

Australian Milk Residue Analysis Survey

Annual Report 2017–18



The Australian Milk Residue Analysis (AMRA) Survey is the independent chemical residue monitoring program for bovine milk, delivered for the Australian Government Department of Agriculture and Water Resources and State Regulatory Authorities:



Australian Government
Department of Agriculture
and Water Resources



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Public Health and Clinical Services

Table of Contents

Executive summary	2
Setting of Australian residue standards	3
Survey design and sample collection	3
Compounds tested	4
Chloramphenicol.....	4
Antimicrobials.....	4
Animal parasite control chemicals.....	4
Feed contaminants.....	5
Environmental contaminants	5
Anti-inflammatory treatments.....	5
Report on results	6
Table 1 AMRA Survey Sample Results (1 July 2017 – 30 June 2018)	7
Industry residue testing	9
Antimicrobial residue testing	9
Table 2: Company residue testing results for antimicrobial residues (1 July 2017 – 30 June 2018)	10
Other residue testing.....	10
Table 3: Company residue testing results for other residues performed on raw milk and finished products (1 July 2017 – 30 June 2018).....	10
National Residue Survey.....	11
References	12
Appendices	13
Appendix 1: Extract from the Export Control (Milk and Milk Products) Orders 2005	13
Appendix 2: Number of samples tested in each Australian dairy state by test type for the 2017–18 AMRA Survey.....	14
Appendix 3: Contracted laboratories and residue tests performed.....	15

Executive summary

This report summarises the results of the Australian Milk Residue Analysis (AMRA) Survey for the period 1 July 2017 – 30 June 2018. During this time, 1030 milk samples were collected and 13,550 analyses were conducted. Of the samples tested, 100% compliance was achieved with the Australian Maximum Residue Limit (MRL) Standards.

The AMRA Survey is the national residue monitoring program for agricultural and veterinary chemicals and environmental contaminants in milk. The survey facilitates the export requirements of the Australian Government Department of Agriculture and Water Resources (DAWR), under the *Export Control (Milk and Milk Products) Orders 2005* and provides assurance that Australian dairy products meet the requirements of importing countries. The DAWR is the competent authority that approves the annual AMRA Survey.

The AMRA survey is funded through the Department of Agriculture and Water Resources (DAWR). Dairy Food Safety Victoria (DFSV) co-ordinates the survey.

The survey involves testing randomly selected raw whole milk samples for a range of residues. The samples are taken from all dairying regions commensurate with milk production volumes in each region.

The AMRA Survey is a risk-based program designed to identify, monitor and manage potential chemical inputs in the Australian milk supply chain. The survey verifies the effectiveness of the control measures in place to ensure food safety outcomes and therefore provides assurance to consumers both in Australia and overseas regarding the safety and quality of Australian dairy products.

Setting of Australian residue standards

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is the federal authority responsible for the evaluation and registration of agricultural and veterinary chemicals (agvet chemicals) for supply, sale and use in Australia. The APVMA assesses agvet chemicals for use and sets maximum residue limits (MRLs) applying to both imported and domestic food. They are listed in the *Australia New Zealand Food Standards Code* (ANZFSC)¹ following consideration by Food Standards Australia New Zealand (FSANZ).

The APVMA also sets Extraneous Residue Limits (ERLs). These are the maximum permitted limits of pesticide residues in food commodities arising from environmental sources.

Furthermore, a Maximum Level (ML) is the maximum level of a specified contaminant or natural toxicant which is permitted to be present in a food and applies to chemicals such as heavy metals and mycotoxins¹.

The ANZFSC specifies that where no MRL or ERL has been established for a particular agricultural or veterinary chemical residue in a particular food, there must be no detectable level of that residue present. Any detectable amount of residue is therefore unacceptable. By contrast, where no ML has been set for a particular environmental contaminant in a food, residues as such are allowable at low levels.

Survey design and sample collection

The AMRA Survey is risk-based in its design and is reflective of the agricultural practices in the Australian dairy industry. Samples are taken from all dairying states commensurate with milk production volumes in each region. The European Union (EU) residue monitoring directives are used to provide a framework for the design of the survey. The chemicals selected for analysis generally reflect agricultural and veterinary chemical use patterns in Australian dairy production and those chemicals that may be of interest to Australia's trading partners.

All samples are taken randomly throughout the twelve-month period on a nationwide basis. Within this random selection there are stratified components for certain types of samples. These stratified components may be based on defined geographic areas, seasonal and historical usage patterns. For the 2017–18 AMRA Survey, milk samples allocated on a random basis were analysed for antimicrobials, chloramphenicol, benzimidazoles, levamisole, aflatoxin M1, macrocyclic lactones, organochlorines, organophosphates, synthetic pyrethroids, chemical elements and non-steroidal anti-inflammatory drugs. Samples with stratified components were analysed for triclabendazole residues. The number of samples tested and the types of analyses conducted for the 2017–18 AMRA Survey are listed in Appendix 2.

When a residue is detected in a sample the laboratory immediately notifies DFSV. DFSV informs the relevant State Regulatory Authority (SRA) and DAWR when a sample with a confirmed residue at or greater than the level of action has been detected. The level of action is set at $\geq 50\%$ of the Australian or EU MRL/ERL (whichever is the most stringent) or at any level in the case where no MRL/ERL has been established. The SRA, in cooperation with DAWR and the relevant dairy company then trace the sample back to the sampled tanker. Individual milk samples from each of the farms supplying the tanker are tested to determine the source of the residue. Once the supplying farm or farms have been identified,

further investigations are undertaken to establish the cause of the detection. Corrective and preventative actions may also be implemented by the dairy company to ensure that dairy products with residues greater than the Australian or EU Standard do not enter the respective markets.

All aspects of the AMRA Survey are subject to audit by the DAWR and governments of importing countries. SRAs are responsible for verifying that corrective and preventative activities have been undertaken.

Annual Review

The risk profile of various agricultural, veterinary and environmental contaminants is reviewed annually. The review focuses on emerging chemical residue risks, shifts in chemical use patterns and potential trends. The review also identifies areas for improvement within the survey.

Proficiency Testing

Contracted AMRA laboratories are required to participate in the Milk Laboratory Performance Evaluation Program to verify laboratories competency and be recognised as proficient to provide testing for the AMRA Survey.

The National Residue Survey (NRS) provide the Milk Laboratory Performance Evaluation Program for the AMRA Survey and is accredited by the National Association of Testing Authorities (NATA) as a Proficiency Scheme Testing Provider.

Compounds tested

The AMRA Survey includes a range of residue groups including antimicrobials, endoparasiticides, ectoparasiticides, feed and environmental contaminants. Samples for the survey are tested at nationally accredited laboratories. The test methods used and the requirements for laboratory approval are detailed in Appendix 3.

Chloramphenicol

In Australia, chloramphenicol is strictly prohibited for use on all food producing animals. Chloramphenicol is restricted for use on non-food producing animals such as cats and dogs and is obtained through a veterinary prescription only.

Chloramphenicol is therefore considered to pose a low risk in the Australian dairy risk profile. Thirty random samples were analysed nationally for residues of chloramphenicol to verify that off-label use does not occur and to satisfy importing country requirements.

Antimicrobials

Many antimicrobials, excluding chloramphenicol are registered for use on dairy cattle in Australia and form part of good agricultural practice for managing bacterial infections in livestock. Three hundred milk samples were randomly selected for antimicrobial residues across all dairying states. Each of these milk samples was tested for 22 antimicrobial compounds.

Animal parasite control chemicals

Benzimidazoles, levamisole and macrocyclic lactones are important endoparasiticides and in accordance with good agricultural practices may be routinely used on Australian dairy farms. Of the endoparasiticides mentioned, macrocyclic lactones are the group most commonly

used. In total, 320 random samples were collected nationally (230 macrocyclic lactones, 70 benzimidazoles and 20 levamisole) and tested for these residues.

Triclabendazole is another endoparasiticide which is predominately used in southern parts of Australia during certain times of the year. Thirty samples were randomly sampled from these parts of Australia and monitored for the residue.

The control of external parasites is common livestock farming practice in Australia. In accordance with good agricultural practice, organophosphates and synthetic pyrethroids contained in registered veterinary products are used on cattle for external parasite control. In total, 230 random samples were collected nationally and tested for organophosphate and synthetic pyrethroid residues.

Feed contaminants

Organophosphates and synthetic pyrethroids are also used for insect control on harvested and stored food crops such as grains. Feed contaminants may enter the milk supply chain via the use of such feeds. The same samples collected for monitoring the use of animal parasite control were also used to monitor the residue status relating to feed contaminants.

Due to Australia's variable climate, drought conditions are common in parts of Australia. Pasture based feeding often becomes less sustainable in times of drought, resulting in the growing use of supplementary feed for dairy cattle. Some feeds may pose a higher risk of aflatoxin B1 contamination such as peanut by-products, maize and sorghum. Drought stressed crops and high humidity may also favour the growth of *Aspergillus* moulds and the production of aflatoxins. Ingestion of such feeds containing aflatoxin B1 by cattle can result in the toxins being converted and excreted as aflatoxin M1 in milk. Thirty milk samples were tested randomly for the presence of aflatoxin M1 during the 2017–18 year.

Environmental contaminants

Organochlorine pesticides are no longer registered for use in Australia, however they are known to persist in the environment for extended periods. From time to time cattle may ingest soil containing residues of organochlorines. Thirty random samples were taken and analysed for the presence of organochlorine residues.

Chemical elements such as arsenic and heavy metals enter the environment via a number of different pathways. Industrial processes, smoke emission, paints and leaded petrol all contribute to the presence of these elements in the environment. Cattle grazing in such areas may excrete residues of heavy metals in milk. Thirty random samples were analysed nationally and analysed for compounds of arsenic, cadmium, mercury and lead.

Anti-inflammatory treatments

Non-steroidal anti-inflammatory drugs (NSAIDs) may be used from time to time to reduce inflammation and to provide pain relief in dairy cattle due to infections such as mastitis. There are currently four compounds within the NSAIDs group that are registered for use in Australia on dairy cattle.

Thirty random samples were collected and analysed for residues of flunixin, meloxicam, ketoprofen, tolfenamic acid and phenylbutazone. Phenylbutazone is currently not registered for use on dairy cattle but included to verify that off-label use is not occurring in Australia.

Report on results

Summary of results

The results for the 2017–18 AMRA Survey are shown in Table 1.

During 2017–18, 1030 milk samples were collected and a total of 13,550 analyses performed. Of the samples tested, there were no samples identified with residues above the relevant Australian standard.

One sample was identified to contain low levels of ivermectin. The level detected was below 50% of the Australian MRL. Follow up investigation was conducted for export purposes to the EU as there is currently no set EU MRL. The trace back investigation identified the farm responsible and established that the use of ivermectin was in accordance with label directions.

Table 1 AMRA Survey sample results (1 July 2017 – 30 June 2018)

Compound or Analyte Residue	Number of samples		Level of Action# (µg/kg)	Number of detections above Level of Action	Australian Standard* (µg/kg)	Number of results above AU MRL
	Planned	Tested				
Chloramphenicol						
Chloramphenicol	30	30	AD	0	Not set	0
Antimicrobials						
B-lactams						
Benzyl G Penicillin	300	300	1	0	1.5	0
Cloxacillin	300	300	10	0	10	0
Ampicillin	300	300	4	0	10	0
Amoxicillin	300	300	4	0	10	0
Cephalosporins						
Ceftiofur	300	300	50	0	100	0
Cefuroxime	300	300	20	0	100	0
Cephalonium	300	300	10	0	20	0
Tetracyclines						
Tetracycline	300	300	50	0	100	0
Oxytetracycline	300	300	50	0	100	0
Chlortetracycline	300	300	AD	0	Not set	0
Sulfonamides						
Sulfadiazine	300	300	50	0	100	0
Sulfadimidine	300	300	AD	0	Not set	0
Sulfadoxine	300	300	50	0	100	0
Sulfatroxazole	300	300	50	0	100	0
Macrolides						
Erythromycin	300	300	40	0	40	0
Lincomycin	300	300	50	0	20	0
Oleandomycin	300	300	AD	0	Not set	0
Tylosin	300	300	50	0	50	0
Tilmicosin	300	300	20	0	Not set	0
Aminoglycosides						
Streptomycin & Dihydrostreptomycin	300	300	100	0	200	0
Neomycin	300	300	750	0	1500	0
Gentamycin	300	300	AD	0	Not set	0
Endoparasiticides and Ectoparasiticides						
Triclabendazole	30	30	5	0	10	0
Benzimidazoles						
Albendazole	70	70	AD	0	Not set	0
Fenbendazole	70	70	50	0	100	0
Oxfendazole	70	70	50	0	100	0
Febantel	70	70	AD	0	Not set	0
Thiabendazole	70	70	50	0	50	0
Levamisole	20	20	20	0	300	0
Macrocylic Lactones						
Ivermectin	230	230	5	1^	50	0
Abamectin	230	230	5	0	20	0
Doramectin	230	230	5	0	50	0
Moxidectin	230	230	500F	0	2000F	0
Eprinomectin	230	230	10	0	30	0

Compound or Analyte Residue	Number of samples		Level of Action* (µg/kg)	Number of detections above Level of Action	Australian Standard* (µg/kg)	Number of results above AU MRL
	Planned	Tested				
Ectoparasiticides and Feed Contaminants						
Organophosphates						
Bromophos-ethyl	230	230	AD	0	Not set	0
Chlorpyrifos	230	230	100F	0	200F	0
Chlorpyrifos-methyl	230	230	25F	0	50F	0
Chlorfenvinphos	230	230	100F	0	200F	0
Coumaphos	230	230	80F	0	10	0
Dichlorvos	230	230	2	0	20	0
Diazinon	230	230	250F	0	500F	0
Ethion	230	230	50F	0	500F	0
Fenchlorphos	230	230	AD	0	Not set	0
Fenitrothion	230	230	30F	0	50F	0
Fenthion	230	230	6	0	200	0
Malathion (Maldison)	230	230	100F	0	1000F	0
Parathion-methyl	230	230	AD	0	Not set	0
Pirimiphos-methyl	230	230	25	0	50	0
Synthetic Pyrethroids						
Deltamethrin	230	230	25	0	50	0
Flumethrin	230	230	15	0	50	0
Permethrin	230	230	25	0	50	0
Cypermethrin	230	230	500F	0	1000F	0
Fenvalerate	230	230	20	0	200	0
Cyfluthrin	230	230	10	0	100	0
Cyhalothrin	230	230	250F	0	500F	0
Mycotoxins						
Aflatoxin M1	30	30	0.05	0	-	0
Anti-inflammatory Treatments						
Non-steroidal Anti-inflammatory Drugs						
Flunixin	30	30	AD	0	Not set	0
Meloxicam	30	30	5	0	5	0
Ketoprofen	30	30	5	0	50	0
Tolfenamic acid	30	30	25	0	50	0
Phenylbutazone	30	30	AD	0	Not set	0
Environmental Contaminants						
Organochlorines						
Aldrin & Dieldrin	30	30	90F	0	150F	0
BHC	30	30	80F	0	100F	0
Chlordane	30	30	40F	0	50F	0
Lindane	30	30	12.5F	0	200F	0
DDT	30	30	500F	0	1250F	0
Heptachlor	30	30	50F	0	150F	0
HCB	30	30	125F	0	500F	0
Endosulfan	30	30	AD	0	Not set	0
Chemical Elements						
Arsenic	30	30	10	0	-	0
Cadmium	30	30	10	0	-	0
Lead	30	30	10	0	-	0
Mercury	30	30	10	0	-	0

F These analytes are reported in the milk fat.
MRL Maximum residue limit.
Not set No standard has been set for the chemical in milk.
Refers to the level where follow up and/or investigatory action is undertaken. The level of action is set at 50% of the Australian or EU MRL whichever is more stringent or at the level of quantitation (LOQ) or at 'any detection' where no MRL has been specified.
* Food Standards Australia New Zealand. *Food Standards Code. Standard 1.4.1 & Standard 1.4.2.*
AD Any detection.
^ Residue identified below 50% AU MRL, investigation undertaken for export purposes due to no EU MRL.
- No upper limit is applicable for the contaminant. Detections of the contaminant at low levels are allowable.

Industry residue testing

In addition to residue monitoring performed in the AMRA Survey, many Australian dairy companies also carry out their own antimicrobial residue testing. This involves screening for potential antimicrobial residues from silos, bulk milk tankers and individual farm vat milk and screening for a range of other chemicals in raw milk or finished products.

Most dairy companies perform antimicrobial testing on site, and many of these participate in proficiency programs as a measure to verify the accuracy and consistency of their test results.

Bulk milk tanker screening on arrival at the dairy factory is used by companies as a measure to determine the acceptability of milk for further processing. Testing of bulk milk silos and finished products is also carried out by some manufacturers as a further precautionary measure.

Individual on-farm testing is undertaken by most dairy companies, either through regular supplier monitoring by the milk receival company and/or through proactive farmer requests for testing.

Some larger dairy companies also carry out additional testing for pesticides, heavy metals and environmental contaminants. These tests are either performed on raw milk or finished products.

Eleven Australian dairy companies provided an annual summary of their residue test results for analyses performed during the 2017–18 AMRA year. These results are collated in Tables 2 and 3. This information provides additional evidence that the Australian dairy industry's approach to agricultural and veterinary chemical usage is both responsible and effective in delivering safe food. It also demonstrates compliance with industry food safety programs.

Antimicrobial residue testing

Table 2 provides an aggregate summary of antimicrobial residue test results performed by dairy companies on raw milk and finished product for the period of 1 July 2017 – 30 June 2018.

A total of 520,990 routine antimicrobial screen tests were performed on raw milk from farms, bulk tankers and bulk silos and 99.93% of samples had no detectable residues. All Australian dairy companies have documented food safety programs in place which include requirements for the management of detections of antimicrobial residues and other chemical contaminants. In those instances where positive screening results were obtained, the dairy company followed the corrective action procedures outlined in their food safety program.

A total of 20,137 samples of finished products were also tested for antimicrobial residues, 100% of these samples were identified with no detectable levels of residues.

Table 2: Company residue testing results for antimicrobial residues (1 July 2017 – 30 June 2018)

Test Type	Number of Samples Analysed	Percentage of Positive Screening Detections (%)	Percentage of Negative Screening Detections (%)
Raw Milk – On-Farm	54,841	0.370	99.630
Raw Milk – Bulk Tanker	435,921	0.036	99.964
Raw Milk – Silo	30,228	0.003	99.997
Finished Product – (includes Milk, Cream, Powders, Butter and Cheese)	20,137	0.000	100.000

Other residue testing

Most large and some medium-sized companies conduct other residue testing in addition to antimicrobials. Samples were taken from either raw milk or finished products and were tested for various chemical residues including heavy metals, aflatoxins and pesticides. Some of these samples were taken randomly and others were part of a targeted sampling regime. These results are presented in Table 3 as an aggregate summary.

Table 3: Company residue testing results for other residues performed on raw milk and finished products (1 July 2017 – 30 June 2018)

Test Type	Number of Samples Analysed	Percentage of Positive Detections (%)	Percentage of Negative Detections (%)
Heavy Metals	2,917	0.000	100.000
Aflatoxin M1	2,308	0.260	99.740
Melamine	140	0.000	100.000
Organochlorines	25	0.000	100.000
Organophosphates & Synthetic Pyrethroids	162	0.000	100.000

National Residue Survey

The National Residue Survey (NRS) is a monitoring program conducted by the DAWR. The program aims to identify, monitor, and manage any potential chemical residues in Australian agricultural commodities. This survey provides additional evidence of good agricultural and veterinary chemical use practices in the participating animal and agricultural production industries.

The *NRS 2016-17 Industry Brochure: National Residue Survey 2016-17 Annual Summary*² provides a summary of test results in agricultural products which include cattle meat and grain crops. It is estimated that approximately 20% of Australia's meat production is derived from dairy cattle. The analytes tested in the NRS Survey includes most of the analytes tested for in milk by the AMRA Survey.

The results for the NRS cattle meat program and grains program demonstrate a high level of compliance with the ANZFSC¹.

References

1. Food Standards Australia New Zealand. *Australia New Zealand Food Standards Code. Standard 1.4.1 & Standard 1.4.2.* 2017.
<http://www.foodstandards.gov.au/code/Pages/default.aspx>
2. Australian Government Department of Agriculture. *NRS 2016-17 Industry Brochure: National Residue Survey 2016-17 Annual Summary*
<http://www.agriculture.gov.au/SiteCollectionDocuments/agriculture-food/nrs/nrs-results-publications/summary.pdf>

Appendices

Appendix 1: Extract from the Export Control (Milk and Milk Products) Orders 2005

Schedule 6 Product Standards

Part 1 Product standards for milk, milk products and ingredients

Contaminants, natural toxicants, residues and food additives

1.1 Milk and milk products for export as food and their ingredients must not contain any of the following:

- (a) a metal or non-metal contaminant or a natural toxicant in excess of the maximum level specified for the contaminant or toxicant in the Food Standards Code;
- (b) an agricultural or veterinary chemical in an amount that contravenes the requirements of the Food Standards Code;
- (c) a food additive, processing aid, vitamin, mineral, added nutrient, other matter or substance in contravention of the applicable requirements of the Food Standards Code.

Note 1 For the meaning of ingredient see order 7. See further the meaning of unsafe in order 9 and the meaning of unsuitable in order 10.

Note 2 For contaminants and natural toxicants see Standard 1.4.1 and Standard 1.4.4 of the Food Standards Code. For histamines see Standard 2.2.3 of the Food Standards Code.

Note 3 For residues see Standard 1.4.2 of the Food Standards Code.

Note 4 For food additives see Standards 1.3.1 to 1.3.4 of the Food Standards Code.

1.2 Milk and milk products for export as food to a country and their ingredients need not comply with a requirement of subclause 1.1:

- (a) as it applies to a contaminant or natural toxicant—if the importing country authority specifies a maximum level for the contaminant or natural toxicant for milk, milk products or ingredients of the kind concerned and the milk, milk products or ingredients concerned do not exceed that maximum level; and
- (b) as it applies to an agricultural or veterinary chemical—if the importing country authority specifies a maximum limit for the chemical for milk, milk products or ingredients of the kind concerned and the milk, milk products or ingredients concerned do not exceed that limit; and
- (c) as it applies to a food additive, processing aid, vitamin, mineral, added nutrient, other matter or substance—if the importing country authority specifies an alternative requirement for the food additive, processing aid, vitamin, mineral, added nutrient, other matter or substance milk, milk products or ingredients of the kind concerned and the milk, milk products or ingredients concerned comply with the alternative requirement.

1.3 If paragraph 1.2(a), 1.2(b) or 1.2(c) applies the applicable approved arrangement must:

- (a) identify the maximum limit or alternative requirement concerned specified by the importing country authority; and
- (b) document the controls used to ensure compliance with that maximum limit or alternative requirement.

Appendix 2: Number of samples tested in each Australian dairy state by test type for the 2017–18 AMRA Survey

Residue type	State*						
	VIC	NSW	QLD	TAS	SA	WA	Total
Chloramphenicol	20	5	2	1	2	0	30
Antimicrobials	186	38	16	39	11	10	300
Organophosphates & Synthetic Pyrethroids	142	30	14	23	12	9	230
Triclabendazole	20	7	0	3	0	0	30
Aflatoxin M1	21	3	1	3	2	0	30
Macrocyclic Lactones	144	29	14	30	7	6	230
Levamisole	8	4	2	2	3	1	20
Benzimidazoles	42	9	2	9	4	4	70
Non-steroidal Anti-inflammatory Drugs	21	3	3	2	0	1	30
Organochlorines	25	2	0	2	0	1	30
Chemical Elements	21	3	3	1	1	1	30

Key: * Australian States: VIC – Victoria; NSW – New South Wales; QLD – Queensland; TAS – Tasmania; SA – South Australia; WA – Western Australia.

Appendix 3: Contracted laboratories and residue tests performed

For the 2017–18 AMRA Survey milk samples were analysed by two nationally accredited laboratories as listed below:

Lab	Residue Type	Test Method
National Measurement Institute 1/153 Bertie St Port Melbourne Vic 3207 Australia	Antimicrobials Screen	Microbial Inhibition Test (MIT) for beta-lactams, tetracyclines, macrolides and aminoglycosides. Thin Layer Chromatography (TLC) for sulphonamides
National Measurement Institute 1/153 Bertie St Port Melbourne Vic 3207 Australia	Antimicrobials Confirmation, Benzimidazoles, Levamisole, Macrocyclic Lactones, Triclabendazole, Aflatoxin M1 and Non-steroidal Anti-inflammatory Drugs	Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)
Dairy Technical Services Food Assurance 5/352 Macaulay Road Kensington VIC 3031 Australia	Organochlorines, Organophosphates, Synthetic Pyrethroids	Gas Chromatography Tandem Mass Spectrometry (GC-MS/MS), Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)
Dairy Technical Services Food Assurance 5/352 Macaulay Road Kensington VIC 3031	Chloramphenicol	Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)
National Measurement Institute 1/153 Bertie St Port Melbourne Vic 3207 Australia	Chemical Elements	Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Contracted laboratories are required to be accredited by NATA or equivalent for the methods used in the AMRA Survey, and accreditation to ISO/IEC Standard 17025. All laboratories are required to participate in a laboratory proficiency evaluation program coordinated by the NRS.