Department for Environment, Food and Rural Affairs

The Expert Committee on Pesticide Residues in Food (PRiF)

Report on the pesticide residues monitoring programme: Quarter 1 2020

This publication is available at Expert Committee on Pesticide Residues in Food

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

Contents

Introduction and summary results

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

The PRiF's 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 food, 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 food which is put into circulation and for monitoring the correct use of these chemicals.

Chair's summary of results

This is our first quarterly report for 2020. During this year's surveillance programme, we are looking for a range of up to 372 pesticides in the fruit and vegetable surveys. This quarter's programme surveyed 602 samples of 21 different foods (see contents page for a full list).

28 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, carrots, cauliflower, liver, okra, potatoes and rice. A summary 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 carrots and cauliflower should be treated as breaches of the legislation in place at the time of sampling and 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 identified some residues of interest in one sample of speciality beans containing dimethoate and omethoate. Based on the full risk assessment performed on this sample, we consider any effect on health unlikely at the levels of exposure anticipated. However, the findings are undesirable due to the concerns for possible genotoxicity. This finding led to the issuing of a European information notification through the EC's Rapid Alert System for Food and Feed (RASFF)

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. We hope this 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 specifically for publication are available in Section 2 sample details and supplier responses.

Ann Davison
Chair of the Expert Committee on Pesticide Residues in Food

Summary of Table of Results

Food	Analysed	With residues at or below the MRL[1]	With residues above the MRL	With residues of non- approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Avocado	35	11	0	0	1	9	0
Beans with pods	24	13	3	0	10	1	1
Carrot	22	9	5	0	6	2	0
Cauliflower	23	4	8	0	3	1	0
Fish (oily)	24	3	0	0	1	0	0
Grapes	24	24	0	0	22	0	0
Kiwi Fruit	24	9	0	0	1	3	0
Lamb	12	1	0	0	0	1	0
Lettuce	36	22	0	0	15	4	0

[1]. In analytical terms this is a reportable value between LOD and the MRL

Food	Analysed	With residues at or below the MRL[1]	With residues above the MRL	With residues of non- approved pesticides (UK only)	With multiple residues	Organic samples tested	Organic samples with residues
Liver	22	2	2	0	0	0	0
Mango	24	18	0	0	8	1	0
Milk	84	0	0	0	0	25	0
Okra	24	5	5	0	7	0	0
Onions	24	10	0	0	2	8	0
Oranges	17	17	0	0	17	0	0
Pate (fish)	24	3	0	0	0	0	0
Pears	30	25	0	0	25	4	0
Peas without pods	30	9	0	0	0	1	0
Potatoes	32	23	1	0	10	0	0
Poultry meat	24	0	0	0	0	0	0
Rice	42	11	4	0	8	4	0

Summary of Rapid Alert Notifications sent to FSA

Sample ID	Date of Sampling	Description	Country of Origin	Retail Outlet	Address	Brand Name	Packer / Manufacturer	Pesticide residues found in mg/kg (MRL)
Beans with pods								
4294/2020	18/02/2020	Guar beans	India	International Exotics Ltd	Unit 11, Birmingham Wholesale Market, Nobel Way, The Hub, Witton, Birmingham B6 7EU	None stated	All Seasons Exports Plot No.263, Building No-2, Centre Facility, ATNC Market Dana Market, Sector 19, Navi Mumbai, Maharashtra, 400705, India	acetamiprid 0.2 (MRL = 0.6)
								carbofuran (sum) 0.005 (MRL = 0.01*)
								carbendazim (sum) 0.003 (MRL = 0.2)
								dimethoate 0.01 (MRL = 0.01*)
								dithiocarbamates 0.1 (MRL = 1)
								omethoate 0.04 (MRL = 0.01*)

*** 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.

Summary of MRL Exceedances

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						
3936/2020	Fine Beans	Kenya	acephate	0.1	0.01*	Yes
			hexaconazole	0.03	0.01*	Yes
			methamidophos	0.09	0.01*	Yes
3757/2020	Speciality Beans	Pakistan	profenofos	0.4	0.01*	Yes
4294/2020	Speciality Beans	India	omethoate	0.04	0.01*	Yes
Carrot						
1013/2020	Fresh	UK	chlorate	0.03	0.01	N/A
3238/2020	Fresh	UK	chlorate	0.02	0.01	N/A
3761/2020	Fresh	UK	chlorate	0.04	0.01	N/A
3860/2020	Fresh	Spain	chlorate	0.02	0.01	N/A

Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
4301/2020	Fresh	South Africa	chlorate	0.03	0.01	N/A
Cauliflower						
1039/2020	Frozen	Belgium	chlorate	0.02	0.01	N/A
3016/2020	Frozen	UK	chlorate	0.3	0.01	N/A
3074/2020	Frozen	UK	chlorate	0.1	0.01	N/A
3094/2020	Frozen	UK	chlorate	0.1	0.01	N/A
3299/2020	Frozen	UK	chlorate	0.1	0.01	N/A
3340/2020	Frozen	UK	chlorate	0.1	0.01	N/A
3362/2020	Frozen	Belgium	chlorate	0.06	0.01	N/A
3368/2020	Frozen	UK	chlorate	0.09	0.01	N/A
Liver						
1092/2020	Ox	UK	BAC (sum)	0.3	0.1	Yes
3648/2020	Ox	UK	BAC (sum)	0.4	0.1	Yes

Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
Okra						
3544/2020	Fresh	India	tebuconazole	0.03	0.02*	No
3634/2020	Fresh	Thailand	acephate	1.5	0.01*	Yes
			methamidophos	0.1	0.01*	Yes
3940/2020	Fresh	Honduras	tebuconazole	0.07	0.02*	Yes
4291/2020	Fresh	Honduras	flubendiamide	0.03	0.01*	Yes
4554/2020	Fresh	India	flonicamid (sum)	0.4	0.03*	Yes
Potatoes						
4400/2020	New	UK	chlorpropham	13	10	No
Rice						
1156/2020	Basmati	UK	buprofezin	0.03	0.01*	Yes
			tricyclazole	0.02	0.01*	No
3200/2020	Basmati	UK	buprofezin	0.02	0.01*	Yes
			tricyclazole	0.02	0.01*	Yes

Sample ID	Food	Country of Origin	Pesticide Detected	Residue Detected (mg/kg)	MRL (mg/kg)	MRL exceedance after allowing for measurement uncertainty
3371/2020	Basmati	UK	thiamethoxam	0.07	0.01*	Yes
3550/2020	Basmati	UK	buprofezin	0.04	0.01*	Yes
			tricyclazole	0.02	0.01*	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 LOD MRL in place at the time of sampling have not been marked as exceedances, see Section 4 for explanation.

Section 1: findings by food

Avocado

Summary of results

In a survey of 35 samples avocados collected between January and March 2020, 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

The assessments for avocado consider both consuming with peel and without peel (flesh only).

Based on the Health and Safety Executive's risk assessment of the residues detected (see risk assessments in Section 3) we consider that an effect on health is not expected if the peel is not consumed. In the event that all of the peel is eaten when consuming large portions of avocado containing the highest level of prochloraz found in this report, we consider that an effect on health is unlikely.

Survey design

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

Avocado will be collected in quarter one and quarter three of 2020.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

35 samples were tested for up to 366 pesticide residues

Fresh

- 26 samples were imported from outside the EU
- 8 samples came from the EU

Frozen

- 1 sample came from the UK

Pesticide residues detected from those sought

24 samples contained no residues from those sought

11 samples contained residues above the reporting level

None of the samples contained residues above the MRL

9 samples were labelled as organic. None contained residues from those sought

The country of origin of samples may not be the same as the country where the avocado was produced. It may be where the avocado was processed, where it was packed for consumer purchase or the address of the brand owner.

Multiple residues

1 sample contained residues of more than one pesticide

- 1 sample contained 4 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in avocado

Risk assessments

Five samples of avocado contained a residue of prochloraz at levels where the effect on health needed to be considered in more detail. The highest level detected was 1.4mg/kg. The EU MRL assessment assumes that avocados are peeled before consumption, and if the peel is not consumed, then an effect on health is not expected. However, assuming that consumers eat all of the peel then an effect on health is unlikely after eating large portions (97.5th percentile) of avocado containing the highest level found in this report. The full risk assessment is available at page 71.

Combined risk assessments

One sample contained residues of more than one pesticide. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Beans with Pods

Summary of results

In a survey of 24 samples of beans with pods collected between January and March 2020, three 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

Dimethoate and omethoate

One sample of Guar bean contained residues of dimethoate and omethoate where the effect on health needed to be considered in more detail.

Dimethoate and omethoate are chemically related insecticides and for toxicology purposes are considered together. Omethoate is also the main metabolite of dimethoate. They used to also have a single, summed MRL but at present have separate MRLs for the two pesticides.

Omethoate is not approved for use in the EU. Dimethoate has been recommended for non-renewal of approval of use in the EU, (EU, 2019)[2]. Pesticide products containing dimethoate are not permitted to be used in the EU after the end of 2019.

In 2018[3] EFSA reviewed dimethoate and concluded that no toxicological reference values could be determined for dimethoate and omethoate, due to a lack of a fully supporting toxicological database. We think that, at the anticipated highest exposures following consumption of this bean sample, there is unlikely to be a risk of ill health effects based on short term toxicity. These exposures are undesirable but are not expected to inhibit acetylcholinesterase[4] It is not clear, from the underlying toxicological data, if these residues may cause any adverse effect. In terms of long-term adverse health effects, it is unclear whether dimethoate can damage genetic material (is genotoxic); studies with omethoate provide some evidence that this metabolite (omethoate) is genotoxic.

A combined assessment was also presented for this sample, which also contained the insecticide carbofuran at a low level of 0.005 mg/kg (MRL 0.01mg/kg). Carbofuran (a carbamate) can have a similar short-term toxicological effect as dimethoate and omethoate (which are organophosphates), as they have the potential to inhibit the enzyme acetylcholinesterase if present at large enough exposure levels. At the anticipated exposure levels, the presence of carbofuran would have a minimal impact on the assessment based on omethoate and dimethoate alone. Overall, it is not expected that the combined exposures would inhibit acetylcholinesterase.

Based on the full risk assessment performed (see page 72), we consider any effect on health unlikely at the levels of exposure anticipated. On a precautionary basis any findings of dimethoate and omethoate are undesirable due to the concerns for genotoxicity.

---

[2] European Commission Document reference SANTE/11494/2018 Rev. 1 of 21 May 2019

[3] EFSA (European Food Safety Authority), 2018. Conclusion on the peer review of the pesticide risk assessment of the active substance dimethoate. *EFSA Journal* 2018;16(10):5454, 29 pp. https://doi.org/10.2903/j.efsa.2018.5454

[4] this enzyme, acetylcholinesterase, is included in the Glossary on page 103

This sample was collected as part of the rolling reporting programme and following HSE's assessment of risk and detailed discussion with the Food Standards Agency RASFF notification 2020.1798 was issued by the European Commission in April 2020.

Monocrotophos

One sample (4290/2020) contained a residue of monocrotophos at 0.004 mg/kg. The MRL is 0.01 mg/kg.

Monocrotophos is an insecticide that has not been authorised for use in the EU since 2003; the toxicological data package for monocrotophos is old, and HSE has used the JMPR assessment of these data. At this level of 0.004 mg/kg the intake is below the ADI and the ARfD. Nevertheless, because of uncertainty about the potential for genetic damage (genotoxicity) at low doses, on a precautionary basis any findings of monocrotophos in food are not desirable.

Due to concerns about potential toxicological issues, for 2020 onwards, we have reduced the reporting level for monocrotophos. We wish to determine how prevalent it is in food. A more detailed explanation is with the risk assessments on page 70

Survey design

Beans with pods surveys are reported more regularly throughout the year as part of rolling reporting and will be surveyed in all quarterly reports of 2020.

The samples were collected by either, Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 366 pesticide residues

Dwarf Beans

- 1 sample was imported from outside the EU

Fine Beans

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

Green Beans

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

Runner Beans

- 4 samples were imported from outside the EU

Speciality Beans

- 6 samples were imported from outside the EU

Pesticide residues detected from those sought

8 samples contained no residues from those sought

16 samples contained residues above the reporting level

3 samples contained residues above the MRL

1 sample was labelled as organic. It contained residues from those sought

Multiple residues

10 samples contained residues of more than one pesticide

- 5 samples contained 2 residues
- 2 samples contained 3 residues
- 2 samples contained 6 residues
- 1 sample contained 7 residues

Residues measured above the MRL

The laboratory detected 3 residues above the MRL in beans with pods

- 1 sample of fine Beans from Kenya contained residues of
    - acephate at 0.1 mg/kg. The MRL is 0.01* mg/kg.
    - hexaconazole at 0.03 mg/kg. The MRL is 0.01* mg/kg.
    - methamidophos at 0.09 mg/kg. The MRL is 0.01* mg/kg.

- 1 sample speciality Beans from Pakistan contained a residue of profenofos at 0.4 mg/kg. The MRL is 0.0* mg/kg.

- 1 sample of speciality Beans (Guar) from India contained a residue of omethoate at 0.04 mg/kg. The MRL is 0.01* mg/kg.

Risk assessments

One sample required a detailed evaluation of risk and this is summarised below. For the remaining findings of individual residues or combined residues detected by the laboratory an effect on health is not expected.

Dimethoate and omethoate

One sample of Guar beans (sample 4924/2020) contained residues of dimethoate of 0.01 mg/kg (MRL 0.01mg/kg) and omethoate at 0.04 mg/kg (MRL 0.01mg/kg) where the effect on health needed to be considered in more detail.

Dimethoate and omethoate are chemically related insecticides and for toxicology purposes are considered together. Omethoate is also the main metabolite of dimethoate.

EFSA (2018)[5] for dimethoate, has indicated that no toxicological reference values could be determined for dimethoate and omethoate, due to a lack of a fully supporting toxicological database.

Short term effects: We think that at the anticipated highest exposures following consumption of this bean sample, there is unlikely to be acetylcholinesterase[6] inhibition when the basis of recent evaluations of the ARfD (EFSA, 2018 and JMPR, 2019) are considered. We consider risk of ill health effects based on short term toxicity unlikely.

Long term effects: It is unclear whether dimethoate can damage genetic material (is genotoxic); studies with omethoate provide some evidence that this metabolite (omethoate) is genotoxic.

Based on the full risk assessment performed (see page 72), we consider any effect on health unlikely at the highest levels of exposure anticipated. On a precautionary basis any findings of dimethoate and omethoate are undesirable due to the concerns for genotoxicity.

The HSE assessment has considered the presence of dimethoate and omethoate in an individual sample and this is reflected in the detailed risk assessment on page 84.

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 and determined that in all but one sample an effect on health was unlikely. One sample required a detailed combined assessment.

HSE carried out a combined risk assessment of the Guar bean sample (4924/2020) that contained dimethoate at 0.01 mg/kg and omethoate at 0.04 mg/kg. The same sample also contained carbofuran at a low level of 0.005 mg/kg. These are insecticides from different chemical groups (carbofuran is a carbamate and dimethoate and omethoate are organophosphates) but both groups can, if present at high exposure levels, have the effect of inhibiting the enzyme acetylcholinesterase. The conclusion discussed above (page 84) for dimethoate and omethoate is still considered valid for this combined assessment as carbofuran intakes are only 17% of its ARfD and would have a minimal impact on the assessment based on omethoate and dimethoate alone. Therefore, we consider residues of dimethoate, omethoate and carbofuran together in this sample are not, in the short-term, expected to adversely inhibit acetylcholinesterase, at the estimated exposure levels. In the long-term, on a precautionary basis any findings of dimethoate and omethoate are not desirable due to genotoxicity concerns. Overall, an effect on health is unlikely.

[5] EFSA (European Food Safety Authority), 2018. Conclusion on the peer review of the pesticide risk assessment of the active substance dimethoate. *EFSA Journal* 2018;16(10):5454, 29 pp. https://doi.org/10.2903/j.efsa.2018.5454

[6] this enzyme, acetylcholinesterase, is included in the Glossary on page 101

Follow up actions

Letters sent

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

Organic sample with a residue

The Secretariat has written to the supplier of the sample of organic beans with pods from Egypt with residues of abamectin and pyridaben which are not permitted in organic food production. Defra's Organic Farming branch and the organic certification organisation were also informed.

RASFFs issued

The EU issued a notification for the following samples through the EC's Rapid Alert System for Food and Feed (RASFF) (see glossary for more details)

- One sample from India containing dimethoate of 0.01 mg/kg and omethoate at 0.04 mg/kg. RASFF issued 29 April 2020 (1010.1798)

Carrots

Summary of results

In a survey of 22 samples of carrots collected between January and February 2020, five 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 in five frozen samples above the MRL in place at the time of sampling.

We are testing a limited number of foods for chlorate in 2020, as we have since 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 MRL in place at the time these samples were taken, and this report was prepared, 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 view these residues as breaches of the legislation. 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 and future MRLs for chlorate is available in Section 4.

Survey design

This year carrots being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme and will be surveyed in each quarter of 2020.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

22 samples were tested for up to 368 pesticide residues

Fresh

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

Pesticide residues detected from those sought

8 samples contained no residues from those sought

14 samples contained residues above the reporting level

5 samples contained residues above the MRL

2 samples were labelled as organic. Neither contained residues from those sought

Multiple residues

6 samples contained residues of more than one pesticide

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

Residues measured above the MRL

The laboratory detected 5 residues above the MRL in carrots

- 1 sample from UK contained a residue of chlorate at 0.03 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample from UK contained a residue of chlorate at 0.02 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample from UK contained a residue of chlorate at 0.04 mg/kg. The MRL is 0.01*mg/kg.
- 1 sample from Spain contained a residue of chlorate at 0.02 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample from South Africa 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.

* **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.

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 response received is in Section 2.

Cauliflower

Summary of results

In a survey of 23 samples of cauliflower collected between January and March 2020, eight 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 in eight frozen samples above the MRL in place at the time of sampling.

We are testing a limited number of foods for chlorate in 2020, as we have since 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 MRL in place at the time these samples were taken, and this report was prepared, 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 view these residues as breaches of the legislation. 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 and future MRLs for chlorate is available in Section 4.

Survey design

This year cauliflower is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme and will be surveyed in every quarter of 2020.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

23 samples were tested for up to 369 pesticide residues

Fresh

- 9 samples came from the UK
- 6 samples came from the EU

Frozen

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

Pesticide residues detected from those sought

11 samples contained no residues from those sought

12 samples contained residues above the reporting level

8 samples contained residues above the MRL

1 sample was labelled as organic. It did not contain residues from those sought

Multiple residues

3 samples contained residues of more than one pesticide

- 3 samples contained 2 residues

Residues measured above the MRL

The laboratory detected 8 residues above the MRL in frozen cauliflower

- 1 sample from Belgium contained a residue of chlorate at 0.02 mg/kg. The MRL is 0.01* mg/kg.
- 1 sample from UK contained a residue of chlorate at 0.3 mg/kg. The MRL is 0.01 mg/kg
- 4 samples from UK contained a residue of chlorate at 0.1 mg/kg. The MRL is 0.01 mg/kg
- 1 sample from Belgium contained a residue of chlorate at 0.06 mg/kg. The MRL is 0.01 mg/kg
- 1 sample from UK contained a residue of chlorate at 0.9 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.

* **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.

Combined risk assessments

One sample contained residues of more than one pesticide. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Follow up actions

Letters sent

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

Fish (oily)

Summary of results

In a survey of 24 samples of fish collected between January and March 2020, 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.

BAC

One sample of salmon contained a residue of BAC. This substance is widely used as a biocide (disinfectant) during food preparation and processing. This is the most likely source of the residue.

DDT

One sample of salmon and two samples of seabass contained residues of DDT.

The use of DDT is banned or heavily restricted in many countries because the residues take a long time to breakdown in the environment and can accumulate in fatty tissue.

An interpretation of the analytical results shows that the DDT residue found was in the form of DDE which indicates historical use. More detailed information about DDT residues is in section 4 of this report.

Survey design

Fish (oily) will be surveyed in every quarter of 2020.

The 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 38 pesticide residues

Mackerel

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

Salmon

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

Seabass

- 3 samples were imported from outside the EU

Trout

- 2 samples came from the UK

Pesticide residues detected from those sought

Pesticide residues detected from those sought

21 samples contained no residues from those sought

3 samples contained residues above the reporting level

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Grapes

Summary of results

In a survey of 24 samples of grapes collected between January and March 2020, 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

This year grapes are being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme and will be surveyed in each quarter of 2020 as part of the rolling reporting.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 369 pesticide residues

24 samples were 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

22 samples contained residues of more than one pesticide

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

Residues measured above the MRL

The laboratory detected no residues above the MRL in grapes

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Kiwi Fruit

Summary of results

In a survey of 24 samples of kiwi fruit collected between January and March 2020, 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

This year kiwi fruit is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The kiwi fruit samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 370 pesticide residues

24 samples came from the EU

Pesticide residues detected from those sought

15 samples contained no residues from those sought

9 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

1 sample contained residues of more than one pesticide

- 1 sample contained 2 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in kiwi fruit.

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately.

Lamb

Summary of results

In a survey of 12 samples of lamb collected between January and March 2020, 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 lamb samples were bought by a market research company from retail outlets across the UK and lamb will be surveyed in all quarters of 2020.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

12 samples were tested for up to 38 pesticide residues

Lamb

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

The country of origin of samples may not be the same as the country where the lamb was produced. It may be where the lamb was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

11 samples contained no residues from those sought

1 sample contained a residue above the reporting level

None of the samples contained residues above the MRL

1 sample was labelled as organic. It did not contain residues from those sought

Multiple residues

No samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected no residues above the MRL in lamb

Risk assessments

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

Lettuce

Summary of results

In a survey of 36 samples of lettuce collected in January and March 2020, 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 lettuce 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 Pesticide Residues in Food Quarterly Data

Samples tested

36 samples were tested for up to 366 pesticide residues

Iceberg

- 15 samples came from the EU

Little Gem

- 12 samples came from the EU

Romaine

- 5 samples came from the EU

Round

- 4 samples came from the UK

Pesticide residues detected from those sought

14 samples contained no residues from those sought

22 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

- 9 samples contained 2 residues

- 3 samples contained 3 residues
- 1 sample contained 4 residues
- 1 sample contained 5 residues
- 1 sample contained 6 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in lettuce

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Liver

Summary of results

In a survey of 22 samples of liver collected between January and March 2020, two 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.

BAC

Two samples of ox liver contained a residue of BAC above the MRL. This substance is widely used as a biocide (disinfectant) during food preparation and processing. This the most likely source of the residue. Bovine would not be likely to be exposed to these substances in their environment or in their feed.

Survey design

This year liver is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The liver 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 Pesticide Residues in Food Quarterly Data

Samples tested

22 samples were tested for up to 109 pesticide residues

Calf

- 1 sample came from the UK

Cattle/Cow

- 1 sample came from the EU

Lamb

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

Ox

- 9 samples came from the UK

Pig

- 1 sample came from the UK

The country of origin of samples may not be the same as the country where the liver was produced. It may be where the liver was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

18 samples contained no residues from those sought

4 samples contained residues above the reporting level

2 samples contained residues above the MRL

None of the samples were labelled as organic.

Multiple residues

No samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected 2 residues above the MRL in liver (ox)

- 1 sample from UK contained a residue of BAC (sum) at 0.3 mg/kg. The MRL is 0.1mg/kg.
- 1 sample from UK contained a residue of BAC (sum) at 0.4 mg/kg. The MRL is 0.1mg/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 response received are in Section 2.

Mango

Summary of results

In a survey of 24 samples of mango collected between January and March 2020, 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

The assessments for mango consider both consuming with peel and without peel (flesh only).

HSE's detailed risk assessment indicate that at the highest level of prochloraz found of 1.8 mg/kg consumption of peeled fruit by 4-6 years old children could lead to a small exceedance of the acute reference dose (ARfD) though an effect on health is unlikely.

If it is anticipated that the fruit is not peeled several of the consumer groups could exceed the ARfD, with 4-6 year old having the highest intake which could be 467% of the ARfD. At this level some people might experience minor gastrointestinal disturbance of a short term and reversible nature.

We understand that the MRL for prochloraz will be reduced to 0.03 mg/kg from the 4 September 2020, which means that fruit containing the levels which could pose a risk can no longer be legally traded. We note that mango is due to be surveyed later in the year (July to September) and will be able to check compliance.

Survey design

The mango samples were bought by a market research company from retail outlets across the UK and mango will be surveyed in all quarters of 2020.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 371 pesticide residues

Fresh

- 22 samples were imported from outside the EU

Frozen

- 2 samples came from the UK

The country of origin of samples may not be the same as the country where the mango was produced. It may be where the mango was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

6 samples contained no residues from those sought

18 samples contained residues above the reporting level

None of the samples contained residues above the MRL

1 sample was labelled as organic. It did not contain residues from those sought

Multiple residues

8 samples contained residues of more than one pesticide

- 8 samples contained 2 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in mango

Risk assessments

Five samples of mango contained a residue of prochloraz at levels where the effect on health needed to be considered in more detail. The highest level detected was 1.8 mg/kg

The EU MRL assessment assumes that mangoes are peeled before consumption, and if the peel is not consumed, then 22% of the residue remains and an effect on health is unlikely.

However, assuming that consumers eat all of the peel then several of the consumer groups could exceed the ARfD, with 4-6 year old children having the highest intake which could be 467% of the ARfD. At this level some might experience gastrointestinal disturbance (salivation, soft faeces, vomiting) after eating large portions (97.5th percentile consumption) of mango containing the highest levels found in this report. Such effects would be expected to be minor, short-lived, and reversible. The full risk assessment is available at page 74.

The vast majority of the residue was determined as parent prochloraz 1.6 mg/kg (the remainder, 0.2 mg/kg as two metabolites of prochloraz), suggesting that the residue was likely present arising from post-harvest treatment and might predominate in the peel. Removing the peel before consumption would lead to a reduction in the pesticide intake, and on basis of consumption of peeled fruit we conclude that an effect on health is unlikely.

Combined risk assessments

Some samples contained residues of more than one pesticide. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Milk

Summary of results

In a survey of 84 samples of milk collected in January and March 2020, none of the samples contained a pesticide residue. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No pesticide residues detected.

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 Pesticide Residues in Food Quarterly Data

Samples tested

84 samples were tested for up to 108 pesticide residues

Cows milk

- 82 samples came from the UK

Goats milk

- 2 samples came from the UK

Pesticide residues detected from those sought

84 samples contained no residues from those sought

None of the samples contained residues above the reporting level

25 samples were labelled as organic. None contained residues from those sought.

Risk assessments

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

Okra

Summary of results

In a survey of 24 samples of okra collected between January and March 2020, five 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

Monocrotophos

One sample contained a residue of monocrotophos at 0.009 mg/kg. The MRL is 0.01 mg/kg.

Monocrotophos is an insecticide that has not been authorised for use in the EU since 2003; the toxicological data package for monocrotophos is old, and HSE has used the JMPR assessment of these data. At this level of 0.009 mg/kg the intake is below the ADI and the ARfD. Nevertheless, because of uncertainty about the potential for genetic damage (genotoxicity) at low doses, on a precautionary basis any findings of monocrotophos in food are not desirable

Due to concerns about potential toxicological issues, for 2020 onwards, we have reduced the reporting level for monocrotophos. We wish to determine how prevalent it is in food. A more detailed explanation is with the risk assessments on page 70.

Survey design

This year okra is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme and will be surveyed in each quarter of 2020 as part of the rolling reporting.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 366 pesticide residues

Fresh

- 21 samples were imported from outside the EU

Frozen

- 3 samples were imported from outside the EU

The country of origin of samples may not be the same as the country where the okra was produced. It may be where the okra was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

14 samples contained no residues from those sought

10 samples contained residues above the reporting level

5 samples contained residues above the MRL

None of the samples were labelled as organic

Multiple residues

7 samples contained residues of more than one pesticide

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

Residues measured above the MRL

The laboratory detected 5 residues above the MRL in fresh okra

- 1 sample from India contained a residue of tebuconazole at 0.03 mg/kg. The MRL is 0.02* mg/kg

- 1 sample from Thailand contained a residue of
    - acephate at 1.5mg/kg. The MRL is 0.01 mg/kg
    - methamidophos at 0.1mg/kg. The MRL is 0.01 mg/kg

- 1 sample from Honduras contained a residue of tebuconazole at 0.07 mg/kg. The MRL is 0.02mg/kg

- 1 sample from Honduras contained a residue of flubendiamide at 0.03kg/mg. The MRL is 0.01 mg/kg

- 1 sample from India contained a residue of flonicamid (sum) 0.4mg/kg. The MRL is 0.03mg/kg

Risk assessments

One sample of contained a residue of monocrotophos.

Monocrotophos is an insecticide that has not been authorised for use in the EU since 2003; the toxicological data package for monocrotophos is old, and HSE has used the JMPR assessment of these data. At this level of 0.009 mg/kg the intake is below the ADI

* **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.

and the ARfD. Nevertheless, because of uncertainty about the potential for genetic damage (genotoxicity) at low doses, on a precautionary basis any findings of monocrotophos in food are not desirable. Therefore, for 2020 onwards we have reduced the reporting level for this active as we wish to determine how prevalent it is in food. A more detailed explanation is with the risk assessments on page 70.

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 response received are in Section 2.

Onions

Summary of results

In a survey of 24 samples of onion collected between January and March 2020, 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

This year onions are being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 365 pesticide residues

Fresh

- 17 samples came from the UK
- 7 samples came from the EU

Pesticide residues detected from those sought

14 samples contained no residues from those sought

10 samples contained residues above the reporting level

None of the samples contained residues above the MRL

8 samples were labelled as organic. None contained residues from those sought

Multiple residues

2 samples contained residues of more than one pesticide

- 2 samples contained 2 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in onions

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Oranges

Summary of results

In a survey of 17 samples of oranges collected between January and March 2020, 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 of orange contained residues where a detailed risk assessment was undertaken assuming a situation where the peel was not eaten (the basis of EU MRL assessment) and where it was eaten (a more precautionary assessment). Based on the Health and Safety Executive's risk assessment of the residues detected we consider that an effect on health is not expected if the peel is not consumed.

In the event that all of the peel is eaten when consuming large portions (97.5th percentile consumption) of oranges, the assessments are more precautionary. On this basis, we conclude for the highest residue levels of thiabendazole and imazalil found in this report, that an effect on health would be unlikely. For chlorpyrifos, we do not anticipate an effect on health following assessment where HSE has used an ARfD set by the JMPR using valid human toxicology data.

Residues were also found of a pesticide which indicates the presence of either lambda-cyhalothrin or gamma-cyhalothrin. These residues are indistinguishable by conventional analysis and in the past have been assessed for risk on the basis that the pesticide residue arose from lambda-cyhalothrin. Recently a lower acute reference dose has been established for gamma-cyhalothrin so on a precautionary basis when assessing consumer risk HSE have assumed that the residues are the more toxic form. At a residue of 0.05 mg/kg, assumed to be gamma-cyhalothrin, we consider that some people might experience transient mild muscle tremors after eating or drinking large portions (97.5th percentile consumption) of whole oranges, including all of the peel, 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 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, and an effect on health is not expected.

Survey design

This year oranges are being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

17 samples were tested for up to 368 pesticide residues

5 samples were imported from outside the EU

12 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

17 samples contained residues of more than one pesticide

- 2 samples contained 2 residues
- 7 samples contained 3 residues
- 5 samples contained 4 residues
- 1 sample contained 5 residues
- 1 sample contained 7 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in oranges

Risk assessments

Some samples of orange contained a residue of pesticides at levels where the effect on health needed to be considered in more detail. HSE always undertake assessments that consider both when the peel is not eaten, as per the EU MRL assessment, and one where it is assumed that the peel is eaten. These assessments are detailed on page 7575 and should be consulted for the full assessment of risk.

Chlorpyrifos

One sample of orange 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 0.05 mg/kg. HSE's risk assessment concluded that in the event that all the peel is consumed at the time of eating/drinking the oranges, an effect on health would not be expected where HSE has used an ARfD set by the JMPR using valid human toxicology data. The full risk assessment is available at page 75.

Imazalil

12 samples of oranges contained a residue of imazalil at levels where the effect on health needed to be considered in more detail (residues between 0.8 mg/kg and 3.0 mg/kg). If all the peel is consumed then HSE's assessment of risks concludes that an effect on health is unlikely. This takes into account the protective nature of the two different ARfD values used in the assessment, one for the general population and one for pregnant and nursing

females. The reasons for this are explained in the full risk assessment at page 75. However, if the peel is not consumed then only 7% of the residue remains and based on this lower intake an effect on health is not expected.

Thiabendazole

One sample of oranges contained a residue of thiabendazole at a level of 0.9 mg/kg where the effect on health needed to be considered in more detail. If all the peel is consumed then HSE's assessment of risks concludes that an effect on health is unlikely. However, if the peel is not consumed then only 2% of the residue remains and based on this lower intake an effect on health is not expected.

Lambda cyhalothrin, Gamma cyhalothrin

One sample of oranges contained a residue of lambda-cyhalothrin at a level of 0.05 mg/kg where the effect on health needed to be considered in more detail.

Residues of lambda-cyhalothrin are indistinguishable analytically from gamma-cyhalothrin, and the residue could have arisen from application of either gamma-cyhalothrin or lambda-cyhalothrin. As a worst case, it is assumed that the residues in the sample are possibly derived from application of gamma-cyhalothrin to the crop, and therefore this assessment has used the specific ARfD for gamma-cyhalothrin (which is two-fold lower than that for lambda-cyhalothrin). However it is recognised that the residue could have arisen from the different isomeric form (lambda-cyhalothrin) with is less toxic than gamma-cyhalothrin.

If all the peel was consumed then HSE's assessment of risk concludes that some people might experience mild transient muscle tremors after eating or drinking large portions (97.5th percentile) of whole oranges, including all of the peel, 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 6% of the residue remains and based on this lower intake an effect on health is not expected. Full risk assessment is available at page 75.

Combined risk assessments

Some samples contained residues of more than one pesticide. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately.

Pate (Fish)

Summary of results

In a survey of 24 samples of pate (fish) collected between January and March 2020, none of the samples contained a pesticide residue above the MRL. There are no MRLs for fish. These products also contain other spreads (vegetable or dairy based) 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.

BAC

Three samples contained a residue of BAC. This substance is widely used as a biocide (disinfectant) during food preparation and processing. We think that is where the residue was introduced. Fish would not be likely to be exposed to these substances in their environment or in their feed.

Survey design

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

Pate (fish) will be surveyed again in Quarter 4 of 2020.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 38 pesticide residues

Crab

- 2 samples came from the UK

Haddock

- 1 sample came from the UK

Mackerel

- 1 sample came from the UK

Salmon

- 17 samples came from the UK

Tuna

- 3 samples came from the UK

The country of origin of samples may not be the same as the country where the pate (fish) was produced. It may be where the pate (fish) was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

21 samples contained no residues from those sought

3 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

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.

Pears

Summary of results

In a survey of 30 samples of pears collected between January and March 2020, 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

This year pears are being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

30 samples were tested for up to 371 pesticide residues

3 samples came from the UK

3 samples were imported from outside the EU

24 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

25 samples contained residues of more than one pesticide

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

- 1 sample contained 6 residues
- 1 sample contained 7 residues

Residues measured above the MRL

The laboratory detected no residues above the MRL in pears

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. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Peas without pods

Summary of results

In a survey of 30 peas without pods collected between January and March 2020, 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

Peas without edible pods will be surveyed in quarter 1 and quarter 3 of 2020.

Full sample details, including brand name information, pesticides sought and residues found are available in an accessible format at Pesticide Residues in Food Quarterly Data

Samples tested

30 samples were tested for up to 365 pesticide residues. Chlorate was not sought in this survey.

Fresh

- 5 samples were imported from outside the EU

Frozen

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

The country of origin of samples may not be the same as the country where the peas without pods were produced. It may be where the peas without pods were processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

21 samples contained no residues from those sought

9 samples contained residues above the reporting level

None of the samples contained residues above the MRL

1 sample was labelled as organic. It did not contain residues from those sought

Note chlorate was not tested for in this survey.

Multiple residues

No samples contained residues of more than one pesticide

Residues measured above the MRL

The laboratory detected no residues above the MRL in peas without pods

Risk assessments

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

Potatoes

Summary of results

In a survey of 31 samples of potatoes collected between January and March 2020, one 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

A detailed risk assessment was conducted for one potato sample containing a residue of chlorpropham of 13 mg/kg. This is above the MRL of 10 mg/kg but not identified as a breach of the MRL after taking into account measurement uncertainty. We consider that some people might experience nausea after eating large portions of unpeeled potato (for instance, as a jacket potato) 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 short-lived and reversible. This assumes that potatoes are eaten unpeeled (for example as jacket potato); much of the residue is expected to be associated with the peel.

We are aware that chlorpropham has not been renewed for use in the EU. No changes have yet been made to MRLs: We understand that the consideration of future MRLs is now underway and will specifically include residues in potatoes incurred from contamination from potato storage facilities rather than use. We are keeping up to date on the situation and any implications for the monitoring programme including the assessment of risks to consumers.

Survey design

This year potatoes are being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

Potato surveys are reported more regularly throughout the year as part of rolling reporting and will be surveyed in all quarterly reports of 2020

The samples were collected by either Animal and Plant Health 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 Pesticide Residues in Food Quarterly Data

Samples tested

32 samples were tested for up to 370 pesticide residues

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

Pesticide residues detected from those sought

8 samples contained no residues from those sought

24 samples contained residues above the reporting level

1 sample contained a residue above the MRL

None of the samples were labelled as organic.

Multiple residues

10 samples contained residues of more than one pesticide

- 9 samples contained 2 residues

Residues measured above the MRL

The laboratory detected 1 residue above the MRL in potatoes

- 1 sample from UK contained a residue of chlorpropham at 13 mg/kg. The MRL is 10* mg/kg.

Risk assessments

One sample of potatoes contained a residue of chlorpropham at levels where the effect on health needed to be considered in more detail. The highest level detected was 13 mg/kg.

The highest calculated intake of chlorpropham from unpeeled potatoes is 276% of the ARfD. We consider the likelihood of an effect on health to be low, because this intake is 36 times lower than a single dose which caused no observed adverse effect in an animal study.

The risk assessment concluded that based on this highest calculated intake some people might experience nausea after eating large portions (97.5th percentile consumption) of potato containing the highest levels found in this report. Such effects would be expected to be short-lived and reversible. We consider the likelihood of an effect on health to be low; the reasons for this are explained in the full risk assessment on page 80.

This estimate assumes that potatoes are eaten unpeeled (for example as jacket potato); much of the residue is expected to be associated with the peel.

Combined risk assessments

Some samples contained residues of more than one pesticide. We do not expect these residues to have an effect on health, either separately or in combination. The pesticide residues found in each sample do not include more than one of the pesticides from the groups that the Health and Safety Executive (HSE) consider separately

Follow up actions

Letters sent

The secretariat has written to the suppliers of the samples with residues above the MRL. Any response 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.

Poultry meat

Summary of results

In a survey of 24 samples of poultry meat collected in between January and March 2020, none of the samples contained a pesticide residue. These results were reviewed by the Expert Committee on Pesticide Residues in Food (PRiF).

Comments by the PRiF

No pesticide residues were detected.

Survey design

This year poultry meat is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The 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 Pesticide Residues in Food Quarterly Data

Samples tested

24 samples were tested for up to 109 pesticide residues

Chicken

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

Turkey

- 4 samples came from the UK

The country of origin of samples may not be the same as the country where the poultry meat was produced. It may be where the poultry meat was processed, where it was packed for consumer purchase or the address of the brand owner.

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 were labelled as organic.

Risk assessments

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

Rice

Summary of results

In a survey of 42 samples of rice collected between January and March 2020, four 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. We have included HSE's consideration of the risk from tricyclazole as a formal risk assessment is not possible due to the absence of toxicological reference values.

In 2019 we undertook a small survey of rice to determine whether rice now imported to the UK meets the recent change to the MRL for tricyclazole. The MRL for tricyclazole was reduced during 2017, to 0.01 mg/kg, in June 2017 for non- Basmati rice and in December 2017, for Basmati rice. Rice that was imported into the UK before that date can be legally traded at the higher rate.

Correspondence with the rice trade indicates that rice, that has been grown prior to and during 2017 is still in the UK supply chain.

We have asked HSE to consider whether this is expected and whether further follow up with the industry is required.

Survey design

This year rice is being surveyed across the EU as part of the EU Co-ordinated Multi Annual Control Programme.

The 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 Pesticide Residues in Food Quarterly Data

Samples tested

42 samples were tested for up to 371 pesticide residues

Basmati

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

Brown

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

Other

- 8 samples came from the EU

White

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

The country of origin of samples may not be the same as the country where the rice was produced. It may be where the rice was processed, where it was packed for consumer purchase or the address of the brand owner.

Pesticide residues detected from those sought

27 samples contained no residues from those sought

15 samples contained residues above the reporting level

4 samples contained residues above the MRL

4 samples were labelled as organic. None contained residues from those sought

Multiple residues

8 samples contained residues of more than one pesticide

- 1 sample contained 2 residues
- 1 sample contained 3 residues
- 1 sample contained 4 residues
- 2 samples contained 6 residues
- 3 samples contained 7 residues

Residues measured above the MRL

The laboratory detected 4 residues above the MRL in Basmati rice

- 1 sample from UK contained residues of
  - buprofezin at 0.03 mg/kg. The MRL is 0.01* mg/kg.
  - tricyclazole at 0.02 mg/kg. The MRL is 0.01 mg/kg

- 1 sample from UK contained residues of
  - buprofezin at 0.02 mg/kg. The MRL is 0.01 mg/kg
  - tricyclazole at 0.02 mg/kg. The MRL is 0.01 mg/kg

- 1 sample from UK contained a residue of thiamethoxam at 0.07mg/kg. The MRL is 0.01 mg/kg

- 1 sample from UK contained residues of
  - buprofezin at 0.04 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.

- tricyclazole at 0.02 mg/kg. The MRL is 0.01 mg/kg

Risk assessments.

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

A formal risk assessment of the three residues of tricyclazole is not possible as toxicological reference values have not been established in the EU or by other international bodies (JMPR or regulatory authorities). However, HSE have taken into account an assessment performed by EFSA (EFSA Conclusion, 2015) prior to the non-renewal of tricyclazole in the EU (2016). Full details are with the detailed risk assessment on page 82.

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 response received are in Section 2.

Section 2: Sample details and supplier responses

Sample details

The sample details are published on Pesticide Residues in Food Quarterly Data 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.

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.

Supplier responses

Liver samples 1092/2020 and 3648/2020: Response from Asda

Firstly, thank you for your letter dated 10th June 2020 in which you detail the results of sampling Asda ox liver purchased on the 2nd February and 16th March (sample IDs 1092/ 2020 and 3648/ 2020) namely being in excess of Benzalkonium Chloride (BAC) Maximum Residue Level. We have completed a thorough investigation into this matter and please be reassured we take any non-compliances very seriously.

All our fresh offal is supplied by Hilton Meat Products (Unit 21, Kilroot Park, Carrickfegus, BT38 7PR). This site is accredited to the BRC unannounced standard and currently hold the A* grading. Their most recent audit report conducted on the 5th March 2020 does not list any non-conformances or actions associated with chemical agents in the production area.

We have worked closely with Hilton Meats who have reviewed their cleaning/ rinsing schedules and chemical usage and after consultation with the local regulatory authorities, who are satisfied they remain compliant. Hilton Meats are now a BAC-free site having replaced the only source of BAC detergent and as a precaution have now committed to completing weekly BAC residue testing for a minimum of 6 weeks.

In summary, Hilton Meats have two suppliers of raw material ox liver (Dunbia and Linden Foods both situated in Dungannon) who have themselves completed investigations into this exceedance state they do not use BAC on their sites but nevertheless have re-verified their cleaning and rinsing schedules and are confident they remain compliant.

We continue to work closely with Hilton Meats to understand and manage any potential source of BAC and to ensure we do not have a reoccurrence of this non-compliance. I would also like to reiterate we take all non-compliances very seriously and we work closely with our suppliers to ensure that as a responsible retailer we maintain compliant with all relevant legislation.

Pate (fish) sample 3002/2020: Response from John Ross Jr (Aberdeen) Ltd

We have reviewed the chemical we are currently using which is supplied by an approved chemical supplier, and we have identified the chemical which contains BAC.

We do rinse down the factory after cleaning and sanitisation. Our thinking is that perhaps some BAC chemical residue had been left in the mixing bowl used for pate production.

We are now rinsing this machine further making sure that it is 100% dry before use.

We will continue to monitor this, and will look at testing through our UKAS approved accredited laboratory in the future.

Rice sample 3200/2020: Response from Veetee

In spite of having a rigorous due diligence process to screen MRL levels in rice, it appears, certain parcels escaped such tests. Veetee is further strengthening their process.

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: The HSE Pesticide Website then search for Consumer Exposure. Here you will find information and further links.

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 supplied by the registrants in the regulatory data packages 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 that we refer to and use in the HSE risk assessments 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.

It is not expected that consumers will always eat peel, and further data are being generated to better understand the circumstances, to include frequency and amounts, when peel is consumed.

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. The dithiocarbamate risk assessments used to consider ziram as worst case, whereas following the update to the ARfD for thiram in late 2018, the assessment now considers thiram as worst case.

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. If more than one triazole, or more than one organophosphate/carbamate is found or the following combinations captan/folpet, BAC/DDAC, chlormequat/mepiquat, 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” was published in 2002. Foods Standards Agency Risk Assessment of Mixtures of Pesticides

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. Further information is available on: The HSE Pesticide Website. Search for the Data Requirements Introduction and Index and follow the links.

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 EFSA Scientific Colloquium N°7: Cumulative Risk Assessment of Pesticides to Human Health: the Way forward 2006

EFSA's The EFSA's 7th Scientific Colloquium Report - Cumulative Risk Assessment of pesticides to human health: The Way forward 2008;

EFSA Opinion of the Scientific Panel on Plant Protection products and their Residues;

EFSA Scientific Opinion on Risk Assessment for a Selected Group of Pesticides from the Triazole Group).

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 EU Pesticides database

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 The HSE Pesticide Website then search for Consumer Exposure. Here you will find information and further links.

For the Q1 (2020) 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 avocado were used despite a low number of consumers in several of the sub-groups. However, use of these consumption data was considered reasonable after comparison with alternative data.
- Data on beans with pods were used for okra and all forms of green beans, including speciality beans.
- Data on mango were used despite a low number of consumers in several of the sub-groups. However, use of these consumption data was considered reasonable after comparison with alternative data.
- Data on meat excluding poultry and offal data were used for lamb.
- Data on liver available for all forms of liver were used.
- Data on fish were used for all forms of oily fish and fish pate.

Monocrotophos in beans and okra

Monocrotophos was found in beans with pods (guar beans) and okra. Authorisations 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. The highest residue of 0.009 mg/kg gives a highest estimated short term intake of 0.000045 mg/kg bw/day for infants. 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.

Quarter 1 2020 Short-term risk assessments

Avocado

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Avocado	Prochloraz	1.4	0.023	0.042 (infant) 0.041 (toddler) 0.035 (4-6 year old child) 0.031 (vegetarian)	0.025	EFSA, 2011

Comment on risk assessment

Avocado flesh after peeling

The EU MRL risk assessment assumes that avocado are peeled before consumption. After peeling only 8% of the residue remains (JMPR, 2004), the highest intake is 0.0034 mg/kg bw/d, and there are no exceedances of the ARfD.

However, assuming that consumers eat all the peel, intakes for infants, toddlers, 4-6 year old children and vegetarian exceeded the ARfD. The highest intake was for infants.

Whole avocado, including all the peel

If infants ate large portions of avocado containing prochloraz at 1.4 mg/kg, their intake of prochloraz could be 169% of the Acute Reference Dose. This intake is 60 times lower than a dose which caused no observed adverse effect in a 90-day dog study, a multigeneration rat study and 14-day dog study. The European Food Safety Authority used these studies 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 60 still enough to make an effect on health unlikely.

This estimate assumes that peel of avocado 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.

Beans with pods

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group[†]		
Beans with pods (Guar beans)	Dimethoate and Omethoate	0.01 (D: dimethoate) and 0.04 (O: omethoate)	D: 0.000023	D: 0.000050 (infant) 0.000050 (toddler) 0.000037 (4-6 year old child) 0.000028 (vegetarian) 0.000027 (15-18 year old child) 0.000023 (adult) 0.000022 (elderly own home) 0.000020 (7-10 year old child) 0.000020 (11-14 year old child) 0.000011 (elderly residential home)	Not established	EU, 2019
			O: 0.000092	O: 0.00020 (infant) 0.00020 (toddler) 0.00015 (4-6 year old child) 0.00011 (vegetarian) 0.00011 (15-18 year old child) 0.000092 (adult) 0.000087 (elderly own home) 0.000081 (7-10 year old child) 0.000078 (11-14 year old child) 0.000044 (elderly residential home)	Not established	EFSA, 2018 and EU, 2019 (dimethoate)

Comment on risk assessment

The EFSA Conclusion (2018) for dimethoate has indicated that no toxicological reference values could be determined for

dimethoate and omethoate, due to a lack of a fully supporting toxicological database. Omethoate is not approved in the EU and dimethoate has been recommended for non-renewal of approval in the EU, (EU, 2019), and pesticide products containing dimethoate are currently subject to withdrawal from the marketplace.

Short term effects: For dimethoate, EFSA (2018) stated an indicative value for a hypothetical toxicological reference value for short term exposure of 0.0001 mg/kg bw/day. Using this indicative value, all the estimated dietary intakes of dimethoate for all the consumer subgroups do not exceed this reference value. However, the estimated dietary intakes of omethoate for infants, toddlers, 4-6 year old children, vegetarians, and 15 to 18 year old children exceeds this indicative reference value. The highest intake was for infants and toddlers.

If infants and toddlers ate large portions of Guar beans (beans with pods) containing omethoate at 0.04 mg/kg their intake could be 200 % of the above mentioned hypothetical toxicological reference value for short term exposure. This indicative toxicological reference value is a precautionary value intended to protect the nervous system in the developing foetus and child, which has been set well below intakes which caused no observed effects in animal studies. The JMPR (September 2019) established an ARfD for dimethoate of 0.02 mg/kg bw; this supports the view that the proposed hypothetical reference value from the EFSA Conclusion is precautionary. These exposures are undesirable but it is not clear from the underlying toxicological data if they may cause any adverse effect. The estimated exposures are not expected to inhibit acetylcholinesterase[7], the basis of previous evaluations of the safety of dimethoate and omethoate.

Long term effects: It is unclear whether dimethoate can damage genetic material in people (is genotoxic), however this is unlikely at the exposure levels estimated in this assessment. There is some evidence that omethoate is genotoxic, and the follow up studies that may clarify this have not been performed. There is some reassurance that risks of developing ill health effects over the long term following single and even repeat exposures are likely to be low, since omethoate did not cause cancer in studies with repeat daily doses in rats and mice over their life-span. The doses used in both the genotoxicity tests and the cancer studies were orders of magnitude higher than the exposures estimated in this assessment. Nevertheless, because of the uncertainty, on a precautionary basis any findings of dimethoate and omethoate in food are not desirable.

Overall, although on a precautionary basis any findings of dimethoate and omethoate are not desirable, we conclude that any risks of an effect on health are unlikely after eating large portions (97.5th percentile consumption) of Guar beans (beans with pods) containing the levels found in this report.

[7] this enzyme, acetylcholinesterase, is included in the Glossary on page 101

Mango

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Mangoes	Prochloraz	1.8	0.035	0.12 (4-6 year old child) 0.099 (toddler) 0.086 (7-10 year old child) 0.049 (15-18 year old child) 0.039 (vegetarian) 0.035 (adult) 0.029 (11-14 year old child)	0.025	EFSA, 2011

Comment on risk assessment.

Mango flesh after peeling

EU MRL risk assessment usually assumes that mangoes are peeled before consumption. After peeling, 22% of the residue remains (JMPR, 2004), and the intake for 4-6 year old children of 0.026 mg/kg bw/day exceeds the ARfD.

If a 4-6 year old child ate or drank large portions of peeled mango (containing prochloraz at 0.396 mg/kg [22% of 1.8 mg/kg]) their intake of prochloraz could be 103% of the Acute Reference. This intake is 96 times lower than a dose which caused no observed adverse effects in a 90-day dog study, a multigeneration rat study and 14-day dog study. The European Food Safety Authority used these studies 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 96 still enough to make an effect on health unlikely.

However, assuming that consumers eat all the peel, intakes for 4-6 year old children, toddlers, 7-10 year old children, 15-18 year old children, vegetarian, adults and 11-14 year old children exceeded the ARfD. The highest intake was for 4-6 year old children.

Whole mango, including all of the peel

If a 4-6 year old child ate large portions of mangoes containing prochloraz at 1.8 mg/kg, their intake of prochloraz could be 467% of the Acute Reference Dose. This intake is 21 times lower than a dose which caused no observed adverse effect in a 90-day

dog study, a multigeneration rat study and 14-day 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. We consider this significant reduction in the factor of 100 to a level of 21 undesirable.

In conclusion, we consider that some people might experience gastrointestinal disturbance (salivation, soft faeces, vomiting) after eating large portions (97.5th percentile consumption) of mango containing the highest levels found in this report. Such effects would be expected to be minor, short-lived, and reversible.

In this case, the vast majority of the residue was determined as parent prochloraz 1.6 mg/kg (the remainder, 0.2 mg/kg as two metabolites of prochloraz), suggesting that the residue was likely present arising from post-harvest treatment and might predominate in the peel. Removing the peel before consumption would lead to a reduction in the pesticide intake (refer to above assessment for consideration of mango flesh after peeling).

Oranges

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Oranges	Chlorpyrifos	0.05	0.0011	0.0066 (infant)	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

Orange flesh after peeling

EU MRL risk assessment usually assumes that oranges are peeled before consumption. After peeling only 2% of the residue remains (EFSA, 2017), the highest intake is below 0.005 mg/kg bw/d, and there are no exceedances of the ARfD.

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

Whole orange, including all the peel

If infants ate or drank large portions of orange containing chlorpyrifos at 0.05 mg/kg, their intake of chlorpyrifos could be 133% of the EU Acute Reference Dose. This intake is 76 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 76 still enough to make an effect on health unlikely.

Furthermore, HSE consider that the EU ARfD was derived using a particularly sensitive 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.

Assessment B with reference to the ARfD set by the JMPR

If infants ate or drank large portions of orange, including all of the peel, containing chlorpyrifos at 0.05 mg/kg, their intake of chlorpyrifos could be 133% of the Acute Reference Dose. However, the EU ARfD was set without taking into account scientifically valid data from studies using human volunteers. 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. This value 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.

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Oranges	Imazalil	3.0	0.068	0.40 (infants) 0.30 (toddlers) 0.22 (4-6 year olds) 0.15 (7-10 year olds) 0.11 (11-14 year olds) 0.092 (15-18 year olds) 0.077 (vegetarians) 0.068 (adults)	General population 0.1 Pregnant and nursing females	EFSA, 2007

					0.05	

Comment on risk assessment

Orange flesh after peeling

The EU MRL risk assessment assumes that oranges 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, toddlers, 4-6 year old children, 7-10 year old children and 11-14 year old children exceed the acute reference dose of 0.1 mg/kg bw/day (for the general population excluding pregnant and nursing females). In consumer groups aged over 11 years intakes for all groups exceed the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing females) with 11-14 years old being the critical consumer.

Whole orange, including all the peel

Pregnant and nursing women

The intakes for 11-14 year old children, 15-18 year old children, vegetarians and adults exceed the acute reference dose of 0.05 mg/kg bw/day (for pregnant and nursing females. The highest intake was for 11-14 year old children.

If 11-14 year olds ate or drank large portions of orange containing imazalil at 3.0 mg/kg their intake could be 218% of the Acute Reference Dose of 0.05 mg/kg bw/d. This intake is 46 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. The remaining margin of 46 is considered to still be sufficient to account for the uncertainties associated with the use of animal data and possible differences in susceptibility between people. It is not possible because of the way data were reported, to attribute effects at higher doses to single or multiple treatments. Therefore, the ARfD is suitably protective when considering single day exposures and might be overprotective. Based on this assessment an effect on health is unlikely.

General population

The intakes for infants, toddlers, 4-6 year old children, 7-10 year old children and 11-14 year old children exceed the ARfD of 0.1 mg/kg bw/d for the general population. The highest intake was for infants.

The intake of the critical group (infants) is 25 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. We consider this significant reduction in the factor of 100 to a level of 25 undesirable. However, the remaining margin is considered to still be sufficient to allow for the uncertainties associated with the use of 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) is likely to be very protective for the general population. Based on this assessment an effect on health is unlikely.

Conclusion

In conclusion, we consider that an effect on health is 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†		
Oranges	Lambda-cyhalothrin or gamma-cyhalothrin	0.05	0.0011	0.0066 (infants) 0.0050 (toddlers) 0.0036 (4-6 year old child)	0.0025 (ARfD for gamma-cyhalothrin).	EU, 2014

Comment on risk assessment

Residues of lambda-cyhalothrin are indistinguishable analytically from gamma-cyhalothrin, and the residue could have arisen from application of either gamma-cyhalothrin or lambda-cyhalothrin. As a worst case, it is assumed that the residues in the sample are possibly derived from application of gamma-cyhalothrin to the crop, and therefore this assessment has used the specific ARfD for gamma-cyhalothrin (which is two-fold lower than that for lambda-cyhalothrin). However, it is recognised that the

residue could have arisen from the different isomeric form (lambda-cyhalothrin) with is less toxic than gamma-cyhalothrin.

Orange flesh after peeling

The EU MRL risk assessment assumes that oranges are peeled before consumption. After peeling 6% of the residue remains (EFSA, 2015), the highest intake is below 0.0025 mg/kg bw/d, and there are no exceedances of the ARfD.

However, assuming that consumers eat all the peel, intakes for infants, toddlers and 4-6 year old children exceed the acute reference dose of 0.0025 mg/kg bw/day. The highest intake was for infants.

Whole orange, including all the peel

If infants ate/drank large portions of oranges containing gamma-cyhalothrin at 0.05 mg/kg, their intake could be 265% of the Acute Reference Dose of 0.0025 mg/kg bw/d for gamma-cyhalothrin. This intake is 76 times lower than a dose which caused no observed adverse effects in a 1-year oral toxicity study in dogs with lambda-cyhalothrin. The European Food Safety Authority used this study as the basis of the ARfDs that were set for gamma- cyhalothrin and lambda-cyhalothrin.

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. However, the factor used for gamma-cyhalothrin was two-fold greater (200) to reflect the greater toxicity of gamma-cyhalothin compared to lambda-cyhalothrin. We consider the likelihood of an effect on health to be low, given the remaining factor of 76 (from 200). This is because an adverse effect on health would rely on

1) the residue having arisen from treatment of the crop with gamma-cyhalothrin rather than lambda-cyhalothrin
2) a susceptible individual eating and/or drinking 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
3) the actual difference in susceptibility between that individual and dogs, being higher than the factor we are left with in this situation; and
4) 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 transient mild muscle tremors after eating/ drinking large portions (97.5^{th} percentile consumption) of whole oranges, including all of the peel, containing the highest levels found in this report if it is assumed that the residue is from use of gamma-cyhalothrin, 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 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 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†		
Oranges	Thiabendazole	0.9	0.020	0.12 (infant)	0.1	EU, 2017

Comment on risk assessment

Orange flesh after peeling

The EU MRL risk assessment assumes that oranges 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 ARfD.

However, assuming that consumers eat all the peel, intakes for infants exceed the acute reference dose of 0.1 mg/kg bw/day.

Whole orange, including all the peel

If infants ate or drank large portions of orange containing thiabendazole at 0.9 mg/kg, their intake of thiabendazole could be 119% of the EU Acute Reference Dose. This intake is 83 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 uncertainties caused by using animal data and possible differences in susceptibility between people. We consider the reduced factor of 83 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 the ARfD and an effect on health is not expected.

Potatoes

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Potatoes	Chlorpropham	13	0.31	2.0 (infant) 1.4 (toddler) 1.0 (4-6 year old child)	0.5	EU, 2019

				0.72 (7-10 year old child) 0.51 (11-14 year old child)		

Comment on risk assessment

The intakes for infants, toddlers, 4-6 year old, 7-10 year old and 11-14 year old children exceeded the ARfD. The highest intake was for infants.

Assessment for infants:

If infants ate large portions of potato containing chlorpropham at 13 mg/kg their intake could be 400% of the Acute Reference Dose. This intake is 25 times lower than the single dose given to dogs without any adverse effects. The European Food Safety Authority used this study as the basis of the ARfD.

Much of the residue is expected to be associated with the peel. The available consumption data indicate no consumption of jacket potatoes by infants.

Therefore, when considering the form of potatoes consumed, the highest intake is anticipated to be for toddlers.

Assessment for toddlers:

For toddlers that are expected to consume the peel, the highest intakes, without applying a processing factor to provide a further refinement to the intakes are 276% of the ARfD. This intake is 36 times lower than a single dose which caused no observed adverse effect in the above mentioned dog study.

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 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 dog, 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 nausea after eating large portions (97.5th percentile consumption)

of potato 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 short-lived and reversible.

This estimate assumes that potatoes are eaten unpeeled (for example as jacket potato); much of the residue is expected to be associated with the peel.

Rice

Crop	Pesticide	Highest residue (mg/kg)	Intake (mg/kg bw/day)		ARfD (mg/kg bw/day)	Source
			Adult	Critical group†		
Rice	Tricyclazole	0.02	0.00012	0.00025 (toddler) 0.00022 (7-10 year old child) 0.00022 (4-6 year old child) 0.00017 (15 to 18 year old child) 0.00016 (11 to 14 year old child) 0.00015 (vegetarian) 0.00012 (adult) 0.00011 (infant) 0.000078 (Elderly-own home) 0.000036 (Elderly-residential care)	Toxicological reference values are not established.	**EU, 2016**

Comment on risk assessment

A formal risk assessment is not possible as toxicological reference values have not been established in the EU or by other international bodies (JMPR or regulatory authorities). An assessment was performed by EFSA (EFSA Conclusion, 2015) prior to the non-renewal of tricyclazole in the EU (2016).

In 2015, EFSA concluded on NOAELs from acceptable toxicological studies, the most critical NOAEL suitable for short term

exposure assessment being 5 mg/kg bw/day for maternal toxicity in a rat developmental toxicity. The highest intake for rice in the current assessment for the critical group toddler is 20,000 times lower than this NOAEL. In setting an ARfD, toxicologists usually apply a factor of 100 to the NOAEL dose to take into account uncertainties caused by using animal data and possible differences in susceptibility between people. Therefore, an effect on health is not expected.

[†]Highest intake of all ten consumer groups, or intakes for all consumer groups that exceed the ARfD

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

Crop/Critical group	Pesticide	Residue mg/kg	Intake			ARfD	Source
			mg/kg bw	% ARfD			
Critical consumer group- Infant							
Beans (with pods) (Guar beans)	dimethoate	0.01	0.0001		} See	Not established	EU, 2019
	omethoate	0.04	0.0002		} discussion	Not established	See above table
	carbofuran	0.005	0.000025	16.7	} below	0.00015	EFSA, 2009

Comment on risk assessment:

The individual risk assessment for dimethoate and its metabolite omethoate is presented in the above table (page 71). The presence of carbofuran also needs to be considered together with dimethoate (organophosphorus insecticide) and omethoate (metabolite of dimethoate), as carbofuran is a carbamate insecticide that also inhibits acetylcholinesterase[8]. For dimethoate, EFSA (2018) stated an indicative value for a hypothetical toxicological reference value for short term exposure of 0.0001 mg/kg bw/day and for the current residue levels of 0.01 mg/kg of dimethoate and 0.04 mg/kg of omethoate, the estimated highest intakes of dimethoate and omethoate are 50% and 200% of this indicative value respectively. The conclusion discussed above (page 71) for dimethoate and omethoate is still considered valid for this combined assessment as carbofuran intakes are only 17% of its ARfD and would have a minimal impact on the assessment based on omethoate and dimethoate alone. Therefore, we consider residues of dimethoate, omethoate and carbofuran together in this sample are not, in the short term, expected to adversely inhibit acetylcholinesterase, at the estimated exposure levels. In the long-term, on a precautionary basis any findings of dimethoate and omethoate are not desirable due to genotoxicity concerns. Overall, an effect on health is unlikely.

[8] this enzyme, acetylcholinesterase, is included in the Glossary on page 101

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

Issues arising in this report

Chlorate (position as at publication)

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.

Enforcement of MRLs before 20 June 2020

This report covers samples taken before 20 June 2020, when the default MRL of 0.01 mg/kg was in place.

Within the EU it was agreed that while the default MRL for chlorate remained in place, enforcement should be left to the discretion of Member States. The UK regulators approach, and so ours, was to not consider residues above the default as non-compliant, and that is the approach taken in this report.

MRLs after 20 June 2020

After detailed discussion and consultation with stakeholders the EU agreed new MRLs for chlorate that came into force on 20 June 2020.

As part of this process we commented directly to the European Commission[9] 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. Our colleagues from the Advisory Committee on Microbiological Safety of Food made similar comments, stressing our joint concern 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. Comments from across the EU were similarly sceptical, but the Commission has explained it considers it is bound under EU law to proceed with the proposals.

[9] https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-334046/feedback/F18048_en?p_id=368328

The new chlorate MRLs include a footnote referring specifically to taking account of the use of biocides during processing in addition to the MRs for food as harvested or initially produced. The footnote exceptionally specifies that for considering compliance with chlorate MRLs simple types of processing that do not affect the other residue levels, such as packing, washing, chopping and freezing.

The MRLs have changed from the default to new higher MRLs with immediate effect. So we will be able to apply them to samples taken on or after 20 June and the food industry will be able to take them into account. The responsibility for providing evidence showing that residues from processing can be taken into account, lies with the food business operator, and so we will be interested to see such where appropriate.

Best practice for use

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.

Drinking Water

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.

Advisory Committee on the Microbiological Safety of Food

Microbiological safety of food

The HSE 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.

Dietary intakes

Since 2018 the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) has been 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[10] establishes appropriate health-based guidance values for chlorate exposure to protect against acute and chronic risks to health.

[10] EFSA Journal 2015;13(6):4135 [103 pp.]
http://ec.europa.eu/food/plant/standing_committees/sc_phytopharmaceuticals/index_en.htm

DDT

The use of DDT is banned or heavily restricted in many countries. It isn't allowed for use on food crops anymore, 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.

Dithiocarbamate residues

Dithiocarbamate residues are determined as carbon disulphide (CS_2) 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 thiram (a molecular weight conversion is applied to estimate the level of residue based on thiram) and this is compared to the ARfD for thiram. 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 thiram) leads to an exceedance of the thiram 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.

These dithiocarbamate risk assessments used to consider ziram as worst case, whereas following the update to the ARfD for thiram in late 2018, the assessment now considers thiram as worst case.

We have noted before that it would be valuable if additional cost-effective analytical tests could be developed to enable a more specific risk assessment. Defra have funded some

development work which it is hoped will in due course result in such tests being available for our programme. These tests may at least be able to rule out that certain pesticides had been used.

Processing factors

In nearly all cases the EU MRL is set for the food in its raw, unprocessed form (these foods are listed in Annex I of Regulation 396/2005) but is then applied to processed foods using appropriate processing factors. Processing factors take account of the effect of processing on the food as traded. Different forms of processing may remove, concentrate, or dilute residues, and the effect may vary depending on the food and the pesticide concerned.

In this report it was not necessary to consider processing factors for any of the results for the food tested.

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 setting 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 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.

In our next report:

Due to the COVID-19 situation, the sampling programme was suspended between April and June 2020. As a consequence our next full report will be for sampling that takes place in quarter three

In Quarter 3 of 2020 we will look at results for:

Avocado

Beans (dried)

Beans with pods

Bread (ordinary)

Bread (savoury)

Carrots

Cauliflower

Courgette

Dried fruits (grapes)

Fish (oily)

Grapes

Herbs

Infant formula

Kiwi fruit

Lamb

Lettuce

Liver (bovine)

Mango

Okra

Onions

Orange juice

Oranges

Pears

Peas without edible pods

Potatoes

Poultry meat

Pumpkin & squash

Rice

Rye

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 Chair, Ann Davison has worked in consumer affairs for most of her career, running consumer organisations and networks. The committee also includes members with expertise in food science, food production and supply as well as two public interest experts.

Information on the membership of the PRiF is also available on the PRiF's website:

Expert Committee on Pesticide Residues in Food

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 EU-Pesticide Database

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. The full definition must be sought. Residues found are usually of the metabolites.
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) for certain animal products.

	Pirimicarb only for fruit and vegetables and some animal products.
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)	Thiamethoxam (sum of thiamethoxam and clothianidin expressed as thiamethoxam) 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. Inhibition of this enzyme can interfere with this nerve transmission function. This is a short-term effect of concern with organophosphate and carbamate pesticides at levels above the ARfD.

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 Minor 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".

Genotoxicity: Genotoxicity is the effect of substances (called genotoxins) which can alter or damage the genetic material (DNA, RNA or chromosomes) within a cell. Cells have the capacity to protect themselves from genotoxic effects by many repair processes and therefore many genotoxic events do not become evident as mutations. Where mutations occur, this can lead to cancer or effects that can be passed to unborn children (e.g. birth defects, inherited diseases).

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 97.5^{th} 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 Extensions of Authorisations for Minor Use (EAMUs)

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 using the following link: The HSE Pesticide Website then search for Consumer Exposure. Here you will find information and further links.

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 using the following link: The HSE Pesticide Website then search for Consumer Exposure. Here you will find information and further links.

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.

Off Label: See EAMUs

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 RASFF - Food and Feed Safety Alerts

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.