health needed to be considered in more detail (1.9 to 3.5 mg/kg). The highest level detected was 3.5 mg/kg. Based on HSE's risk assessment of the residues detected an effect on health is unlikely when it is assumed that all of the peel is consumed. If the peel is not consumed an effect on health is not expected. The full risk assessment is on page 100.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Grapes

Summary of results

In a survey of 36 samples of grapes collected between July and September 2018, one sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

Two samples contained a residue of ethephon below the MRL that required a detailed risk assessment. We have presented the risk assessment in full. Based on HSE's risk assessment of the residues detected, we consider an effect on health is unlikely.

Survey design

The grape samples were collected by the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesale markets, retail depots, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

36 samples were tested for up to 371 pesticide residues

- 17 samples were imported from outside the EU
- 19 samples came from the EU

Pesticide residues detected from those sought

- 2 samples contained no residues from those sought
- 34 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- 1 sample was labelled as organic. None contained residues from those sought

Multiple residues

26 samples contained residues of more than one pesticide

- 6 samples contained 2 residues
- 7 samples contained 3 residues
- 4 samples contained 4 residues
- 3 samples contained 5 residues
- 4 samples contained 6 residues

- 1 sample contained 10 residues
- 1 sample contained 12 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in grapes

- 1 sample from Chile contained a residue of captan (sum) at 0.08 mg/kg, the MRL is 0.03* mg/kg.

Risk assessments

Ethephon

Eleven samples of grape contained a residue of ethephon at a level where the effect on health needed to be considered in more detail. The highest level detected was 0.9 mg/kg. Based on HSE's risk assessment of the residues detected an effect on health is unlikely. The full risk assessment is at page 102.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Infant food (cereal based)

Summary of results

In a survey of 37 samples of cereal based infant foods collected between June and July 2018, one sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year infant food is being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The infant food samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

37 samples were tested for up to 373 pesticide residues

- 11 samples came from the UK
- 4 samples were imported from outside the EU
- 22 samples came from the EU

Pesticide residues detected from those sought

- 36 samples contained no residues from those sought
- 1 sample contained residues above the reporting level
- 1 sample contained residues above the MRL
- 14 samples were labelled as organic.1 contained residues from those sought

Multiple residues

None of the samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in infant food

- 1 sample from Switzerland contained a residue of chlormequat at 0.02 mg/kg, the MRL is 0.01 mg/kg.

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Follow up actions

Letters sent

The secretariat has written to the supplier of the samples with residues above the MRL. Any response received is at Section 2.

Organic sample with a residue

The Secretariat has written to the supplier of the sample of organic oat-based cereal from Switzerland with a residue of chlormequat. This is not permitted for use as a pesticide in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

Lentils

Summary of results

In a survey of 48 samples of lentils collected between June and August 2018, 3 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The lentil samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

48 samples were tested for up to 366 pesticide residues

Black Lentils

- 1 sample was imported from outside the EU

Brown Lentils

- 6 samples came from the UK
- 4 samples were imported from outside the EU

Green Lentils

- 4 samples came from the UK
- 6 samples were imported from outside the EU
- 5 samples came from the EU

Puy Lentils

- 1 sample came from the UK

Red Lentils

- 6 samples came from the UK
- 12 samples were imported from outside the EU
- 2 samples came from the EU

Yellow Lentils

- 1 sample came from the UK

The country of origin on the packaging does not necessarily indicate where the lentils were from. It may be where they were processed or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 14 samples contained no residues from those sought
- 34 samples contained residues above the reporting level
- 3 samples contained residues above the MRL
- 5 samples were labelled as organic. None contained residues from those sought

Multiple residues

14 samples contained residues of more than one pesticide

- 8 samples contained 2 residues
- 3 samples contained 3 residues
- 3 samples contained 4 residues

Residues measured above the MRL

The laboratory detected 3 residues above the MRL in lentils

- 2 samples from UK contained a residue of procymidone at 0.2 mg/kg and 0.08 mg/kg, the MRL is 0.01* mg/kg.
- 1 sample from India contained a residue of glyphosate at 11 mg/kg, the MRL is 10 mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Melon

Summary of results

In a survey of 30 samples of melons collected between July and September 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year melons are being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

Chlorate

We found chlorate over the MRL in one of the samples. However, we do not think that these findings should be treated as breaches of the legislation, and we have not highlighted them as such in the brand name annex.

We expected to find residues of chlorate above the MRL in food with a high-water content or that has been washed with water. We are testing a limited number of foods for chlorate in 2018, as we did in 2017, to provide evidence on consumer safety and confirm that it is necessary to review the existing default MRL in order to take account of non-pesticide sources. In particular, chlorine-based treatments of drinking and irrigation water as well as chlorine-based surface disinfectants which are widely used to ensure microbiological safety. We agree with HSE and the FSA that the current MRL does not take account of these often-unavoidable sources.

Following the HSE's risk assessment, we do not expect any of the residues we found to have an effect on health. We do not think any change in production practice by the brand-owners or manufacturers is needed in response to these findings.

This adds to a growing body of evidence, from both official monitoring across the EU and from the food and farming industries, about the incidence of chlorate residues in food.

More information on work being done on chlorate in the diet is available on 108.

Survey design

The melon samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

30 samples were tested for up to 364 pesticide residues

Cantaloupe

- 3 samples came from the EU

Galia

- 6 samples came from the EU

Honeydew

- 1 sample was imported from outside the EU
- 2 samples came from the EU

Piel De Sapo

- 3 samples came from the EU

Watermelon

- 15 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the melon was grown. It may be where it was prepared or where it was packed for consumer purchase.

Pesticide residues detected from those sought

- 17 samples contained no residues from those sought
- 13 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- 3 samples were labelled as organic. None contained residues from those sought

Multiple residues

2 samples contained residues of more than one pesticide

- 1 sample contained 2 residues
- 1 sample contained 4 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in melon

- 1 sample from Spain contained a residue of chlorate at 0.02 mg/kg, the MRL is 0.01* mg/kg.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Milk

Summary of results

In a survey of 72 samples of milk collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The milk samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

72 samples were tested for up to 104 pesticide residues

Cows milk

- 67 samples came from the UK

Goats milk

- 5 samples came from the UK

Pesticide residues detected from those sought

- 69 samples contained no residues from those sought
- 3 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 17 samples were labelled as organic. None contained residues from those sought

Multiple residues

No samples contained residues of more than one pesticide

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Mushrooms (cultivated)

Summary of results

In a survey of 17 samples of cultivated mushrooms collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year mushrooms are being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The mushroom samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

17 samples were tested for up to 368 pesticide residues

Button

- 7 samples came from the UK

Chestnut

- 8 samples came from the UK
- 2 samples came from the EU

Pesticide residues detected from those sought

- 13 samples contained no residues from those sought
- 4 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 6 samples were labelled as organic. None contained residues from those sought

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

One sample contained residues of two pesticides. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Okra

Summary of results

In a survey of 24 samples of okra collected between July and September 2018, 5 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The okra samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 365 pesticide residues

Fresh

- 15 samples were imported from outside the EU
- 3 samples came from the EU

Frozen

- 6 samples were imported from outside the EU

The country of origin on the packaging does not necessarily indicate where the okra was grown. It may be where the okra was processed or where they were packed for consumer purchase.

Pesticide residues detected from those sought

- 13 samples contained no residues from those sought
- 11 samples contained residues above the reporting level
- 5 samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

4 samples contained residues of more than one pesticide

- 3 samples contained 2 residues
- 1 sample contained 5 residues

Residues measured above the MRL

The laboratory detected 5 residues above the MRL in okra

- 1 sample from India contained a residue of propargite at 0.03 mg/kg, the MRL is 0.01* mg/kg.
- 2 samples from India contained a residue of flonicamid (sum) at 0.04 mg/kg and 0.1 mg/kg, the MRL is 0.03* mg/kg.
- 2 samples from Jordan contained a residue of thiacloprid at 0.5 mg/kg and 0.6 mg/kg, the MRL is 0.01* mg/kg.

Risk assessments

None of the individual residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Pears

Summary of results

In a survey of 17 samples of pears collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The pear samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

17 samples were tested for up to 369 pesticide residues

- 6 samples were imported from outside the EU
- 11 samples came from the EU

Pesticide residues detected from those sought

- 5 samples contained no residues from those sought
- 12 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- 3 samples were labelled as organic. None contained residues from those sought

Multiple residues

11 samples contained residues of more than one pesticide

- 4 samples contained 2 residues
- 3 samples contained 3 residues
- 3 samples contained 4 residues
- 1 sample contained 5 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

One sample contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Peppers

Summary of results

In a survey of 37 samples of peppers collected between July and September 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

This year peppers are being surveyed across the EU as part of the EU co-ordinated multi-annual control programme.

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The pepper samples were collected by either the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesalers, retail depots, ports and import points) or they were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

37 samples were tested for up to 368 pesticide residues

Fresh

5 samples came from the UK

32 samples came from the EU

Pesticide residues detected from those sought

- 17 samples contained no residues from those sought
- 20 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

6 samples contained residues of more than one pesticide

- 4 samples contained 2 residues
- 2 samples contained 4 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in peppers

- 1 sample from Poland contained a residue of ethephon at 0.1 mg/kg, the MRL is 0.05* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Pineapple

Summary of results

In a survey of 18 samples of pineapples collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

Survey design

The pineapple samples were bought by a market research company from retail outlets across the UK.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

18 samples were tested for up to 364 pesticide residues

Canned

- 1 sample came from the UK
- 5 samples were imported from outside the EU

Fresh

- 10 samples were imported from outside the EU

Prepared

- 2 samples came from the UK

The country of origin on the packaging does not necessarily indicate where the pineapples were grown. It may be where they were prepared or where they were packed for consumer purchase.

Pesticide residues detected from those sought

- 8 samples contained no residues from those sought
- 10 samples contained residues above the reporting level
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

One sample contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Potatoes

Summary of results

In a survey of 18 samples of potatoes collected between June and September 2018, 1 sample contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

None of the residues detected would be expected to have an effect on health.

We are aware that the renewal of chlorpropham is under consideration at a European level. We are keeping appraised of the situation and any implications for the assessment of risks to consumers from the results of the monitoring programme.

Survey design

The Animal and Plant Health Agency's Plant Health and Seed Inspectors collected the potato samples from a range of points across the supply chain (wholesalers, potato processors, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

18 samples were tested for up to 367 pesticide residues

Maincrop

17 samples came from the UK

1 sample came from the EU

Pesticide residues detected from those sought

- 10 samples contained no residues from those sought
- 8 samples contained residues above the reporting level
- 1 sample contained residues above the MRL
- 1 sample was labelled as organic. None contained residues from those sought

Multiple residues

3 samples contained residues of more than one pesticide

- 2 samples contained 2 residues
- 1 sample contained 3 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in potatoes

- 1 sample from Germany contained a residue of MCPA (sum) at 0.06 mg/kg, the MRL is 0.05* mg/kg.

Risk assessments

None of the individual residues or combined residues detected by the laboratory would be expected to have an effect on health.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

Soft citrus

Summary of results

In a survey of 18 samples of soft citrus collected between July and September 2018, none of the samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

Several samples contained residues that required a detailed risk assessment. We have presented the risk assessments in full. Based on HSE's risk assessment of the residues detected, we consider an effect on health is unlikely for samples containing the highest residues of imazalil.

The risk assessment for one of the samples containing a residue of thiabendazole at 3.8 mg/kg indicated that that some people might experience loss of appetite after eating large portions (97.5th percentile consumption) of soft citrus including all the peel containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible. However, if the peel is not consumed then an effect on health is not expected.

Survey design

The soft citrus samples were collected by the Rural Payment Agency's Horticultural Marketing Inspectors from a range of points in the supply chain (wholesale markets, retail depots, ports and import points).

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

18 samples were tested for up to 363 pesticide residues

Clementine

- 5 samples were imported from outside the EU

Mandarin

- 7 samples were imported from outside the EU

Minneola

- 1 sample was imported from outside the EU

Satsuma

- 4 samples were imported from outside the EU

Tangerine

- 1 sample was imported from outside the EU

Pesticide residues detected from those sought

- All samples contained residues
- None of the samples contained residues above the MRL
- None of the samples were labelled as organic.

Multiple residues

18 samples contained residues of more than one pesticide

- 1 sample contained 3 residues
- 5 samples contained 4 residues
- 5 samples contained 5 residues
- 2 samples contained 6 residues
- 1 sample contained 7 residues
- 3 samples contained 8 residues
- 1 sample contained 10 residues

Risk assessments

Imazalil

5 samples of soft citrus contained a residue of imazalil at levels where the effect on health needed to be considered in more detail (range 1.9 to 3.4 mg/kg). The highest level detected was 3.4 mg/kg. Based on HSE's risk assessment of the residues detected an effect on health is unlikely when it is assumed that all of the peel is consumed. If the peel is not consumed an effect on health is not expected. Full risk assessment is available at page 102.

Thiabendazole

5 samples of grapefruit contained a residue of thiabendazole at levels where the effect on health needed to be considered in more detail. The highest level detected was 3.8 mg/kg. Based on HSE's risk assessment of the residues detected we consider that some people might experience loss of appetite after eating large portions (97.5th percentile consumption) of soft citrus including all the peel containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible. However, if the peel is not consumed then an effect on health is not expected. Full risk assessment is available at page 104.

Combined risk assessments

Some samples contained residues of more than one pesticide. The pesticide residues found are not chemically related to each other and do not have the same toxicological effects. Following the Health and Safety Executive (HSE)'s risk assessment, we do not expect these residues to have an effect on health, either separately or in combination.

Vine leaves

Summary of results

In a survey of 24 samples of vine leaves collected between July and August 2018, 10 samples contained a pesticide residue above the MRL. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

One sample contained a residue that required a detailed risk assessment. We have presented the risk assessment in full. Based on HSE's risk assessment of the residues detected, we consider an effect on health is not expected. The full risk assessment can be found at page 105.

Survey design

The vine leaf samples were bought by a market research company from retail outlets across the UK. All of the samples were processed either dried or in brine.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at https://data.gov.uk/dataset/pesticide-residues-in-food.

Samples tested

24 samples were tested for up to 363 pesticide residues

Dried

- 1 sample came from the UK
- 4 samples came from the EU

In Brine

- 2 samples came from the UK
- 3 samples were imported from outside the EU
- 14 samples came from the EU

The country of origin on the packaging does not necessarily indicate where the vine leaves were grown. It may be where they were prepared or where they were packed for consumer purchase.

Pesticide residues detected from those sought

- 12 samples contained no residues from those sought
- 12 samples contained residues above the reporting level
- 10 samples contained residues above the MRL
- 2 samples were labelled as organic. None contained residues from those sought

Multiple residues

10 samples contained residues of more than one pesticide

- 4 samples contained 2 residues
- 1 sample contained 3 residues
- 2 samples contained 4 residues
- 1 sample contained 5 residues
- 1 sample contained 18 residues
- 1 sample contained 19 residues

Residues measured above the MRL

The laboratory detected 48 residues above the MRL in vine leaves. Note the MRL's for vines leaves are a separate category than the MRL's for grapes.

- 1 sample from Germany contained residues of:
    - boscalid at 0.6 mg/kg, the MRL is 0.01* mg/kg
    - difenoconazole at 0.08 mg/kg, the MRL is 0.05* mg/kg
    - flusilazole at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - iprodione at 0.02 mg/kg, the MRL is 0.01* mg/kg
- 1 sample form Germany contained residues of:
    - boscalid at 0.6 mg/kg, the MRL is 0.01* mg/kg
    - difenoconazole at 0.08 mg/kg, the MRL is 0.05* mg/kg
    - iprodione at 0.02 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from Turkey contained residues of:
    - dodine at 0.6 mg/kg, the MRL is 0.01* mg/kg
    - lambda-cyhalothrin at 0.2 mg/kg, the MRL is 0.02* mg/kg
- 1 sample from Greece contained a residue of tebuconazole at 0.05 mg/kg, the MRL is 0.02* mg/kg.

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* **Maximum Residue Levels set at the LOD (LOD MRL):** These MRLs are set at a default level, i.e. at the limit of determination (LOD) as specified in EC Regulation 396/2005.

- 1 sample from Egypt contained residues of:
    - boscalid at 0.05 mg/kg, the MRL is 0.01* mg/kg
    - chlorpyrifos at 7.8 mg/kg, the MRL is 0.05* mg/kg
    - cyflufenamid at 0.3 mg/kg, the MRL is 0.02* mg/kg
    - dithiocarbamates at 0.2 mg/kg, the MRL is 0.05* mg/kg
    - emamectin at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - fenbutatin oxide at 0.08 mg/kg, the MRL is 0.05* mg/kg
    - fluopyram at 0.1 mg/kg, the MRL is 0.01* mg/kg
    - iprodione at 0.09 mg/kg, the MRL is 0.01* mg/kg
    - methoxyfenozide at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - metrafenone at 0.7 mg/kg, the MRL is 0.01* mg/kg
    - penconazole at 0.2 mg/kg, the MRL is 0.05* mg/kg
    - proquinazid at 0.04 mg/kg, the MRL is 0.02* mg/kg
    - pyrimethanil at 0.2 mg/kg, the MRL is 0.01* mg/kg
    - spirotetramat (sum) at 1 mg/kg, the MRL is 0.1* mg/kg
    - tebuconazole at 0.06 mg/kg, the MRL is 0.02* mg/kg
    - tebufenpyrad at 0.03 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from Egypt contained residues of:
    - acetamiprid at 0.1 mg/kg, the MRL is 0.01* mg/kg
    - azoxystrobin at 0.03 mg/kg, the MRL is 0.01* mg/kg
    - boscalid at 0.05 mg/kg, the MRL is 0.01* mg/kg
    - carbendazim (sum) at 1.3 mg/kg, the MRL is 0.1* mg/kg
    - chlorpyrifos at 1 mg/kg, the MRL is 0.05* mg/kg
    - cyfluthrin (sum) at 0.07 mg/kg, the MRL is 0.02 mg/kg
    - dimethomorph at 0.08 mg/kg, the MRL is 0.01* mg/kg
    - fipronil (sum) at 0.02 mg/kg, the MRL is 0.005* mg.kg
    - flusilazole at 0.2 mg/kg, the MRL is 0.01* mg/kg
    - iprodione at 0.02 mg/kg, the MRL is 0.01*

    - lambda-cyhalothrin at 0.04 mg/kg, the MRL is 0.02* mg/kg
    - lufenuron at 0.1 mg/kg, the MRL is 0.01 mg/kg
    - propiconazole at 0.4 mg/kg, the MRL is 0.01* mg/kg
    - thiophanate-methyl at 1.1 mg/kg, the MRL is 0.1* mg/kg
- 1 sample from Romania contained residues of:
    - dimethomorph at 0.1 mg/kg, the MRL is 0.01* mg/kg
    - triadimefon & triadimenol at 0.02 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from Bulgaria contained residues of:
    - dimethomorph at 0.09 mg/kg, the MRL is 0.01* mg/kg
    - metrafenone at 0.02 mg/kg, the MRL is 0.01* mg/kg
- 1 sample from UK contained residues of:
    - ametoctradin at 0.3 mg/kg, the MRL is 0.01* mg/kg
    - dimethomorph at 0.02 mg/kg, the MRL is 0.01* mg/kg
    - dithiocarbamates at 0.9 mg/kg, the MRL is 0.05* mg/kg
- 1 sample from UK contained a residue of azoxystrobin at 0.02 mg/kg, the MRL is 0.01* mg/kg

Risk assessments

One sample of vine leaves contained a residue of chlorpyrifos at a level where the effect on health needed to be considered in more detail. The level detected was 7.8 mg/kg. HSE conducted risk assessments using toxicological values derived from data which examined impacts upon animals and on humans. HSE accepts that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment does not expect an effect on health. The full assessment can be found at page 105.

Combined risk assessments

Some samples contained residues of more than one pesticide. Some of these residues are from pesticides which belong to similar chemical groups and may have similar toxicological effects. So, the risk assessors needed to consider their possible impacts on human health, both on their own and in combination.

HSE carried out a combined risk assessment of the relevant samples. We would not expect any of these combinations to have an effect on health.

The sample which contained chlorpyrifos at 7.8 mg/kg also contained 0.01 mg/kg of chlorpyrifos-methyl. The chlorpyrifos residues alone represented a twofold exceedance of the acute reference dose(see the risk assessment table for the detailed assessment). The presence of the chlorpyrifos-methyl adds minimally to the chlorpyrifos exposure. As such

the conclusion for the chlorpyrifos alone is valid for this combined assessment and an effect on health is not expected.

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any responses received are in Section 2.

Section 2: Sample details and supplier responses

Sample details

The sample details are published on data.gov.uk as a dataset in ODS format.

About sample information

The following information is available on each sample collected this quarter:

- Date and place of collection
- Description (e.g. 'runner bean', organic milk);
- Country of origin or manufacture;
- Brand name and packer/manufacturer; and
- Residues detected (results shown in green indicate residues above the MRL).
- Where the brand name of a sample is given the produce involved may have been on sale in other retail premises at the same time.

The description and country of origin are taken from labelling on the food or at the point of sale. The country of origin of processed food may not be the country where the unprocessed produce was produced. This is true even of food that has undergone minimal processing, such as meat that has been butchered or frozen vegetables.

Samples with residues above the MRL are in bold, green text.

UK samples with residues of pesticides not approved for use on that food in the UK in bold, blue text.

Organic samples with residues of pesticides not permitted for use in organic food production are in bold text.

Some brand name details have been withheld – these will be published once enquiries are complete.

The Government's 'brand naming' policy

The Government has decided that brand name information should be published as part of the Government food chemical surveillance programme. Brand names have been published for most pesticide residue surveys since 1998. Certain samples are excluded from the release of brand name information. These include samples taken as part of any pesticide residues enforcement programme and those taken as part of surveys to study individual people/farms. This policy was reviewed in 2000/1, when Ministers agreed to its continuation.

Where we find residues above an MRL or the presence of non-approved pesticides brand owners/retailers/ growers are notified of the result in advance of publication of reports and given four weeks to comment.

Interpreting brand name information

There is no ready definition of what constitutes a brand in all cases. For clearly branded produce like breakfast cereals or biscuits the “brand owner” is shown. In the case of “own brand” goods this may be one of the multiple retailers. For fruit and vegetables, the retailer is generally shown. For meat, milk and most other animal products the retailer is also generally shown. Finally, for all commodities the country of origin is shown where this was displayed either on the produce or in the store.

Our programme takes samples of produce in approximate proportion to the market share of the main retailers. This has been done to ensure we obtain an accurate representation of a sector (e.g. fruit and vegetables).

Individual programmes are not capable of generating statistically valid information on residues in particular crops from particular retailers. This would require the collection of a much larger number of samples: either substantially increasing costs or greatly reducing the range of different foods sampled in any one year. Therefore, results from an individual survey cannot be taken as a fair representation of the residues status of any particular brand.

However, we do collect samples from a variety of outlets in a range of locations, over a period of years. Successive programmes should therefore help generate information on the typical residues profile of particular types of produce and on major trends in the incidence and levels of pesticides. It should be noted that this quarterly report is not intended to give a comprehensive comparison with previous surveys of the same commodities.

A particular issue arises in relation to the country of origin of fruit and vegetables. The origins included in the reports are those recorded either on the produce or in the store. However, it is not uncommon for mixing to occur on shop shelves. We have responded by increasing the proportion of pre-packed goods sampled. However, pre-packed samples are not available for some produce in some stores and it could also introduce bias to surveys if loose produce were not sampled. Loose produce is therefore sampled but the origin of the sample should be interpreted with a degree of caution.

Action taken by HSE

HSE wrote to:

- The suppliers of all samples containing residues above the MRL
- The authorities of the exporting countries of all samples containing residues above the MRL
- The suppliers of UK samples that contained residues that were not approved for that crop
- The Organics branch of Defra about samples that were labelled as organic and contained residues of pesticides not approved for organic production
- The suppliers and certification organisation of all organic samples containing residues of pesticides not approved for organic production

Recipients of the letters are given 4 weeks to provide a statement for inclusion in the report. The Expert Committee on Pesticide Residues in Food reviews any replies received.

Section 3: HSE assessment of risk

The surveillance programme is designed to enable the regulatory authorities to check that:

- specified pesticide MRLs are being respected;
- users of pesticides are complying with conditions of use specified in the authorisation;
- Dietary intakes of residues are within acceptable limits.

This section details how risks from dietary intakes are assessed.

When assessments are carried out

A screening assessment is done for each residue and commodity combination to identify residue levels that would lead to intakes above the relevant reference doses. Further information on this screening approach is available on request from HSE. Detailed assessments are then produced for every case where the actual residue level found could lead to an intake by any group above the reference dose.

Assessing Dietary intakes

Assessing the acceptability of dietary intakes is complicated. Consumer risk assessments are carried out for both short-term (peak) and long-term intakes. These assessments use information on food consumption collected in UK dietary surveys in conjunction with the residue levels we find. Occasionally, additional pesticide specific information on the losses of residues that occur during preparation and/or cooking of food is also used.

How the assessment is carried out

Short-term intakes (also called NESTIs) are calculated using consumption data for high-level consumers, based on single-day consumption values and the highest residue found in a food commodity. The residue found is multiplied by a variability factor to take account of the fact that residues may vary between individual items that make up the sample analysed. The estimated intake is compared to the Acute Reference Dose (ARfD). This is done for ten consumer groups; adults, infants, toddlers, 4-6 year olds, 7-10 year olds, 11-14 year olds, 15-18 year olds, vegetarians, elderly living in residential homes and elderly living in their own homes.

Long-term intakes (NEDI) are also calculated for high-level consumers, but in this case the consumption data are high-level long-term values rather than peak single-day events, and similarly the residue values used reflect long-term average levels rather than occasional high values. Again, these estimates are made for the ten consumer groups. In this case the estimated intake is compared to the Acceptable Daily Intake (ADI). More information on intake assessments is available on HSE's website: www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/data-requirements-handbook/consumer-intake-assessments-new-intake-calculation-models.

The reference doses (ADI, ARfD) are set by the Advisory Committee on Pesticides (ACP), or agreed within the EC (an increasing proportion of UK pesticide authorisations are now

carried out in accordance with harmonised EU processes). However, where neither the UK nor the EC has set a reference dose, levels set by regulatory authorities in other countries may be used. For a small number of pesticides, the reference doses used have been determined by HSE. These have not been independently peer-reviewed and should therefore be regarded as provisional.

Although MRLs are not safety levels, an MRL would not be established if the residue concentrations measured in the supervised trials used to support the MRL would give rise to health concerns. In most cases residues present at the MRL result in intakes below the ARfD and the ADI. So even if the MRL is exceeded this does not always lead to an intake above the ARfD or ADI.

In addition, an estimated intake that exceeds the ADI or ARfD does not automatically result in concerns for consumer health, because a protective approach is used in setting the ADI and ARfD. In the unusual circumstance of an intake exceeding the ADI or ARfD, an evaluation of the toxicological data is made, and details of this assessment would be presented.

Most consumer intake assessments are for short-term exposure rather than chronic exposure. This is because in most cases the monitoring data show the majority of samples to contain residues below the reporting limit and so chronic exposure would not present a concern. Long-term risk assessments have been carried out on a case-by-case basis but are not routinely reported. Long-term exposure assessments are done using median residue levels, rather than using the highest residues found. Therefore, long-term risk assessments would only need to be carried out where data indicated a high proportion of samples contained residues above the MRL (this would result in a higher median residue level than that previously assessed when setting the MRL), or where there is no MRL and acute toxicology is not considered relevant for the particular pesticide concerned.

Where intakes exceed a reference dose, it is necessary for the underlying toxicological studies (animal studies) to be considered to enable the significance of such an exceedance to be understood. Toxicological studies are conducted using different doses to determine the nature of any ill health effects as well as the levels at which such effects can be expected to occur.

Toxicological studies are conducted using test animals to identify the highest experimental dose that causes no detectable adverse effects (the NOAEL). Where there is more than one relevant toxicological study, the lowest appropriate NOAEL for the most sensitive adverse effect is typically used. There is some uncertainty in extrapolating between animals and people and it is therefore important to use a ‘safety factor’ to account for sources of variation. This safety factor is incorporated (by dividing the NOAEL by the safety factor) in deriving a reference dose, either an ADI or an ARfD, to which consumer intakes are compared. A safety factor therefore extrapolates from the animal testing to the general population. Factors in the order of x100 are commonly used, x 10 for animal to man, and x10 for within human population differences in sensitivity. However, toxicologists may propose different values (e.g. from 5 to 1000) based on scientific reasoning in accordance with study designs and the quality of the data that has been generated from the studies.

In order to ensure exposures to pesticides do not pose unacceptable risk to humans a wide range of investigations are performed. Most of these are performed on experimental animals because the only end-points that can be examined in human volunteers are those involving observation or blood and urine sampling. Human volunteer studies involving pesticides are not generated in current regulatory work. There is debate at the international

level as to whether human studies that have been generated should be used for risk assessment purposes. In the EU, the policy is not to use these data in assessments; the JMPR chose to apply judgement in the appropriate use of these data if available. The HSE risk assessments will usually refer to test animal species, such as dog, rat, and rabbit. All toxicological work is undertaken based on principles of minimising animal distress. Where scientifically valid human data are available the risk assessments will refer to these as they reduce the uncertainty in the assessment. Therefore, human data is only referred to in more limited circumstances.

Acute (short term) toxicology is not a concern for all pesticides, as some are not acutely toxic. In terms of the pesticides that have been found in fruit and vegetables through the surveillance programme an acute risk assessment would not be necessary on the following: tecnazene, maleic hydrazide, diphenylamine, furalaxyl, iprodione, kresoxim-methyl, pendimethalin, propargite, propyzamide, quintozene and tolclofos-methyl.

As the surveillance programme monitors residues in all types of food, from raw commodities (e.g. potatoes) to processed (e.g. wine), dried (e.g. dried fruit) and composite foods (e.g. fruit bread), consumer risk assessments are specifically tailored to address processed and mixed food products. MRLs are generally set for raw commodities, although when MRLs are established the assessment of dietary intakes takes into account the potential for residues to remain in processed foods produced from the raw agricultural commodities. MRLs have been set for processed infant foods, and in future may be extended to other processed food products.

Residues are usually reduced during food processing and occasionally may concentrate. The alteration of residues can be considered in consumer risk assessments, for example, in oil seed rape a fat-soluble pesticide may result in higher residues in the oil compared to residues in the raw seed. Consumption data are available for many major processed food items such as boiled potatoes, crisps, fruit juice, sugar, bread, and wine. Where such consumption data are not available, the intake estimates are based on the total consumption of the raw commodity, which would represent the worst-case (for example, breakfast cereals consumption would be based on total cereal products consumption). In the case of composite products, a suitable worst-case alternative would be used, for example total bread consumption for fruit bread consumption.

Dithiocarbamate residues

Dithiocarbamate residues are determined as carbon disulphide which is a common product from different dithiocarbamate pesticides; for the risk assessment a precautionary approach is taken: the worst case dithiocarbamate residue is calculated by assuming the residue is derived from ziram ((a molecular weight conversion is applied to estimate the level of residue based on ziram) and this is compared to the ARfD for ziram. Where it can be confirmed that a specific dithiocarbamate was applied the equivalent residue of the specific active substance is estimated and the intake compared to the appropriate reference dose. We only present a detailed risk assessment when either the worst case assessment of intake (based on ziram) leads to an exceedance of the ziram ARfD and it has not been possible to further identify the dithiocarbamate source of the residues, or, when further refined assessments based on a specific knowledge of the dithiocarbamate pesticide applied in practice still lead to an exceedance of the ARfD for the known dithiocarbamate pesticide.

Probabilistic Modelling

The standard calculations of consumer exposure use realistic consumption data and residue levels. However, they tend to overestimate intakes in most circumstances. This is due to the assumptions used; fruit and vegetables would contain high levels of residue in an individual unit and that these would be consumed by high-level consumers. They do not take into account the possible range of residue levels and consumption distributions that may occur in reality. These possible combinations of residues and consumption levels can be taken into account using modelling/simulation techniques to produce probability distributions of residue intake levels to indicate the range of consumer intakes, presented as a probabilistic assessment of consumer exposure. These techniques are not yet routinely used to estimate dietary intakes of pesticide residues in the EC.

Multiple residues

The risk assessment process is not standing still. We are aware that some consumers are concerned by the 'cocktail effect'- the possible implications of residues of more than one chemical occurring in, say, a single portion of fruit or vegetables or the interaction between mixtures of pesticides and veterinary medicines at residue levels.

Where more than one pesticide residue is found in a sample, we produce a separate table which identifies each sample and what was found (see Appendix D). If more than one organophosphate/carbamate is found, we will undertake an additional risk assessment. If the combination of pesticides found is either unusual or gives cause for concern, then this will be detailed in the report.

The Food Standards Agency (FSA) asked the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment to assess these concerns. Their report "Risk Assessment of Mixtures of Pesticides and Veterinary Medicines" was published in 2002. https://cot.food.gov.uk/sites/default/files/cot/reportindexed.pdf

The Committee concluded that the probability of any health hazard from exposures to mixtures is likely to be small. Nonetheless, it identified areas of uncertainty in the risk assessment process and made recommendations for further work. These fell under the broad headings of regulatory, surveillance, research and public information issues. An action plan to take forward the recommendations was published by the FSA. A number of research projects were commissioned by the FSA to help progress the action plan.

Scientific methodologies have yet to be developed to deal with mixtures from groups of pesticides identified by the Committee. However, the Advisory Committee on Pesticides (ACP) has developed an approach for the anticholinesterase compounds. They have also recommended an approach for assessing compounds that might have combined toxicity. This includes a consideration of the proportion of the respective reference doses taken up by the predicted exposures to each active substance. If this is only a small proportion (e.g. <50% if there are two components; <33% for 3 etc.) then assuming simple additivity the risks would still be acceptable. However if exposures to each active substance represent a high proportion of the respective reference doses and the total exceeds 100% a more detailed consideration is needed (www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/data-requirements-handbook/toxicity-assessment-of-combinations-of-2-or-more-compounds-in-a-formulation).

We are keen to ensure our reports reflect consumer concerns. We therefore now regularly assess findings showing multiple residues of organophosphate and carbamate pesticides. Combined assessment is a new development in risk assessment, which is being taken forward at the international level, e.g. the European Food Safety Authority (EFSA) held a colloquium in 2006 and has set-up two working groups to help develop the methodology (http://www.efsa.europa.eu/en/events/event/colloque061128.htm; http://www.efsa.europa.eu/en/supporting/pub/117e.htm; http://www.efsa.europa.eu/en/efsajournal/pub/705.htm; http://www.efsa.europa.eu/en/efsajournal/pub/1167.htm). Further advances in risk assessment methodology will be taken into account in developing the approach to multiple risk assessments in the future.

Assessment of Risk to Human Health: Short-term intake estimates

Screening assessments have been done for all acutely toxic and potentially acutely toxic pesticides to check that predicted intakes are within the ARfD (or ADI, as appropriate, where an ARfD is not available). An acute exposure assessment is not done for pesticides which are not acutely toxic where it has been established that an ARfD is not required. Toxicological endpoints can be found in the DG SANCO EU Pesticides database which is available at http://ec.europa.eu/food/plant/protection/evaluation/database_act_subs_en.htm

The screening assessment uses the internationally agreed approach to short-term (acute) consumer exposure assessment with UK food consumption data as detailed within the UK NESTI model which is available on the HSE website at http://www.pesticides.gov.uk/approvals.asp?id=1687.

Screening assessments have been done for all acutely toxic and potentially acutely toxic pesticides to check that predicted intakes are within the ARfD (or ADI, as appropriate, where an ARfD is not available). An acute exposure assessment is not done for pesticides which are not acutely toxic where it has been established that an ARfD is not required. Toxicological endpoints can be found in the DG Sanco EU Pesticides database which is available at http://ec.europa.eu/food/plant/protection/evaluation/database_act_subs_en.htm

The screening assessment uses the internationally agreed approach to short-term (acute) consumer exposure assessment with UK food consumption data as detailed within the UK NESTI model which is available on the CRD website at http://www.pesticides.gov.uk/approvals.asp?id=1687.

For the Q3 (2018) assessments, the following approaches have been taken to refine the NESTI according to case-by-case issues and to ensure that appropriate consumption values are used for less frequently consumed commodities where available food consumption data may be limited:

- Data on beans with pods were used for okra and all forms of speciality green beans.
- Berries: Data on both blackberries and raspberries were considered for the screening assessment for blackberries and blueberries as there are low numbers of consumers in some groups. Data on raspberry alone were used for adults, toddlers, vegetarians, and elderly in own home, where the numbers are sufficient, with data from both commodities used for the remaining groups. Although there are low numbers of consumers in the infant and 4-6 year old children groups for both commodities, use of these data was considered reasonable after comparison with alternative data. Data on gooseberries were available and used for gooseberries.

- Data on cabbage were used for Chinese leaf. Data on broccoli with a variability factor of 7 were used for bok choi and pak choi. This was previously considered in 2016 after the move of choi sum MRL to within the broccoli MRL, when it was considered appropriate to use broccoli data with a variability factor of 7, taking account of the unit weights for pak choi, rather than 5 (as in the UK model for broccoli). Chinese cabbage data would be the most appropriate however the number of consumers is too low for robust risk assessments. The EU PRIMo data indicate that broccoli is precautionary when compared to EU Chinese cabbage data.

- Data on ginger and garlic were considered for the screening assessment for ginger as there are low numbers of consumers in some groups. Data on ginger alone were used for most consumer groups, where the numbers are sufficient, with data from both commodities used for infants and elderly living in a residential setting.

- Frozen fruits and smoothie mixes: For frozen fruits, residues were screened using the usual approach for each of the specific fruits. For mixed fruits (as for the usual screening approach for prepared fruits), data on apples without the use of a variability factor were used for screening purposes. As fruit pieces are small, a whole fruit consideration which takes account of unit to unit variability does not seem so relevant; the consumption values for a range of different fruits were considered and consumption values for apple are likely to be reasonably protective to cover the range of fruits consumed in this way. For smoothie mixes, the propriety recommendations for make-up were referred to and it was assumed for screening purposes, that two smoothies (each 80 g fruit mix) were consumed (in a day).

- Consumption values were provided by the Food Standards Agency for grapefruit to identify the various contributions of grapefruit in the diet. The consumption values used here (and as in Q1 and Q2 2018, Q2 2016 and Q4, 2016) cover consumption for fresh grapefruit excluding juice, canned grapefruit and grapefruit consumed in other recipe forms. For the current assessments, the consumer groups covered represent infants (4 to 18 months old), toddlers (1.5 to 3 years), 4-6 year olds, 7-10 year olds, 11-14 year olds, 15-18 year olds, and elderly. These are slightly different to the groups used previously. For the new survey data vegetarians, elderly residential and elderly in their own home are not reported separately. For some of the consumer subgroups, the number of grapefruit consumers in the surveys (from years 2008 to 2012) are very low e.g. infants which is not unexpected. The highest number of young consumers out of all the young consumer groups was three persons for infants (3 out of 2863 infant consumers). These data are used as they represent the best up to date data. Adults and elderly consume fresh grapefruit at a higher frequency (a higher number of consumers) than the other consumer groups, and of these adults is the most critical consumer group.

- Vine leaves – Dried and chopped vine leaves. Residues in finely chopped /dried vine leaves were expressed on a fresh product basis to perform the risk assessment using a rehydration factor of 3.25 and the assessment performed using (fresh) parsley consumption data. For fresh vine leaves (whole, in brine) consumption data were very limited (in the EU PRIMo model there is a consumption value for a German child consuming grape vine leaves, however this might be one consumer only). Therefore, the screening and risk assessment for vine leaves was therefore done on the assumption that a consumer of at least toddler age might

eat four (stuffed) medium sized vine leaves in a day as a large daily portion. Propriety pack information indicates that a single medium sized leaf might weigh 3.64 g.

- Data on melon were used for all forms of melon and watermelon.
- For potato/chlorpropham, as per Q1 and Q2 2018, the default variability factor of 7 was used, from the EFSA Conclusion (EFSA, 2017).
- Data on mandarin were used for all forms of soft citrus.
- Data on meat (excluding poultry and offal) were used for all forms of beef.
- Data on meat (excluding poultry and offal) and data on poultry were used for screening of residues found in game samples.
- Data on cheese were used for all forms of soft cheese.
- Data on fish were used for all forms of white fish.
- Data on bread were used for all forms of bread, including speciality breads.

Monocrotophos residues:

Monocrotophos was found in beans with pods (Guar beans) at a level of 0.02 mg/kg. The highest residue gives a highest estimated short term intake of 0.0001 mg/kg bw/day for infants. Authorisation for use in the EU were withdrawn in 2003 and EU reference values have not been set. The EFSA use JMPR reference values, set in 1995, to assess risks from monocrotophos residues. This intake is less than both the ARfD of 0.002 mg/kg bw/day and ADI of 0.0006 mg/kg bw/day. However, studies in laboratory animals at doses orders of magnitude higher which were toxic to the animals have indicated that monocrotophos can damage genetic material. It is not known if lower doses which are not toxic also have this effect. Monocrotophos did not increase cancer incidence in long term feeding studies in rats or mice or cause dominant lethal mutations in mice and these findings provide some reassurance that any risks from exposure are likely to be small. Nevertheless, because of uncertainty about the potential for genetic damage at low doses, on a precautionary basis any findings of monocrotophos in food are not desirable.

Table C: Short-term intake estimates

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Apple	Dithiocarbamates (ziram)	2.2*	0.033	0.22 (infants) 0.16 (toddlers) 0.12 (4-6 year olds) 0.090 (7-10 year olds)	0.08	EU, 2004

Comment on risk assessment:

The usual non-specific approach for dithiocarbamates indicated a potential intake above the ARfD for ziram. The intakes for infants, toddler, 4-6 year old children, and 7-10- year old children exceeded the ARfD. The highest intake was for infants.

If infants ate or drunk large portions of apple containing ziram at 2.2 mg/kg their intake would be 269% of the Acute Reference Dose. This intake is 36 times lower than a dose which caused no observed adverse effects in a ten day rat developmental study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the likelihood of an effect on health to be low, given the remaining factor of 36. This is because an adverse effect on health would rely on;

1) a susceptible individual eating a large quantity of the product which in turn had the highest levels of residue (i.e. 7 times the maximum value found in monitoring) ; and

2) the actual difference in susceptibility between that individual and rats, being higher than the factor we are left with in this situation; and

3) the critical NOAEL being close to the actual doses needed to produce an adverse effect in the animals studied.

In conclusion we consider that some people might experience slight loss of appetite after eating or drinking large portions (97.5th percentile

consumption) of apple containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor and reversible.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group[†i]		
Grapefruit	Chlorpyrifos	0.2	0.0029	0.011 (infants)	0.005	EU, 2015

Comment on risk assessment:

The risk assessments detailed below refer to the EU acute Reference Dose 2015 value but also consider the risks based on the existing JMPR value which was based on data which examined impacts upon humans. HSE accept that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment do not expect an effect on health.

Assessment A using the ARfD set in the EU

Grapefruit flesh after peeling;

EU MRL risk assessment usually assumes that grapefruits are peeled before consumption. After peeling only 3% of the residue remains (EFSA, 2015), the highest intake is below 0.005 mg/kg bw/d, and there are no exceedances of the ARfD.

Whole grapefruit, including all the peel;

However, assuming that consumers eat all the peel, intakes for infants exceed the acute reference dose of 0.005 mg/kg bw/day.

The intakes for infants exceeded the EU ARfD. If infants ate large portions of grapefruit containing chlorpyrifos at 0.2 mg/kg, their intake of chlorpyrifos could be 220% of the EU Acute Reference Dose. This intake is 45 times lower than a dose which caused no observed adverse effects in a single dose rat study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the likelihood of an effect on health to be low, given the remaining factor of 45. This is because an adverse effect on health would rely on;

1) a susceptible individual eating a large quantity of the product which in turn had the highest levels of residue (i.e. 7 times the maximum value found in monitoring) ; and

2) the actual difference in susceptibility between that individual and rats being higher than the factor we are left with in this situation; and

3) the critical NOAEL being close to the actual doses needed to produce an adverse effect in the animals studied.

Furthermore, the ARfD derived is considered to have been set using a precautionary approach since red blood cell cholinesterase inhibition was used as the end-point. This is a sensitive way to assess adverse effects due to cholinesterase inhibition.

In conclusion we consider that some people might experience salivation, intestinal disturbances or sweating after eating large portions (97.5th percentile consumption) of grapefruit containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible.

Assessment B with reference to the ARfD set by the JMPR

The intakes for infants exceeded the EU ARfD. If infants ate large portions of grapefruit, including all of the peel, containing chlorpyrifos at 0.2 mg/kg, their intake of chlorpyrifos could be 220% of the Acute Reference Dose. However, the EU ARfD was set without taking into account scientifically valid human data. The JMPR (Joint FAO/WHO meetings on pesticides) has recommended a higher Acute Reference Dose (ARfD) of 0.1 mg/kg bw/d using that human data. It allows an appropriate factor (10) to account for possible differences in susceptibility between people. Intakes in all groups are within the JMPR ARfD. Based on this assessment we do not expect an effect on health.

Conclusion

HSE accept that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment do not expect an effect on health.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Grapefruit	Imazalil	3.5	0.051	0.19 (infants) 0.051 (adults)	General population 0.1 Pregnant and nursing females 0.05	EFSA, 2007

Comment on risk assessment:

Grapefruit flesh after peeling

The EU MRL risk assessment assumes that grapefruits are peeled before consumption. After peeling only 7% of the residue remains (EU, 2010), the highest intake is below 0.05 mg/kg bw/d, and there are no exceedances of either ARfD.

However, assuming that consumers eat all the peel, intakes for infants exceed the acute reference dose of 0.1 mg/kg bw/day (for the general population excluding pregnant and nursing women) and intakes for adults exceed the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing females)

Whole grapefruit, including all the peel

Pregnant and nursing females;

The intakes for adults exceeded the ARfD of 0.05 mg/kg bw/d for pregnant and nursing females.

If adults ate large portions of grapefruit containing imazalil at 3.5 mg/kg their intake could be 101% of the Acute Reference Dose of 0.05 mg/kg bw/day. This intake is 99 times lower than a dose which caused no observed adverse effects in a 13 day repeat dose rabbit developmental study (the ARfD is based on a NOAEL of 5 mg/kg bw/day for fetal toxicity (increased resorptions)). The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 99 still enough to make an effect on health unlikely.

General population;

The intakes for infants exceed the ARfD of 0.1 mg/kg bw/d for the general population.

If infants ate or drank large portions of grapefruit containing imazalil at 3.5 mg/kg, their intake of imazalil could be 191% of the Acute Reference Dose of 0.1 mg/kg bw/d for the general population. This intake is 53 times lower than a dose which caused no observed adverse effect in a rabbit developmental study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible

differences in susceptibility between people. Also, it is noted that an ARfD based on maternal toxicity in a developmental study with repeated dosing (13 days) might be over-protective for the general population. Based on this assessment we consider the reduced factor of 53 still enough to make an effect on health unlikely.

This estimate assumes that peel of the fruit is consumed. However, if the peel is not consumed then the risk assessment that is the basis for the MRL applies (see the first paragraph of this assessment) and intakes in all groups are within both ARfDs and an effect on health is not expected.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Grapes	Ethephon	0.9	0.018	0.055 (toddlers)	0.05	EU, 2008

Comment on risk assessment:

The intakes for toddlers exceeded the ARfD;

If toddlers ate large portions of grapes containing ethephon at 1.2 mg/kg, their intake of ethephon could be 110% of the Acute Reference Dose. This intake is 109 times lower than a dose which caused no observed adverse effect in a 28 day oral dog study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. However, in this case the factor was larger (120) to ensure consistency with the findings of human volunteer studies. We consider the reduced factor of 109 (from 120) still enough to make an effect on health unlikely. More detail on the factors applied is on page 91 of this report.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Soft Citrus	Imazalil	3.4	0.038	0.19 (toddlers) 0.13 (4-6 year olds) 0.061 (11-14 year olds)	General population 0.1 Pregnant and nursing females 0.05	EFSA, 2007

Comment on risk assessment:

Soft citrus flesh after peeling
The EU MRL risk assessment assumes that soft citrus are peeled before consumption. After peeling only 7% of the residue remains (EFSA, 2017), the highest intake is below 0.05 mg/kg bw/d, and there are no exceedances of either ARfD.

Whole soft citrus, including all the peel

However, assuming that consumers eat all the peel, intakes for toddlers and 4-6 year old children exceed the acute reference dose of 0.1 mg/kg bw/day (for the general population excluding pregnant and nursing women). It is noted that in consumer groups aged over 11 years intakes for 11-14 year old children exceed the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing women).

Pregnant and nursing women;

The intakes for 11-14 year old children exceeded the ARfD of 0.05 mg/kg bw/d for pregnant and nursing females.

If 11-14 year old children ate large portions of soft citrus containing imazalil at 3.4 mg/kg their intake could be 122% of the Acute Reference Dose of 0.05 mg/kg bw/day. This intake is 82 times lower than a dose which caused no observed adverse effects in a 13 day repeat dose rabbit developmental study (the ARfD is based on a NOAEL of 5 mg/kg bw/day for fetal toxicity (increased resorptions). The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 82 still enough to make an effect on health unlikely.

General population;

The intakes for toddlers and 4-6 year old children exceed the ARfD of 0.1 mg/kg bw/d for the general population. The highest intake was for toddlers.

If toddlers ate large portions of soft citrus containing imazalil at 3.4 mg/kg their intake could be 189% of the Acute Reference Dose of 0.1 mg/kg bw/day. This intake is 53 times lower than a dose which caused no observed adverse effects in a rabbit developmental study, used as the basis of the ARfD (the ARfD is based on a NOAEL of 10 mg/kg bw/day for reduced bodyweight gain and food consumption in dams). The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible

differences in susceptibility between people. Also, it is noted that an ARfD based on maternal toxicity in a developmental study with repeated dosing (13 days) might be over-protective for the general population. Based on this assessment we consider the reduced factor of 53 still enough to make an effect on health unlikely.

This estimate assumes that peel of the fruit is consumed. However, if the peel is not consumed then the risk assessment that is the basis for the MRL applies (see the first paragraph of this assessment) and intakes in all groups are within both ARfDs and an effect on health is not expected.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Soft Citrus	Thiabendazole	3.8	0.042	0.21 (toddlers) 0.14 (4-6 year olds) 0.11 (7-10 year olds)	0.1	EU, 2017

Comment on risk assessment:

Soft citrus flesh after peeling

The EU MRL risk assessment assumes that soft citrus are peeled before consumption. After peeling only 2% of the residue remains (EFSA, 2016), the highest intake is below 0.1 mg/kg bw/d, and there are no exceedances of the Acute Reference Dose (ARfD).
However, assuming that consumers eat all the peel, intakes for toddlers, 4-6 year old children, and 7-10 year old children exceed the ARfD. The highest intake is for toddlers.

Whole soft citrus, including all the peel

If toddlers ate large portions of soft citrus containing thiabendazole at 3.8 mg/kg their intake could be 211 % of the ARfD. This intake is 47 times lower than a dose which caused no observed adverse effects in a developmental study in rats over 11 days. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account the uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the likelihood of an effect on health to be low, given the remaining factor of 47.

This is because an adverse effect on health would rely on

1) a susceptible individual eating a large quantity of the product which in turn had the highest levels of residue (i.e. 7 times the maximum value found in monitoring) ; and

2) the actual difference in susceptibility between that individual and rats being higher than the factor we are left with in this situation; and

3) the critical NOAEL being close to the actual doses needed to produce an adverse effect in the animals studied.

In conclusion, we consider that some people might experience loss of appetite after eating large portions (97.5th percentile consumption) of soft citrus including all the peel containing the highest levels found in this report, but we consider the likelihood of an effect on health to be low. Such effects would be expected to be minor, short-lived, and reversible.

This assessment assumes that peel of the fruit is consumed. However, if the peel is not consumed then the risk assessment that is the basis for the MRL applies (see the first paragraph of this assessment) and intakes in all groups are within the ARfD and an effect on health is not expected.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Vine leaves	Chlorpyrifos	7.8	0.0015	0.0078 (toddlers) 0.0055 (4-6 year olds)	0.005	EU, 2015

Comment on risk assessment:

Vine leaves have not been sampled before. Consumption data are limited, please refer to the approach taken in the bullet point above.

The risk assessments detailed below refer to the EU acute Reference Dose 2015 value but also consider the risks based on the existing JMPR value which was based on data which examined impacts upon humans. HSE accepts that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment do not expect an effect on health.

The consumption data for vine leaves are limited and these assessments have been made on the basis of assumptions (see the above bullet point for further details).

Assessment A using the ARfD set in the EU

The intakes for toddlers and 4-6 year olds exceeded the ARfD. The highest intake was for toddlers.

If toddlers ate large portions of vine leaves containing chlorpyrifos at 7.8 mg/kg, their intake of chlorpyrifos could be 157% of the EU Acute Reference Dose. This intake is 64 times lower than a dose which caused no observed adverse effects in a single dose rat study. The European Food Safety Authority used this study as the basis of the ARfD.

Toxicologists usually apply a factor of 100 to this dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 64 still enough to make an effect on health unlikely.

Assessment B with reference to the ARfD set by the JMPR

The intakes for toddlers and 4-6 year olds exceeded the ARfD. The highest intake was for toddlers.

If toddlers ate large portions of vine leaves containing chlorpyrifos at 7.8 mg/kg, their intake of chlorpyrifos could be 157% of the Acute Reference Dose. However, the EU ARfD was set without taking into account scientifically valid human data. The JMPR (Joint FAO/WHO meetings on pesticides) has recommended a higher Acute Reference Dose (ARfD) of 0.1 mg/kg bow/day using that human data. It allows an appropriate factor (10) to account for possible differences in susceptibility between people. Intakes in all groups are within the JMPR ARfD. Based on this assessment we do not expect an effect on health.

Conclusion

HSE accept that relevant human toxicology data can be used to calculate the possible impacts of residues in food on humans and based on this assessment and taking account of the assumptions that have been applied to the derivation of these estimates of consumption, we do not expect an effect on health.

[$]Dithiocarbamate residues are determined as carbon disulphide which is a common product from different dithiocarbamate pesticides; for the risk assessment a precautionary approach is taken: the worst case dithiocarbamate residue is calculated by assuming the residue is derived from ziram and this is compared to the ARfD for ziram. Where it can be confirmed that a specific dithiocarbamate was applied the equivalent residue of the specific active substance is estimated and the intake compared to the appropriate reference dose.

* Dithiocarbamate residue calculated as 2.2 mg/kg (using a molecular weight conversion of 2.007 for ziram) based on a carbon disulphide residue of 1.1 mg/kg.

Acute risk assessments for samples containing more than one triazole fungicide, organophosphorus/carbamate, carbendazim/thiophanate-methyl, clothianidin/thiamethoxam or captan/folpet following screening assessment.

Crop/Critical group	Pesticide	Residue mg/kg	Intake				ARfD	Source
			mg/kg bw	%ARfD				
Vine leaves (toddlers)	Chlorpyrifos-methyl	0.01	0.00001	0.01	}	Total	0.1	EU, 2005
	Chlorpyrifos	7.8	0.0078	156.6	}	156.6	0.005	EU, 2015

Section 4: issues arising in this report and updates on previous reports

Issues arising in this report

Chlorate (position as at February 2019)

We have been testing a limited number of foods for chlorate since 2016. The pesticide sodium chlorate is a residual broad action weed killer that is not authorised for use in the EU. However, we are confident that the residues we are detecting come from use of chlorine-based disinfectants used to maintain microbiological safety (control microorganisms that cause food poisoning). Because these residues are unavoidable, and important for the maintaining of microbiological control vital for food safety, we are not treating these results as breaches of the MRL. **We are not advising that food companies change their existing practices as a result of our findings but they should be aware about the ongoing discussion in this area**

We are only part of the work going on across government and beyond to consider what to do about chlorate residues in food and water.

The Food Standards Agency is working with the food industry to develop and promote best practice in the use of sanitisers. This is important because the presence of low level residues of chlorate in food results from measures taken by the food and water industries to protect food safety by reducing microbiological contamination of food and drink (including drinking water, which is a significant source of chlorate in food). Chlorate itself is not used as a disinfectant, but chlorine-based sanitisers can contain small amounts of chlorate.

The Health and Safety Executive is leading UK work in the EU to establish more meaningful statutory levels for chlorate in food to provide reassurance to consumers and allow the continued use of disinfectants that are themselves important for safeguarding human health. Chlorate was historically used as a pesticide and residues of chlorate in food fall under EU legislation on plant protection products. Since it is no longer authorised for use as a pesticide, chlorate is currently subject to a Maximum Residue Limit (MRL) of 0.01 mg/kg in all foods to which MRLs apply. This level was, in line with normal practice for pesticides that are not currently used, set at the default limit of detection rather than on the basis of an assessment of health risks. Our findings are adding to the evidence that current legal limits are not sufficient to allow for the essential use of disinfectants to protect food and water hygiene.

The European Commission has prepared proposals for MRLs based on monitoring data, using the same approach as would be used to derive MRLs from the results of residues trails, and plans to seek stakeholder views on those proposals. During negotiations the UK and other member States pointed out that this approach may still not be sufficient to

permit essential food and water hygiene uses to continue in line with good practice while a wider review takes place. Upon the recent publication of proposed MRLs for chlorate, we have commented directly to the European Commission[1] that chlorate residues may prove impossible to reduce when the main source of chlorate is likely to be from treated drinking water or the use of legitimate biocides. We are concerned, that the effect on overall food safety including microbiological safety should be taken into account. The pesticides MRLs regime is not a useful tool to apply these limits. We will continue to follow developments.

Defra is also working on the EU recast of its Drinking Water Directive. Discussions are underway about the possible future monitoring of chlorate and the level to be achieved. In national legislation throughout the UK it is already a requirement to keep disinfection by-products as low as possible. This is usually achieved through management of disinfectant dosing and storage.

Departments have an approach to enforcement, which reflects an agreement within the EU that, while the default MRL for chlorate remains in place, enforcement should be left to the discretion of Member States. The UK approach, in line with that normally taken for environmental or process contaminants, is to require that levels in food are as low as reasonably achievable to ensure the protection of human health.

We are working with the Advisory Committee on the Microbiological Safety of Food to understand how changes to pesticide MRLs affect biocide use, microbiological food safety, and any change to the overall risk to consumers taking into account both chemical and microbiological safety.

Since 2018 the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has been be considering chlorate as part of its on-going work looking at the chemicals in the diet of infants and young children (up to 5 years). The European Food Safety Authority's 2015 opinion on chlorate[2] establishes appropriate health-based guidance values for chlorate exposure to protect against acute and chronic risks to health.

Residues below the MRL that exceed the ARfD

When MRLs are agreed at the EU level they are set at levels that are compatible with consumer safety. Occasionally, assessment of PRiF monitoring samples containing residues below or at the MRL will show consumer intakes could potentially be above the ARfD. This situation typically arises because of one of three reasons:

- the ARfD may have been lowered because of new information but there is a delay before MRLs have been reassessed or new MRLs are put in place;

- during the MRLs process the risk assessments are currently based on the highest residue level observed in residues trials used to support the MRL which will often be less than the actual MRL (it is expected that most residues found will be below the

[1] https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-334046/feedback/F18048_en?p_id=368328
[2] EFSA Journal 2015;13(6):4135 [103 pp.]
http://ec.europa.eu/food/plant/standing_committees/sc_phytopharmaceuticals/index_en.htm

MRL, and if for this reason there are later samples which give intakes above the ARfD the numbers are expected to be low);

- the agreed EU approach might assume the commodity is peeled and data are used to reduce the intake in the risk assessment at the time of setting MRLs, whereas in the PRiF work risk assessments for the whole commodity are presented as routine and, if information showing the effects of processing on residues level is available to PRiF, a refined assessment is presented.

The first two of these reasons are common to EU assessments and the third represents a difference between the approach used by HSE for the risk assessment and that used at the time the MRL is set. We will highlight how our assessments differ from that done at the EU level so that readers are aware of the basis of the evaluation.

DDT

The use of DDT is banned or heavily restricted in many countries. It isn't allowed for use on food crops any more but it is still used in some countries outside the EU as a public health insecticide. Residues of DDT take a long time to break down in the environment and can accumulate in fatty tissue which is a major reason that it has been banned in the EU and many other countries.

Due to the bans and restrictions on use, the levels in food have decreased substantially since the 1960s and 1970s. Even so, because it takes a long time to breakdown we do expect, and do see, occasional DDT residues in our monitoring results. Overall, the incidence and the size of residues have fallen steadily over time, which is what we would expect. In recent years none of our findings were unusual, unexpected or of concern. We can tell from the chemical form that we detect whether the residues we have found are from historic use (which is what we usually find). We explain this every time we publish DDT results to try to make it as clear as we can that the results show food producers are not using DDT today. However, there are occasional media stories about DDT and various links and associations, which do not make this distinction.

The residues we find nowadays are at levels that would not be expected to have any effect on health, either in the short term or in the long term, when checked against today's understanding of the effect of DDT on health. As a committee, we take care to ensure we look thoroughly at this, and the Food Standards Agency is also actively involved in our considerations.

Follow-up from Previous Reports

Quarter 3 2017

Kale

Linuron: Sample numbers 2101/2017, 2108/2017, 5310/2017, 2471/2017 and 3653/2017

We passed details of samples of kale from the UK that contained linuron to HSE. HSE's investigations concluded that there was no evidence that linuron had been applied to any of the kale. A possible source was that kale is susceptible to absorbing volatiles from the environment. HSE actions are complete, so we have included brand name details in this report.

Raspberries

Chlorpyrifos: Sample number 1855/2017

We passed details of a sample of raspberries from the UK that contained a residue of chlorpyrifos to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Quarter 4 2017

Cauliflower

Triallate: Sample number 3698/2017

We passed details of a sample of cauliflower from the UK that contained tri-allate to HSE. HSE's investigation could not rule out cross contamination at some point between the journey from farm to wholesaler to market stall. HSE actions are complete, so we have included brand name details in this report.

Cucumber

Propamocarb (sum): Sample number 3334/2017

We passed details of a cucumber from the UK that contained propamocarb to HSE. HSE's enquiries are not yet complete; an update will appear in a future report.

Quarter 1 2018

Lettuce

Inorganic Bromide: Sample number 4787/2018

We passed details of a sample of lettuce from the UK that contained inorganic bromide, which is the residue from use of methyl bromide, to HSE. HSE's investigation concluded that it is likely the inorganic bromide was naturally present in the soil before the lettuce was grown in it. There was no evidence of illegal methyl bromide use by the grower or their soil supplier. HSE actions are complete, so we have included brand name details in this report.

Quarter 2 2018

Speciality vegetables

Chlorpropham: Sample numbers 0010/2018 and 0629/2018

We passed details of two samples of celeriac from the UK that contained chlorpropham to HSE. HSE's enquiries are not yet complete, any update will appear in a future report.

Chinese cabbage

Acetamiprid: Sample number 0015/2018

Fluopyram: Sample number 1884/2018

We passed details of a choi sum sample from the UK that contained acetamiprid and a sample of pak choi from the UK that contained fluopyram to HSE. HSE's enquiries are not yet complete, any update will appear in a future report.

Acetamiprid: Sample number 0642/2018

We passed details of a sample of Chinese cabbage from the UK that contained acetamiprid to HSE. HSE's investigation concluded that the authorisation for use of acetamiprid on brassicas for baby leaf production, was incorrectly understood to also cover mature crop production. HSE have advised the grower and will be following up more widely to ensure the position is clearer in future. No further action was to be taken by the grower and we have included brand name details in this report.

Mushrooms (speciality)

Chlormequat: Sample numbers 2943/2018, 4224/2018, 1945/2018, 1513/2018 and 4223/2018

We passed details of samples of mushrooms from the UK that contained chlormequat to HSE. HSE's investigations concluded that all the mushroom samples had been grown in straw legally treated with chlormequat. HSE actions are complete, so we have included brand name details in this report.

Brand name details of samples where follow-up action is now complete

Sample ID	Date of Sampling	Description	Country of Origin	Retail Outlet	Address	Brand Name	Packer / Manufacturer	Pesticide residues found in mg/kg (MRL)
0642/2018	18/06/2018	Pak Choi	UK	Burbank Produce Limited	Units 2,4,6,8 St James's Market, Essex Street, Bradford BD4 7PN		FB Eminson & Son Ltd The Poplars, 165 Blackgate Lane, Tarleton, Preston PR4 6UU	acetamiprid 0.02 (MRL = 1.5)
3698/2017	29/10/2017	Cauliflower	UK	Market Place	Market Square, Cambridge CB2 3QJ			triallate 0.01 (MRL = 0.1*)
2101/2017	04/09/2017	Curly Leaf Kale	England (UK)	Sainsbury's	Brook Road, Cambridge CB1 3HP	Sainsbury's	Sainsbury's Supermarkets Ltd 33 Holborn, London EC1N 2HT	linuron 0.02 (MRL = 0.05*)
2108/2017	04/09/2017	Curly Kale	UK	Tesco	Norman Industrial Estate, Cambridge Road, Milton, Cambridge CB24 6AY	Tesco	Tesco Stores Ltd Tesco House, Shire Park, Kestrel Way, Welwyn Garden City AL7 1GA	linuron 0.02 (MRL = 0.05*) Spirotetramat (partial sum) 0.01 (MRL = 7)

5310/2017	03/09/2017	Curly Kale	UK	Tesco	300 Hornchurch Road, Romford RM11 1PY	Tesco	Tesco Stores Ltd Tesco House, Shire Park, Kestrel Way, Welwyn Garden City AL7 1GA	linuron 0.02 (MRL = 0.05*)
2471/2017	04/09/2017	Kale	England (UK)	Waitrose	10 Draybank Road, (off Sinderland Road), Broadheath, Altrincham WA14 5ZL	Waitrose	Waitrose Limited Bracknell, Berkshire RG12 8YA	linuron 0.02 (MRL = 0.05*)
3653/2017	04/09/2017	Kale	England (UK)	Waitrose	Morningside Road, Edinburgh EH10 4AX	Waitrose	Waitrose Limited Bracknell, Berkshire RG12 8YA	linuron 0.01 (MRL = 0.05*) Spirotetramat (partial sum) 0.01 (MRL = 7)
4787/2018	22/01/2018	Lettuce	UK	Tesco Extra	Wragby Road, Lincoln, Lincolnshire LN2 4QQ	Tesco	Tesco Stores Ltd Welwyn, Garden City AL7 1GA	azoxystrobin 0.01 (MRL = 15) boscalid 0.2 (MRL = 50) cyprodinil 0.08 (MRL = 15)

								dimethomorph 0.01 (MRL = 15)
								fludioxonil 0.1 (MRL = 40)
								indoxacarb 0.02 (MRL = 3)
								inorganic bromide 35 (MRL = 50)
								propamocarb (sum) 0.8 (MRL = 40)
								propyzamide 0.06 (MRL = 0.6)
								pyraclostrobin 0.02 (MRL = 2)
								thiamethoxam 0.05 (MRL = 5)
1945/2018	23/04/2018	Portobello Mushrooms	Northern Ireland (UK)	Tesco Extra	5 St Stephens Centre, Park Street, Hull HU2 8LN	Tesco	Tesco Stores Ltd Welwyn Garden City AL7 1GA	chlormequat 0.02 (MRL = 0.9)

4223/2018	09/04/2018	Shiitake Mushrooms	UK	Sainsburys	1 Sury Basin, Kingston upon Thames KT2 5NZ	Sainsburys	Sainsbury's Supermarket Ltd 33 Holborn, London EC1N 2HT	chlormequat 0.1 (MRL = 0.9)
1513/2018	22/04/2018	Shiitake Mushrooms	UK	Asda	89 Dunkeld Road, Perth PH1 5AP	Asda	Asda Stores Ltd Great Wilson Street, Leeds LS11 5AD	chlormequat 0.1 (MRL = 0.9)
4224/2018	**09/04/2018**	**Oyster Mushrooms**	**UK**	**Sainsburys**	**1 Sury Basin, Kingston upon Thames KT2 5NZ**	**Sainsburys**	**Sainsbury's Supermarket Ltd 33 Holborn, London EC1N 2HT**	**chlormequat 4.5 (MRL = 0.9)**
2943/2018	**08/04/2018**	**Oyster Mushrooms**	**UK**	**Sainsburys**	**Eleventh Avenue, Team Valley Trading Estate, Gateshead NE11 0JY**	**Sainsburys**	**Sainsbury's Supermarket Ltd 33 Holborn, London EC1N 2HT**	**chlormequat 4.6 (MRL = 0.9)**

In our next report:

In Quarter 4 of 2018 we will look at results for:

- Animal fats
- Apples
- Aubergine
- Banana
- Beans with pods
- Beef
- Beer
- Bread
- Broccoli
- Cheese (soft)
- Eggs
- Fish (white)
- Frozen fruit and smoothies
- Game
- Ginger
- Grapefruit
- Grapes
- Lettuce
- Melon
- Milk
- Mushrooms
- Okra
- Olive Oil
- Pears
- Peas without pods
- Peppers
- Pineapple
- Potato
- Soft citrus
- Speciality vegetables
- Wheat

Section 5: background and reference

Reasons for pesticide residue testing

Food safety is important. Modern food production processes have given us plentiful supplies of a wide range of good quality affordable produce.

In the food industry of today the production environment can be managed from the preparation of seeds used for crops, through to growth, harvesting and storage of the produce.

One of the ways the food industry controls the environment in which foodstuffs are produced is by applying pesticides. They help farmers and growers maximise the production of food stuffs by, for example, preventing weeds inhibiting the growth of the crop, or insects destroying or infesting them. Pesticides can also be used to help protect seeds or prolong the life of crops after they have been harvested. Biological and physical (cultural) controls are also used to protect crops or as part of an integrated system.

As pesticides are used to control unwanted pests, weeds and diseases, they can potentially also harm people, wildlife and the environment. This is why the UK, in common with most other countries, imposes legally enforceable conditions as to how and when pesticides can be used. No pesticide can be supplied or used on a food or ornamental crops in the UK without Government authorisation. To obtain this authorisation the manufacturer of the pesticide must show that it does not present a concern for people's health or the environment. Naturally derived and synthetic pesticides are subject to the same regulation.

Once the authorisation has been granted Government authorities carry out follow up checks to ensure that the authorisation is providing the necessary degree of protection to users, consumers and the environment and that those who use pesticides are complying with conditions specified within it.

The Government authority responsible for checking pesticide residues in foodstuffs is the Health and Safety Executive. Defra's Expert Committee on Pesticide Residues in Food (PRiF) oversees and provides an independent check on this work. We know that the use of pesticides on crops may lead to traces (residues) of these chemicals in food and we expect to find these in our monitoring programme.

Defra's Expert Committee on Pesticide Residues in Food (PRiF)

The Expert Committee on Pesticide Residues in Food was established in 2011. Our members have a broad range of expertise relating to the food supply industry. The main function of the Committee is to oversee Government's £2 million pesticide residues surveillance programme. Previously this work was carried out by the Pesticide Residues Committee.

Our Chairman, Dr Paul Brantom is an independent consultant in toxicological risk assessment. The Committee also includes members with expertise in toxicology, food production and supply as well as two public interest experts.

Information on the membership of the PRiF is also available on the PRiFs website:

https://www.gov.uk/government/groups/expert-committee-on-pesticide-residues-in-food-prif

Our role is to advise Ministers, the Director of the Health and Safety Executive (HSE) and the Chief Executive of the Food Standards Agency (FSA) on:

- the planning of surveillance programmes for pesticide residues in the UK food supply and the evaluation of the results;
- Procedures for sampling, sample processing, new methods of analysis, the assessment of variability of pesticide residues in food and related issues.

Detail of reporting practice

Results by food commodity

- We include information about the survey (for instance where samples came from) for each commodity
- Detailed tabulated results are at the back of this report - these tables are also available for download from our website
- We summarise our findings and any follow-up action taken.

Risk assessments – single residues

- All results are screened by HSE to check for intakes above the Acute Reference Dose (ARfD). HSE assumes a relatively high level of intake and also assumes that most produce is eaten whole including peel/skin even when these are rarely consumed
- Where intakes above the ARfD are identified, we consider a detailed risk assessment prepared by HSE (at section II of this report).
- Our observations and the follow-up action taken are summarised in the section for that food.

Risk assessments – multiple combined residues

- Residues of more than one pesticide from the same category/class of particular categories of pesticides, which have a similar toxicological mode of action, are screened by HSE to check for intakes above the combined Acute Reference Dose (ARfD).
- Where combined intakes above the combined ARfD are identified, we consider a detailed combined risk assessment prepared by HSE (at section II of this report).
- Our observations and any follow-up action taken are summarised in the section for that food commodity.

Risk assessment - conclusions

- Where, in the light of current knowledge and considering the usual level of scientific uncertainty (or precaution) the intake will not cause ill health the conclusion will say no effect on health is expected.
- Where, in the light of current knowledge and considering a slightly higher level of scientific uncertainty (or less precaution) the intake is not likely to cause ill health, the conclusion will be less definite and state that an effect on health is unlikely.
- Where scientific uncertainty is greater more information is provided.

Residues in UK produce of pesticides which are not approved for use on that crop in the UK.

- All residues found in UK-produced foods are checked by HSE to make sure the pesticide is approved for use.
- Where no UK approval is identified, details of the sample are referred to HSE's Enforcement Section for follow up.
- Our observations and any follow-up action taken to date are summarised in the section for that food commodity. We may have to withhold details of samples while investigations are underway, in which case the details will be published in a later report.

Residues above the MRL, after taking into account measurement uncertainty

- Samples containing residues above the MRL are listed at Appendix B, and those which are clearly above the MRL after taking into account measurement uncertainty of plus or minus 50% are highlighted.
- Our observations and any follow-up action taken are summarised in the section for that food commodity.
- The results in our reports are rounded for publication but not adjusted for measurement uncertainty.
- We apply measurement uncertainty only to decide whether to highlight a result as over the MRL in the brand name annex. To do this we use the actual value reported by the laboratory before rounding. If after taking measurement uncertainty into account that value is found to be over the MRL the result will be highlighted in the brand name annex.

For example:

- The lab reports the results of duplicate analysis of a residue above an MRL at 0.023 mg/kg and 0.025 mg/kg giving an average value of 0.024mg/kg. For reporting purpose this value would be 0.02 mg/kg.
- If measurement uncertainty is then applied to the reported value of 0.02 mg/kg it could take the value to between 0.01 - 0.03 mg/kg. If the MRL is 0.01 mg/kg the lower value would be at the MRL and there is no exceedance.
- However, if measurement uncertainty is applied to the measured result, e.g. 0.024 mg/kg the value could then be in the range of 0.012 – 0.036 mg/kg. In this case the lower value is above the MRL and so will be treated as an exceedance.

Residues in organic food

- We monitor pesticide residues in all the UK food supply, including organic food.
- We are not responsible for checking compliance with the rules associated with organic production. However, when we do detect residues in an organic food we explain whether or not those residues indicate a breach of the rules and inform Defra's Organic Farming Branch.

Brand Name Annex

- Full brand name details for samples included in this report are published in a brand name annex. Within this annex, samples with results of interest are highlighted.
- Brand name details are only published when enough follow-up work is completed for us to be reasonably sure whether a breach of the law or good practice has occurred.
- Therefore, sometimes brand name details are withheld pending completion of this work but are published in a later report.

Pesticides analysed as multi-component analytes and their reporting limits

Why some results cover more than one substance

Both the legal controls and our analytical tests are aimed at checking food for the presence of residues of specific pesticides. Residues are the chemical traces left behind after pesticides are used. In most cases the residue of a pesticide is measured by first identifying the pesticide and then measuring the quantity of that pesticide in the food itself. But for some pesticides the residue remaining in the food is known to be chemically different from the original pesticide and so the laboratory needs to look for more than one component. There are various reasons why this happens, for example:

- the animal or plant can change the pesticide into related chemicals
- the pesticide can change in the environment into related chemicals
- some pesticides are mixtures of chemicals , so the relevant components of the mixture need to be checked for
- in the laboratory sample preparation and/or analysis may change pesticides into related chemicals
- related chemicals may be pesticides in their own right

The MRL setting process takes account of all these issues. The EU may set a complex residue definition to ensure that the identity and quantity of the residue found is representative of the pesticide present. A complex residue definition may be set where it is necessary for safety reasons or to be able to accurately identify the pesticide residue present in the food. This definition usually includes the actual pesticide, plus other related chemicals. These residues are usually reported together as a “sum”. Sometimes different foods need different definitions because different pesticide residues are known to occur in that food. For instances, plants and animals may metabolise a pesticide differently, which forms different residues.

The full definitions of pesticides that we have found in our surveys are described in the table below. If you would like more detail about a particular residue definition, please get in touch. You can email us at prif@hse.gov.uk and other contact details are on the back cover.

Where the detailed individual analysis results tell us something useful, we mention that in our conclusions.

How we calculate sums

Unless the definition says otherwise, the summed result is a simple addition. For individual components that are not detected that result is treated as a zero.

Where a residue definition says, “expressed as”, that means that the individual component results are adjusted by molecular weight before being added together. The residue definition is set this way so that the final calculated result for the whole definition is an expression of the level of the most toxic component, and so that value can be used directly in consumer risk assessment without further adjustment.

Complex residue definitions used in our reports

There are a large number of pesticides used and types of food in the world. So other complex residue definitions may apply to food/pesticide combinations not yet considered by PRiF. You can look up all the EU MRL definitions for pesticide residues at the European Commission’s pesticide database at http://ec.europa.eu/food/plant/pesticides/pesticides_database/index_en.htm

Short name we use in our reports	Legal residue definition – These definitions apply to all foods unless otherwise stated
2,4-D (sum)	2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)
abamectin (sum)	Abamectin (sum of Avermectin B1a, AvermectinB1b and delta-8,9 isomer of Avermectin B1a)
aldicarb (sum)	Aldicarb (sum of Aldicarb, its sulfoxide and its sulfone, expressed as Aldicarb)
aldrin and dieldrin	Aldrin and Dieldrin (Aldrin and dieldrin combined expressed as dieldrin), aka dieldrin (sum)
Amitraz	Amitraz (amitraz including the metabolites containing the 2,4 - dimethylaniline moiety expressed as amitraz)
BAC (sum)	Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C_8, C_{10}, C_{12}, C_{14}, C_{16} and C_{18})
benthiavalicarb (sum)	Benthiavalicarb (Benthiavalicarb-isopropyl (KIF-230 R-L) and its enantiomer (KIF-230 S-D) and diastereomers (KIF-230 R-L and KIF-230 S-D)
bixan (animal products)	Sum of bixafen and desmethyl bixafen expressed as bixafen This definition applies to animal products only
captan and folpet	Sum of captan and folpet aka captan/folpet This definition applies only to pome fruit (fruits such as apples and pears), strawberries, raspberries, currants, tomatoes and beans. For all other foods there are separate MRLs for captan only and

	for folpet only.
carbendazim (animal products)	Carbendazim and thiophanate-methyl, expressed as carbendazim
Carbendazim (sum)	Carbendazim and benomyl (sum of benomyl and carbendazim expressed as carbendazim)
carbofuran (sum)	Carbofuran (sum of carbofuran and 3-hydroxy-carbofuran expressed as carbofuran)
chlordane (animal products)	Chlordane (sum of cis- and trans-isomers and oxychlordane expressed as chlordane) This definition applies to animal products only
chlordane (sum)	Chlordane (sum of cis- and trans- isomers) This definition applies to all foods except animal products
chlorpropham (potatoes)	Chlorpropham only This definition applies only to potatoes
chlorpropham (sum for animal products)	Chlorpropham and 4-hydroxychlorpropham-O-sulphonic acid (4-HSA), expressed as chlorpropham This definition applies only to animal products
chlorpropham (sum)	Chlorpropham (Chlorpropham and 3-chloroaniline, expressed as Chlorpropham) This definition applies to all foods except potatoes and animal products
DDAC (sum)	Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C_8, C_{10} and C_{12})
DDT (sum)	DDT (sum of p,p'-DDT, o,p'-DDT, p-p'-DDE and p,p'-TDE (DDD) expressed as DDT)
Dichlorprop	Sum of Dichlorprop, including dichlorprop-p and its conjugates, expressed as dichlorprop
dicofol (sum)	Dicofol (sum of p, p' and o,p' isomers)
Dimethenamid	Dimethenamid–p (Dimethenamid-p including other mixtures of constituent isomers (sum of isomers))

dimethoate (sum)	Dimethoate (sum of dimethoate and omethoate expressed as dimethoate)
disulfoton (sum)	Disulfoton (sum of disulfoton, disulfoton sulfoxide and disulfoton sulfone expressed as disulfoton)
dithiocarbamates	Dithiocarbamates are a group of pesticides that are chemically similar. Testing for them individually in routine analysis is not possible, so MRLs are set for a test for the group.
endosulfan (sum)	Endosulfan (sum of alpha- and beta-isomers and endosulfan-sulphate expresses as endosulfan)
fenamiphos (sum)	Fenamiphos (sum of fenamiphos and its sulphoxide and sulphone expressed as fenamiphos)
fenchlorphos (sum)	Fenchlorphos (sum of fenchlorphos and fenchlorphos oxon expressed as fenchlorphos)
fensulfothion (sum)	Fensulfothion (sum of fensulfothion, its oxygen analogue and their sulfones, expressed as fensulfothion).
fenthion (sum)	Fenthion (fenthion and its oxygen analogue, their sulfoxides and sulfone expressed as parent)
fenvalerate & esfenvalerate (all isomers)	Fenvalerate (any ratio of constituent isomers (RR, SS, RS & SR) including esfenvalerate)
fipronil (infant food)	Sum of fipronil and fipronil-desulfinyl, expressed as fipronil This definition applies to foods for babies only
fipronil (sum)	Fipronil (sum Fipronil and sulfone metabolite (MB46136) expressed as Fipronil) This definition applies to all foods except foods for babies
flonicamid (sum)	Flonicamid (sum of flonicamid, TNFG and TNFA) This definition applies to all food except animal products
fluazifop-p-butyl (sum)	Fluazifop-P-butyl (fluazifop acid (free and conjugate))
Fosetyl (sum)	Fosetyl-Al (sum of fosetyl, phosphonic acid and their salts, expressed as fosetyl)
haloxyfop (sum)	Haloxyfop including haloxyfop-R (Haloxyfop-R methyl ester,

	haloxyfop-R and conjugates of haloxyfop-R expressed as haloxyfop-R)
Heptachlor (infant food)	Sum of heptachlor and trans heptachlor epoxide This definition applies to foods for babies only
Heptachlor (sum)	Heptachlor (sum of heptachlor and heptachlor epoxide expressed as heptachlor) This definition applies to all foods except infant foods
hexachlorocyclohexane (sum)	Hexachlorocyclohexane (HCH), sum of isomers, except the gamma isomer This definition applies to all foods except animal products (For animal products the alpha and beta isomers have separate MRLs)
Malathion	Malathion (sum of malathion and malaoxon expressed as malathion)
MCPA (animal products)	[Residue definition, animal products] MCPA, MCPB and MCPA thioethyl expressed as MCPA This definition applies to animal products only
MCPA (sum)	MCPA and MCPB (MCPA, MCPB including their salts, esters and conjugates expressed as MCPA) This definition applies to all foods except animal products
Mepanipyrim (sum)	Mepanipyrim and its metabolite (2-anilino-4-(2-hydroxypropyl)-6-methylpyrimidine) expressed as mepanipyrim
methiocarb (sum)	Methiocarb (sum of methiocarb and methiocarb sulfoxide and sulfone, expressed as methiocarb)
methomyl (sum)	Sum of methomyl and thiodicarb expressed as methomyl
Oxydemeton-methyl (sum)	Oxydemeton-methyl (sum of oxydemeton-methyl and demeton-S-methylsulfone expressed as oxydemeton-methyl)
parathion-methyl (sum)	Parathion-methyl (sum of Parathion-methyl and paraoxon-methyl expressed as Parathion-methyl)
Permethrin	Permethrin (sum of isomers)
phorate (sum)	Phorate (sum of phorate, its oxygen analogue and their sulfones expressed as phorate)

phosmet (sum)	Phosmet (phosmet and phosmet oxon expressed as phosmet) This definition applies to all foods except animal products
pirimicarb (sum)	Pirimicarb (sum of Pirimicarb and Desmethyl pirimicarb expressed as Pirimicarb)
Prothioconazole (sum)	Prothioconazole (sum of prothioconazole-desthio and its glucuronide conjugate, expressed as prothioconazoledesthio) This definition applies to animal products only
PTU & propineb	Sum of PTU and propineb This definition applies to food for babies only
quintozene (sum)	Quintozene (sum of quintozene and pentachloro-aniline expressed as quintozene)
Prochloraz (sum)	Prochloraz (sum of prochloraz and its metabolites containing the 2,4,6-Trichlorophenol moiety expressed as prochloraz)
Terbufos (sum)	Terbufos (sum of terbufos, its sulfoxide and sulfone This definition applies only to foods for babies
thiamethoxam (sum)	Thiametoxam (sum of thiametoxam and clothianidin expressed as thiametoxam) There are also separate clothianidin MRLs
tolylfluanid (sum)	Tolylfluanid (Sum of tolylfluanid and dimethylaminosulfotoluidide expressed as tolylfluanid)
triadimefon & triadimenol	Triadimefon and triademenol
vinclozolin (animal products)	Vinclozolin, iprodione, procymidone, sum of compounds and all metabolites containing the 3,5-dichloroaniline moiety expressed as 3,5-dichloroaniline This definition applies to animal products only
vinclozolin (sum)	Vinclozolin (sum of vinclozolin and all metabolites containing the 3,5-dichloraniniline moiety, expressed as vinclozolin) This definition applies to all foods except animal products

Glossary

This is a 'standard' glossary which defines the key terms used in the PRiF reports. Not all the terms listed here are used in this particular report.

Acceptable Daily Intake (ADI): This is the amount of a chemical which can be consumed every day for a lifetime in the practical certainty, on the basis of all known facts, that no harm will result. It is expressed in milligrams of the chemical per kilogram of body weight of the consumer. The starting point for the derivation of the ADI is usually the 'no observed adverse effect level' (NOAEL) that has been observed in animal studies for toxicity. This is then divided by an uncertainty factor (most often 100) to allow for the possibility that animals may be less sensitive than humans and also to account for possible variation in sensitivity between individuals. The studies from which NOAELs and hence ADIs are derived take into account any impurities in the pesticide active substance as manufactured, and also any toxic breakdown products of the pesticide.

Acetylcholine: Acetylcholine is a neurotransmitter, a chemical that carries signals through the nervous system. *See cholinergic*

Acetylcholinesterase: This is an enzyme which degrades acetylcholine and is involved in the regulation of nerve impulses.

Acute Reference Dose (ARfD): The definition of the ARfD is similar to that of the ADI, but it relates to the amount of a chemical that can be taken in at one meal or on one day without appreciable health risk to the consumer. It is normally derived by applying an appropriate uncertainty factor to the lowest NOAEL in studies that assess acute toxicity or developmental toxicity.

As a matter of policy, the EU does not use NOAELs from tests that involve deliberate administration of pesticides to humans to determine ADIs and ARfDs. However, where such data have been ethically and scientifically derived some authorities, e.g. the World Health Organization, do consider such data. Where human data are used there is usually less uncertainty in the resulting reference value compared to extrapolating from animal tests to humans, and a lower uncertainty factor (most often 10) is used to account for the variation in sensitivity between individuals.

The initial risk assessments in PRiF reports use the agreed EU reference values. However, where intakes are above the EU value and a reference value based on acceptable human data is available a refined assessment, which is a more appropriate indicator of the risk, is also reported.

Analyte: This is the name for the substance that the PRiF surveys look for and measure if present; it could be a pesticide itself or a product from a pesticide when it is degraded, or metabolised.

COLEACP (Europe-Africa-Caribbean-Pacific Liaison Committee): It aims to promote the competitive export of fresh fruit, vegetables, flowers and ornamental plants from the ACP. Its specialised information and advisory services are open to all ACP companies in the horticultural export sector and are financed by the European Commission. It has two overriding objectives to enable ACP companies to comply with European food safety and traceability requirements and to consolidate the position of small-scale producers in the ACP horticultural export sector.

Cholinergic: In relation to the animal nervous system, processes and structures are cholinergic if they release or use acetylcholine.

Cryogenic Milling: Processing of commodities at very low temperatures can be achieved by milling/grinding pre-frozen samples in the presence of dry ice, a procedure known as 'cryogenic milling'.

Extensions of Authorisations for Minot Use (EAMUs): Users and authorisation holders of agricultural Plant Protection Products (PPP) may apply to have the authorisation of specific PPP's extended to cover uses additional to those authorised and shown on the manufacturer's product label. For many reasons, label recommendations of approved pesticides do not cover the control of every problem which may arise. This is particularly true for crops that are grown on a comparatively small scale in the UK as well as for pests and diseases that occur less often or which are new to the UK. As part of the process evidence on residues that would arise from the use is required, and consumer safety is evaluated and if necessary a specific MRL set. EAMU is pronounced "emu" these types of authorisations are also informally called "off labels".

Good Agricultural Practice in the Use of Pesticides (GAP): The nationally authorised safe uses of pesticides under conditions necessary for effective and reliable pest control (the way products should be used according to the statutory conditions of approval which are stated on the label). GAP encompasses a range of pesticide applications up to the highest authorised rates of use, applied in a manner which leaves a residue which is the smallest practicable. Authorised safe uses are determined at the national level and include nationally registered recommended uses, which take into account public and occupational health and environmental safety considerations. Actual conditions include any stage in the production, storage, transport, distribution and processing of food commodities and animal feed.

High-level Consumer: A term used in UK risk assessment calculations to describe the amount of food consumed by a person. In line with internationally agreed approaches, the PRiF uses the 97.5th percentile value, which is generally about three times the average amount consumed. This takes account of different eating patterns that may occur throughout the population.

Human Data: See under Acute Reference Dose

Import Tolerance: an MRL set for imported products where the use of the active substance in a plant protection product on a commodity is not authorised in the European Community (EC) or an existing EC MRL is not sufficient to meet the needs of international trade. All import tolerances are assessed for consumer safety.

Imported: The tables in the reports record whether the sample was of UK origin, or imported. This can mean different things depending on the commodity. See also 'Origin'. The PRiF report the country from where the produce has been imported only if this is clear from the packaging or labelling.

JMPR: Joint FAO/WHO Meeting on Pesticide Residues, which conducts scientific evaluations of pesticide residues in food.

LOD (Limit of Determination) and LOD MRLs: The Limit of Determination (LOD) is the lowest concentration of a pesticide residue or contaminant that can be routinely identified and quantitively measured in a specified food, agricultural commodity or animal feed with an acceptable degree of certainty by the method of analysis.

LOD MRL (Maximum Residue Levels set at the LOD): For some pesticides and commodities insufficient trials data are available on which to set a maximum residue level or there may be no

use of the pesticide on that crop. In these cases, the MRL may be set at a default level i.e.; at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. **These MRLs are not based on Good Agricultural Practice (GAP).**

Off Label: See EMAUs

Maximum Residue Level (MRL): The maximum concentration of a pesticide residue (expressed as mg/kg) legally permitted in or on food commodities and animal feeds. MRLs are based on good agricultural practice data and residues in foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable.

MRLs are intended primarily as a check that GAP is being followed and to assist international trade in produce treated with pesticides. **MRLs are not in themselves 'safety limits'**, and exposure to residues in excess of an MRL does not automatically imply a hazard to health.

The MRLs applicable in the UK are now largely set under EC legislation.

Maximum Residue Levels (MRLs) reflect levels of pesticides that could occur in produce, which has been treated in accordance with good agricultural practice. Where pesticides do not give rise to readily detectable residues, or are not approved for use on particular commodities, MRLs are set at the lowest level which can be identified in routine laboratory analysis. Thus, they provide a mechanism for statutory controls on pesticides in produce which is put into circulation and for monitoring correct use of these chemicals.

If no use of a pesticide on a crop is identified when MRLs are set the tolerance for that pesticide/crop combination is set at the limit of determination (effectively zero). Limit of determination MRL are marked by a '*'

MRLs are established under the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuffs) (England and Wales) Regulations 1999 (as amended), the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuffs) (Scotland) Regulations 2000 and the Pesticides (Maximum Residue Levels in Crops, Food and Feeding Stuffs) Regulations (Northern Ireland) 2002. These Regulations list all statutory MRLs established under UK national or EC procedures. Today, virtually all these MRLs are set under an ongoing EC programme and the Regulations are amended periodically as levels are set for increasing numbers of pesticides.

There are a number of pesticides which do not yet have statutory MRLs. In the absence of such MRLs we advise suppliers to adhere to any appropriate levels established by the Codex Alimentarius Commission (CAC) a United Nations body established to promote global trading standards. Codex MRLs are not statutory but have been risk-assessed when set and provide a suitable standard in the absence of a statutory MRL.

MRLs may be extended to composite and processed products but levels are not specifically laid down in legislation. They are derived by calculation on an individual basis.

Maximum Residue Levels set at the LOD (LOD MRL): See LOD MRL. For some pesticides and commodities, insufficient trials data are available on which to set a maximum residue level or there may be no use of the pesticide on that crop. In these cases, the MRL may be set at a default level, i.e. at the limit of determination (LOD) where analytical methods can reasonably detect the presence of the pesticide. **These MRLs are not based on Good Agricultural Practice (GAP).**

MRL exceedances: When a residue is found at a level higher than that set for the MRL.

MRL Exceedances and Relationship with the Acceptable Daily Intake (ADI): Before permitting any use of a pesticide, a detailed assessment is made to ensure that residues in foods derived from commodities comply with MRLs and will not give rise to unacceptable risks to consumers. MRLs do take account of consumer safety aspects and, in effect, are set at levels below safety limits. However, MRLs must not be confused with safety limits, which are expressed in terms of the acceptable daily intake (ADI) of a particular pesticide residue from all sources. The ADI (expressed as mg/kg bw/day) is the amount of chemical that can be consumed every day of an individual's entire lifetime in the practical certainty, on the basis of all known facts, that no harm will result. See ADI for further information.

Whenever unexpectedly high or unusual residues occur during monitoring, the risk to consumers, from exposure to residues at the highest levels found, is assessed by comparison of predicted intakes with the ADI or ARfD as appropriate.

No MRL: For certain pesticides an MRL may not have been set.

Metabolite: A degradation or conversion product from a pesticide when it is metabolised.

Multiple Residues: In this report this term is used to describe when more than one pesticide is found in an individual food sample. It may have arisen because the crop was treated at different times with pesticides applied singularly, or when pesticides are applied as mixtures (several pesticides mixed in the spray tank at the same time) or the marketed pesticide product contains more than one pesticide or any combination of these three situations. Mixtures may be used in response to specific pest pressures and also as part of strategies to minimise pesticide resistance building up on pest populations.

NEDI: National Estimate of Daily Intake. An estimate of intake of pesticide in the diet over the long-term to compare to the ADI. The NEDI is based on median or mean residue levels and a high level consumption (97.5th percentile value) for the daily amounts of the food item consumed over the long term. For further details on the calculation of NEDIs please refer to section 3 of the data requirements handbook: www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/applicant-guide/the-applicant-guide-contents.

NESTI: National Estimate of Short Term Intake. An estimate of peak intake of pesticide in the diet to compare to the ARfD. The NESTI is based on the highest residue found multiplied by a variability factor (see glossary description) and a high level consumption (97.5th percentile value) for the amount of the food item consumed over a single day. For further details on the calculation of NESTIs please refer to section 3 of the data requirements handbook: www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/applicant-guide/the-applicant-guide-contents.

Neurotoxicity: Neurotoxicity is the effect of substances (called neurotoxins) which alter the normal working of an animal's nervous systems and/or damage the nervous tissue.

No Observed Adverse Effect Level (NOAEL): The greatest concentration or amount of a substance, found by experiment or observation, which causes no detectable adverse alteration of morphology, functional capacity, growth, development or life span of the target organism under defined conditions of exposure.

Origin: The brand name annex reports the origins of the samples tested. This can mean different things depending on the commodity. For example, butter is often labelled as 'UK origin'; however, the majority of it comes in bulk from New Zealand and is split into smaller

blocks and packaged in the UK. Lettuce is a fresh produce and 'UK origin' usually means that it has been grown and packaged in the UK. Processed commodities such as cereal bars often contain multiple raw ingredients, each of which may come from a different source/origin. Therefore, the origin of the produce usually reflects the place where it was manufactured. The PRiF report the origin as stated on the packaging or labelling of the commodity concerned, unless other more accurate information is available to indicate that the origin is from elsewhere. Some products are listed as 'unknown origin' because the labelling does not give this information.

Parent: The chemical form of a pesticide as applied to plants, as opposed to metabolites and breakdown products.

Percentile: A percentile is a value that divides a sample of measurements at a specific point when they are listed in ascending order of magnitude. For example, the 97.5th percentile from a food consumption survey is a value that is equal to or more than 97.5% of the measurements and equal to or less than 2.5% of the measurements. So, in a sample of 40 daily food consumption values, the 97.5th percentile is equal to or more than 39 of the measurements. Such high percentile estimates of food consumption are used in risk assessments as they are more protective than using average consumption levels.

Permitted Level (PL): The permitted levels (expressed as mg/kg), in specific commodities, of some substances which can be classified as pesticides but are controlled under the Miscellaneous Food Additives Regulations 1995 (S.I. 1995 No. 3187).

Pesticide: A pesticide is any substance, preparation or organism prepared or used for destroying any pest. The majority of pesticides sought by the PRiF in its monitoring are those used to control pests in agricultural crops, although non-agricultural products may be included where there is a specific reason for doing so, e.g. where there are implications in terms of possible intakes of residues.

Probabilistic Modelling: The usual estimates of consumer exposure use single high values for both consumption amounts and residue levels. Whilst these are based on realistic UK dietary survey data and residue levels, they tend to overestimate most representative intakes. This is because they do not take into account actual variations in both amounts consumed and residue levels. Probabilistic modelling is a technique that considers all the possible different combinations of consumption and residue levels. This provides information on the probability of particular intakes occurring.

Rapid Alert System for Food and Feed (RASFF): The European Commission's Rapid Alert System for Food and Feed (RASFF) allows member authorities (EU and EFTA member States) to quickly exchange information about measures taken when responding to risks detected in food or feed. This exchange of information helps authorities in countries inside the European single market to act more rapidly and in a coordinated way in response to a possible health threats caused by food or feed.

RASFFs notifications about pesticide residues are sent when a residue is over the MRL taking into account measurement uncertainty and a potential consumer risk has been identified. For pesticide residues in food traded in the single market this means when a risk assessment has identified that risk to people eating the food cannot be ruled out.

More information is available on the European Commission website at https://ec.europa.eu/food/safety/rasff_en

Relationship between GAP and MRLs: The MRL can be defined as the maximum concentration of a pesticide residue (expressed as mg/kg) likely to **occur** in or on food commodities and animal feeds, after the use of the pesticide according to the GAP.

Reporting Limit: The reporting limit is the lowest calibrated level employed during analysis to detect residues. The reporting limit may vary slightly from laboratory to laboratory depending on the equipment available and operating procedures used.

'None were detected above the Set RL': This term is used in the Brand Name Annex, where no residues were found above their reporting limit.

Residue: Residues may be present in vegetable and animal products following the application(s) of a pesticide(s). They may not only include the pesticide that was applied but other degradation or reaction products and metabolites that may be of toxicological significance. The levels or amounts of residues present are expressed in milligrams of the chemical in a kilogram of crop/food/commodity (mg/kg), or parts per million.

Risk Assessment: A risk assessment is carried out when residues are found in foods to determine whether, at the levels found, they present a concern for consumer health or not. Consumer risk assessments are routinely conducted as part of the approval process for pesticides and are based on residue trials. Approval of a pesticide is only recommended when the consumer risk is acceptable.

Safety Factor: Values used in extrapolation from experimental studies in animals (usually 100) or humans (usually 10) to the population: for PRiF assessments this represents a value by which the NOAEL is divided to derive an ADI or ARfD. The value depends on the nature of the effect, the dose-response relationship, and the quality of the toxicological information available. The use of such a factor accounts for possible differences in susceptibility between the animal species tested and humans, and for variation between different individuals in the population. The terms 'uncertainty factor' and 'assessment factor' are also sometimes used for this factor; the PRiF will use 'safety factor'.

Sample: The nature of all samples is as designated in the EC's 'sampling' Directive – 2002/63/EC. Examples are: apple – at least 10 apples weighing at least 1 kg; grapes – at least 5 bunches, weighing at least 2 kg.

Technical Exceedances: When an MRL has been set at the LOD because there have been no data to support a higher level. In the context of this report, 'technical exceedances' always relate to produce from third countries.

Variability Factor: A value that describes the variation in residue levels between the highest unit level and the average level in samples made up of many units. Internationally this is agreed to be the 97.5th percentile unit residue level divided by the average of the sum. The variability factor multiplied by the measured residue level from a composite sample (i.e. a sample made up by mixing several units before analysis) gives an estimate of the likely higher residue levels that may have occurred in individual units. These estimated higher levels are used in short-term risk assessments involving fruit and vegetables where consumers eat only a portion of a single item, e.g. melon, or a small number of units e.g. apples and potatoes.

Ware: Ware potatoes, sometimes referred to as main crop potatoes, are harvested between August and November, and are available throughout the period August to June because they are stored under controlled temperature after October.