



Australian Government

Grape and Wine Research and Development Corporation

Analysis of grapes and wine for 2,4-D

FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **AWR 04/02 – Crop protection impacts on wine grapes**

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Research Organisation: **The Australian Wine Research Institute**

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Abstract

The Australian Wine Research Institute has developed a method of analysis for the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) in grapes and wine. In Australia, the MRL for 2,4-D in grapes is 0.05 mg/kg. In a survey of 102 Australian wines from vintages 2000–2004, no wines contained 2,4-D in excess of 0.05 mg/L. In a further analysis of 191 Australian wine from the 2005 and 2006 vintages, no wine contained 2,4-D in excess of 0.05 mg/L, and 29 grapes samples also from the 2005 and 2006 vintages did not contain 2,4-D in excess of 0.05 mg/L.

Executive summary

In response to a request from the Australian Wine and Brandy Corporation to aid the establishment of an appropriate MRL for the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) in grapes and wine by the Pesticides and Veterinary Medicines Authority and Food Standards Australian New Zealand, The Australian Wine Research Institute developed a method of analysis for 2,4-D in grapes and wine. Subsequent analysis of Australian 29 grape and a total of 293 wine samples from vintages ranging from 2000–2006 showed that no grapes of wines contain 2,4-D in excess of the established MRL of 0.05 mg/L.

Background

In April 2005, Food Standards Australia New Zealand (FSANZ) was initially advised that a low level of the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) had been detected in grapes from a Victorian geographical indication (GI) leading to a rejection of the grapes by a winery. Subsequent advice suggested that the 2,4-D was not limited to grapes from that Victorian GI and included grapes from other Victorian GIs and from NSW, SA and WA GIs in the 2005 vintage, where viticulture was adjacent to broad acre farming utilizing 2,4-D as a herbicide. The Pesticides and Veterinary Medicines Authority (APVMA) issued a temporary permit for the use of 2,4-D in vineyards and published a temporary maximum residue limit (MRL) for 2,4-D in grapes in the APVMA MRL Standard. FSANZ subsequently proposed an MRL of 0.05 mg/kg for 2,4-D in grapes in *Standard 1.4.2 Maximum residue limits* in the Australia New Zealand Food Standards Code. MRLs for 2,4-D already exist for a range of foods, and in grapes an MRL of 0.05 mg/kg for 2,4-D does not represent an unacceptable risk to public health and safety. FSANZ also proposed to make a Sanitary and Phyto-Sanitary (SPS) notification to the World Trade Organisation.

The Australian Wine and Brandy Corporation (AWBC) duly requested that The Australian Wine Research Institute (AWRI) determine the concentration of 2,4-D in a range of Australian wines, with particular reference to the maximum permitted concentration defined for export markets of strategic interest to Australia.

Prior to 11 July 2005, there was no maximum residue limit (MRL) for 2,4-D in either grapes or wine for Australia. The USA and Japan have a specific MRL for grapes at 0.50 mg/kg, while in the UK the MRL for grapes is 0.05 mg/kg. In the EU and Germany the MRL for all fruit is 0.05 and 0.10 mg/kg, respectively.

There is little published literature available on the concentration of 2,4-D in grapes and wine. Prior to April 2005, the AWRI did not hold any data on the concentration of 2,4-D in grapes or wine, as there was no published method of analysis for 2,4-D in grapes and wine. The AWRI, therefore, had to develop a method of analysis for 2,4-D in grapes and wine.

Project aims and performance targets

The aims of the project were to:

1. develop a sensitive and reliable method of analysis for 2,4-D (free acid, and for conversion of ester and salt forms to the free acid form) in grapes and wine; and

2. analyse a range of Australian grapes and wines for 2,4-D and its degradation product 2,4-dichlorophenol, to determine if they comply with analytical requirements for Australia and for export markets.

Outputs (aim)	Performance Targets
1. Collect suitable Australian wine samples (survey).	1. Wine samples collected for subsequent analysis by 13 May 2005.
2. Develop and validate method of analysis for 2,4-D in grapes and wine.	2. Method of analysis developed and validated for 2,4-D in gapes and wine by 13 May 2005.
3. Undertake survey of collected Australian wine samples.	3. Analyse survey wines using the developed method of analysis to determine whether they contain detectable 2,4-D by 25 May 2005.
4. Undertake analysis of Australian grape samples and additional wine samples collected.	4. Analyse Australian grape and additional wine samples for 2,4-D by 8 June 2005.

Materials and method

One hundred and two 750 mL bottle samples of red (74) and white (28) commercial wine were provided by the AWBC and the total concentration of 2,4-D (2,4-D and its isopropyl and butyl esters) in the wines determined. The samples of wine spanned five vintages (2000–2004), and were from 38 different grape growing regions in Australia and 18 different varieties.

The 102 samples of wine were analyzed for the concentration of total 2,4-D (2,4-D and its isopropyl and butyl esters) using a liquid chromatograph-ion trap mass spectrometer (LC-MS). Total 2,4-D was extracted from wine, which had been hydrolyzed in order to convert all the 2,4-D esters to the free acid. The extract was then subjected to LC-MS analysis. The limits of quantification (LOQ) and detection (LOD) for 2,4-D analysis were 1 µg/L and 0.5 µg/L, respectively. The details of the method used are available from the AWRI.

In addition, a further 191 wine samples and 29 grape samples were subsequently received for analysis of the concentration of total 2,4-D by the AWRI Analytical Service.

Results

The results of the analysis of 2,4-D in 102 Australian wines are shown in Appendix 5.

In summary:

- Seven wine samples (approximately 7% of the total samples examined) contained a concentration of 2,4-D greater than the limit of quantification (1 µg/L) and the highest concentration was found to be 2.9 µg/L (Table 1).

- None of 28 white wine samples were found to contain a concentration of 2,4-D greater than the limit of detection (0.5 µg/L).

- Forty-four wine samples (approximately 43%) contained a concentration of 2,4-D greater than the limit of detection (0.5 µg/L). All the 44 samples were red wines, and therefore, 59% of red wine samples were found to contain a concentration of 2,4-D greater than the limit of detection (Table 2).

- The proportion of red wine samples containing a concentration of 2,4-D greater than the limit of detection (0.5 µg/L) was found to be lower in 2000 and 2001 vintages compared to red wine produced in the 2002, 2003 and 2004 vintages in the data set available (Table 3).

- The proportion of red wine samples containing a concentration of 2,4-D greater than the limit of detection (0.5 µg/L) were found to be lower in the Victoria (44%) and Western Australia (38%) geographical regions relative to the New South Wales (71%), South Australia (71%) and South Eastern Australia (61%) geographical regions in the data set available (Table 4).

Differences between vintages and geographical regions are presented only as observations from the available data set. To confirm any significance in these differences, a more extensive survey and hence larger data set would be required.

Table 1. Wine samples containing a concentration of 2,4-D in excess of the limit of quantification (1µg/L)

Product description Sample no. Vintage Region/State	Variety	2,4-D concentration (µg/L)
845413 2004 SA	Petit Verdot	2.9
778588 2001 Perricoota, NSW	Shiraz	1.6
891496 2004 SEA	Shiraz/Cabernet Sauvignon	1.5
754924 2003 Riverland, SA	Shiraz/Cabernet Sauvignon	1.4
776853 2002 SEA	Shiraz	1.4
X001 Unknown Unknown	Red	1.3
786391 2002 Geographe, WA	Shiraz	1.0

SA = South Australia, NSW = New south Wales, SEA = South Eastern Australia and WA = Western Australia

Table 2. Wine samples containing a concentration of 2,4-D in excess of the limit of detection (0.5 µg/L)

	Number of samples analysed	Number of samples greater than the LOD (0.5 µg/L)	Occurrence (%)
Total wine samples	102	44	43
White wine samples	28	0	0
Red wine samples	74	44	59

Table 3. Variation by vintage year of red wine samples found to contain a concentration of 2,4-D greater than the limit of detection (0.5 µg/L)

	2000	2001	2002	2003	2004	Total
Number of samples analysed	9	11	23	21	8	72
Number of samples greater than the LOD	3	5	16	14	5	43
Occurrence (%)	33	46	70	67	63	60

Table 4. Variation by geographical region/State of red wine samples found to contain a concentration of 2,4-D greater than the limit of detection (0.5µg/L)

	SEA*	NSW	SA	VIC	WA	TAS
Number of samples analysed	13	14	28	9	8	0
Number of samples greater than the LOD	9	10	17	4	3	0
Occurrence (%)	69	71	61	44	38	0.0

*SEA = South Eastern Australia

The results of the further 191 wine samples and 29 grape samples that were subsequently received for analysis of the concentration of total 2,4-D by the AWRI Analytical Service are as follows in Tables 5 and 6, respectively:

Table 5. Concentration of 2,4-D in 191 wine samples analysed by the AWRI Analytical Service

	Not detected	Trace	1 µg/L	2 µg/L	3 µg/L	5 µg/L
No. samples	120	28	25	12	5	1

Not detected = <0.50
Trace = >0.5 but <1.0

Table 6. Concentration of 2,4-D in 29 grape samples analysed by the AWRI Analytical Service

	Not detected	Trace	1 µg/L	2 µg/L	3 µg/L	4 µg/L	6 µg/L	7 µg/L
No. samples	8	7	3	4	2	2	1	2

Not detected = <0.50
Trace = >0.5 but <1.0

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Discussion

2,4-Dichlorophenoxyacetic acid (2,4-D) is a systemic herbicide used to control broad-leaved weeds, in field, orchard and aquatic sites, and is also used on lawns and turf. It was first registered for use in Australia in 1949. Prior to 11 July 2005, 2,4-D was not registered for used in grape growing in Australia and accordingly, there was no maximum residue limit (MRL) for 2,4-D in grapes. Atmospheric contamination by 2,4-D may occur as a result of volatilisation and drift from application by spraying, and the residues are predominantly in the form of isopropyl and butyl esters. It has been noted that the more volatile esters may move more readily into the atmosphere and cause crop damage downwind (ICPS 1984, US EPA 1987, CCME 1995).

The reason that 2,4-D is toxic to plants is because it mimics a specific plant growth regulator and accordingly disrupts plant growth control (ICPS 1984, US EPA 1987, CCME 1995). Humans and animals do not have such a growth mechanism and hence human and animal growth is not affected. In humans, the acceptable daily intake (ADI) of 2,4-D, as the sum of 2,4-D and its salts and esters, is 0.01 mg/kg of body weight. For a 60 kg individual this equates to 0.60 mg per day from all environmental and food sources. The ADI was established on the basis of the no adverse effect level (NOAEL) of 1 mg/kg of body weight in a one-year toxicity study in dogs and a two-year study in rats, using an uncertainty factor of 100 (FAO/WHO 1997).

If the average concentration of 2,4-D in wine is observed to be 0.005 mg/L, a 60 kg person could ‘safely’ consume up to approximately 120 L of wine per day. If the average concentration of 2,4-D in wine is observed to be 0.05 mg/L, which is equivalent to the MRL value for grapes, a 60 kg person could ‘safely’ consume up to approximately 12 L of wine per day.

The National Health and Medical Research Council’s *Australian Alcohol Guidelines: health risks and benefits* (2001) recommend a maximum of four and two standard (approximately 100 mL) glasses of wine per day for men and women, respectively. Therefore, consumption of this amount of wine per day by men and women, if it contains 0.05 mg/L of 2,4-D, should not compromise human health.

Furthermore in Australia, the health guideline established for drinking water is 0.03 mg/L, which is derived from the ADI based on lifetime exposure for 2,4-D for a 70 kg adult with an average water consumption of 2 L/day (NHMRC/ARMCANZ 1996). In contrast, higher MRLs exist for other foods, for example, the MRL for citrus fruits is 5.0 mg/kg, for cereal grains is 0.20 mg/kg, while for legume vegetables and pulses the MRL is 0.05 mg/kg and for milk is 0.05 mg/L, which is the lower limit of detection of the analytical method for these latter three foods.

Outcomes and conclusions

Analysis of 102 samples of Australian wine for total 2,4,-D showed that only seven contained a concentration greater than the 0.001 mg/L limit of quantification, but lower than the MRL of 0.05 mg/kg for grapes. Therefore, the concentration of 2,4-D in these seven wines is unlikely to compromise the health of moderate consumers of wine.

Analysis of 191 samples of Australian wine for total 2,4-D showed that that only 43 or 22.5% contained a concentration greater than the 0.001 mg/L limit of quantification, but lower than the MRL of 0.05 mg/kg for grapes. Therefore, the concentration of 2,4-D in these 48 wines is unlikely to compromise the health of moderate consumers of wine.

Analysis of 29 samples of Australian grapes for total 2,4-D showed that that 14 (48%) contained a concentration greater than the 0.001 mg/L limit of quantification, but lower than the MRL of 0.05 mg/kg for grapes. Therefore, the concentration of 2,4-D in these 14 grape samples is unlikely to compromise the health of moderate consumers of wine.

Appendix 1: Communication HUMAN HEALTH FACT SHEET FOR 2,4-D

2,4-D

2,4-Dichlorophenoxyacetic acid (2,4-D) is a systemic herbicide used to control broad-leaved weeds, in field, orchard and aquatic sites It is also used on lawns and turf. It was first registered in 1946 in Canada, in 1947 in the USA, and in 1949 in Australia.

Chemistry

2,4-D belongs to the group of chlorophenoxy herbicides and was a component of "Agent Orange" associated with the Vietnam War; accordingly its environmental and human health and safety has been extensively investigated. As a strong free acid it is chemically stable but its salts and esters are rapidly hydrolysed to the free acid (CCME 1995). 2,4-D products are marketed as the free acid, alkali and amine salts and ester formulations.

The taste and odour threshold of 2,4-D is between 0.05 and 3.13 mg/L (US EPA 1987), although the taste threshold of its primary metabolite, 2,4-dicholorophenol, is 0.3 µg/L in water (ICPS 1984).

Maximum residue limits

Atmospheric contamination by 2,4-D may occur as a result of volatilisation and drift from application by spraying, and the residues are predominantly in the form of isopropyl and butyl esters. It has been noted that the more volatile esters may move into the atmosphere and cause crop damage downwind.

In Australia, 2,4-D is not registered for used in grapegrowing and accordingly, there is no maximum residue limit (MRL) for 2,4-D in grapes. Hence "there must be no detectable residue of 2,4-D in grapes (and wine)". Only the USA has established a specific MRL for grapes at 0.50 mg/kg (ppm). MRLs (which are for total 2,4-D) have been established for other commodities as follows:

Country	MRL (mg/kg or ppm)	Commodity
Australia	0.03 (mg/L or ppm)	Drinking water
	(Health guideline value is derived from the Australian ADI (acceptable daily intake based on daily lifetime exposure) of 0.01 mg/kg/day for a 70 kg adult with an average water consumption of 2 L/day).	
	0.20	Cereal grains
	5.00	Citrus fruits
	0.05	**Legume vegetables**
	0.05	**Milk**
	0.05	**Pulses**
	(0.05 refers to lower limit of detection)	
Canada	0.10	Drinking water
	0.10	All foods unless specified
European Union	0.03	Drinking water
	0.05	Fruits and vegetables
Germany	0.10	Fruits and vegetables
UK	0.05	Table and wine grapes
USA	0.07	Drinking water
	0.50	Grapes

The MRLs for each commodity reflect the total amount of that commodity that is consumed in the daily diet.

Human health and safety

ADI

The acceptable daily intake (ADI) of 2,4-D is 0.01 mg/kg of body weight for the sum of 2,4-D and its salts and esters. For a 60 kg individual this equates to 0.60 mg per day from all environmental and food sources. It was established on the basis of the NOAEL of 1 mg/Kg of body weight in a one-year toxicity study in dogs and a two-year study in rats, using an uncertainty factor of 100.

If the average concentration of 2,4-D in grapes is observed to be 0.005 mg/L (5 µg/L), a 60 kg person could 'safely' consume up to approximately 120 L of wine on any one occasion, or if the average concentration is observed to be 0.05 mg/L (50 µg/L, the proposed MRL value), then a 60 kg person could 'safely' consume up to approximately 12 L of wine.

Absorption, metabolism and excretion of 2,4-D

Ingested 2,4-D is almost completely and rapidly absorbed, distributed and excreted essentially unchanged in urine; approx. 75% of the ingested dose is found in the urine after 48 hours. No metabolites form.

The salts of 2,4-D rapidly dissociate and the esters are rapidly hydrolysed to 2,4-D once absorbed, after which they are distributed and excreted indistinguishably from the free acid of 2,4-D, which explains the similar toxicity of the acid, salts and esters of 2,4-D.

Toxicity

Acute and chronic toxicity to orally consumed 2,4-D (acid, salts and ester) occurs only at high doses, between approximately 5 and 30 mg/kg body weight. Toxicity per se is mainly observed in individuals occupationally exposed, such as workers manufacturing 2,4-D products or workers applying 2,4-D products, where they are dermally and inhalationally exposed to 2,4-D. Toxic effects include peripheral neuropathy (pain and muscular damage).

2,4-D has low reproductive toxicity and is not teratogenic, that is, does not cause birth defects.

The reason that 2,4-D is toxic to plants is because it mimics a specific plant growth regulator and accordingly disrupts plant growth control. Humans and animals do not have such a growth mechanism.

Carcinogenicity

2,4-D is not genotoxic (damage DNA) and is classified as a Group D chemical, that is, "not classifiable as to human carcinogenicity". While some epidemiological studies suggested an association between exposure to chlorophenoxy herbicides, including 2,4-D, and the development of soft-tissue sarcoma and non-Hodgkin lymphoma, this has not been consistently confirmed by case-controlled or cohort studies. There is no association between exposure to 2,4-D and the development of any other forms of cancer.

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Updated 11 March 2005

QUESTIONS AND ANSWERS ON 2,4-D AND WINE GRAPES

- **What is 2,4-D?**

2,4–D, or 2,4-dichlorophenoxyacetic acid is a selective systemic herbicide, which controls weeds in a crop without damaging that crop. After 50 years of use, 2,4-D is still the third most widely used herbicide in the USA and Canada, and the most widely used worldwide.

A recently published eight-year U.S Department of Agriculture study reviewed the epidemiology and toxicology of 2,4-D and concluded that "The phenoxy herbicides are low in toxicity to humans and animals. No scientifically documented health risks, either acute or chronic, exist from the approved uses of the phenoxy herbicides."

- **Can 2,4-D affect human health?**

Studies summarised by the World Health Organisation and US EPA show that 2,4-D has low oral toxicity, including neurotoxicity. Toxicity is mainly observed in individuals occupationally exposed to high dermal and inhalational doses, such as workers manufacturing 2,4-D products or workers applying 2,4-D products. 2,4-D has low reproductive toxicity and does not cause birth defects. Also, it is not genotoxic and there is no relationship between exposure to 2,4-D and the development of cancer.

- **What evidence is there that spray drift of 24D has damaged vines and fruit?**

There are heavy pockets of damage to vines in North-West Victoria, particularly around Swan Hill. There is less evidence of damage at the Mildura end of that region. We have only very limited reports of damage from other regions.

- **Why did growers sell their grapes to the wineries when they suspected the grapes had been exposed to 24D?**

When alerted by growers or their vineyard liaison staff, wineries are ensuring that suspect fruit is carefully monitored and clearly separated from other batches. Wineries are then testing the resulting wine for the presence of 2,4-D. Any detected presence will result in rejection of the wine.

- **Have wineries rejected grapes because they detected residues of 24D?**

We are aware of two instances where growers have alerted wineries to the fact that their fruit has been subject to spray drift. The wineries have rejected this fruit and the growers are fully co-operating.

- **How many wine grapes have been affected by the spray drift?**

We do not know precisely but it would be a very small percentage of the vintage.

- **Does this mean Australian wine has 24D in it?**

Not at all. Even if grapes contain 2,4-D the winemaking process may remove the residue. The yeast used to ferment the grapes into wine, and the subsequent fining and filtration processes are very effective at eliminating contaminants.

- **Has Australian wine with 24D residues been sold overseas?**

No. The 2005 vintage is still in progress. No wines have been sold from this vintage.
(Investigations reveal that it is quite possible that drift affected fruit has been used in winemaking in previous seasons. The AWBC has sampled 100 wines from its wine library and commissioned analysis for 2,4-D residues. Results are anticipated by mid May.)

- **What testing is done on the wine before it's released for sale, domestically or for export?**

All wineries have testing regimes in place for routine quality control reasons. Many wineries also test for the presence of agrochemicals. In addition, the Australian Wine and Brandy Corporation randomly selects 300 wines each year for a range of tests, including spray residues.

- **How often do the random tests take place?**

Wine is produced once a year. The tests are conducted on each year's production.

- **Is there a maximum residue level or MRL for wine sold domestically?**

No.

- **Is there an MRL for exported wine?**

No. The USA has an MRL for grapes (not wine) of 500 ppb and Canada of 100 ppb, while the Europe Union allows 50 ppb in grapes. The international food standards body, the Codex Alimentarius Commission, has a limit of 50 ppb in milk. Australia also has a limit of 50 ppb for milk and a health guideline for drinking water of 30 ppb. The levels detected in the rare parcels of Australian grapes are only of the order of 1 to 10 ppb.

- **Has WFA or its members discussed the spray drift issue with grain growers in affected areas?**

We believe the Victorian Department of Primary Industry will be receiving a submission from the Murray Valley Winegrowers Organisation.

- **Will your members or the WFA sue grain producers who've allowed their spray to affect grapes?**

Breaching standards for the application of sprays is an offence in Victoria. The Victorian DPI would prosecute, if appropriate, but finding the culprits is not easy (*the spray can drift up to 30-35 km from the application site*).

- **What regulations are in force covering spraying near vineyards?**

No national regulations. There are defined "chemical control areas" in Victoria and Western Australia but these should be reviewed in the light of recent activity.
(These areas were defined in the 1960s when horticulture extended only a few km from the River Murray. Furthermore, spray drift was one of the defining issues behind the establishment of the Coonawarra Grapegrowers Council in 1973. They were successful in developing protocols applying to that region, whereby no sprays were applied during the grapevine growing season (Sept to May). Farmers and local councils generally seem to have obeyed these protocols).

- **Should the regulations be strengthened?**

The cotton and other horticultural crops have also recently been affected by spray drift from pasture. This is an issue that should be addressed with a view to determining appropriate national standards for all crops.

- **How much will this problem cost the industry?**

The precautionary testing that is currently being undertaken is very expensive. Nevertheless the industry will spare no expense to ensure the wholesomeness of all Australian wine.

Prepared by Steve Guy, AWBC and Creina Stockley, AWRI
March 2005

Appendix 5: Raw data

Table 1. Concentration of total 2,4-D in a sample of 102 Australian red and white wines

Product ID	Product Description	GI	State	Concentration of 2,4-D (μg/L or ppb)
682473	2000 Shiraz	McLaren Vale Coonawarra Barossa	SA	Trace**
696730	2000 Chardonnay	Geographe	WA	Nd*
716583	2000 Cabernet Sauvignon	South Eastern Australia	SEA*	nd
568648	2000 Cabernet Sauvignon	South Australia	SA	nd
862484	2000 Block Cabernet Franc	Yarra Valley	VIC	nd
779118	2000 Cabernet Sauvignon	Wrattonbully & McLaren Vale	SA	nd
754079	2000 Cabernet Sauvignon	McLaren Vale	SA	Trace
858419	2000 Cabernet Merlot	Grampians	VIC	Trace
568351	2000 Pinot Noir	Manjimup	WA	nd
498415	2000 Sauvignon Blanc	Mount Barker	SA	nd
672348	2000 Hunter Chardonnay	Hunter Valley	NSW	nd
615651	2000 Cabernet Sauvignon	Yarra Valley	VIC	nd
638912	2001 Shiraz	Margaret River	WA	nd
843945	2001 Merlot Cabernet Franc Cabernet Sauvignon	Pemberton	WA	nd
682068	2001 Cabernet Sauvignon	Hunter Valley	NSW	Trace
689221	2001 Estate Pinot Noir	Mornington Peninsula	VIC	nd
703370	2001 Shiraz	Mudgee	NSW	nd
724257	2001 Cabernet Sauvignon Merlot	South Eastern Australia	SEA	Trace
751947	2001 Cabernet Merlot Shiraz Cabernet Franc	Adelaide Hills	SA	nd
742909	2001 Chardonnay	Tasmania	TAS	nd
890789	2001 Shiraz	Coonawarra	SA	Trace
698301	2001 Cabernet Sauvignon Cabernet Franc Merlot	Margaret River	WA	nd
778588	2001 Shiraz	Perricoota	NSW	**1.6**
840427	2001 Merlot Cabernet Malbec	Adelaide Hills	SA	Trace
874280	2002 Pinot Noir	Adelaide Hills	SA	nd

777493	2002 Shiraz	Rutherglen	VIC	Trace
761266	2002 Shiraz Merlot Cabernet	Barossa	SA	nd
845140	2002 Shiraz	Riverland	SA	Trace
761928	2002 Shiraz	Mount Barker	SA	nd
830999	2002 Cabernet Sauvignon	Southern Highlands	NSW	nd
787632	2002 Cabernet Sauvignon	South Eastern Australia	SEA	nd
843696	2002 Shiraz	Barossa	SA	Trace
868371	2002 Cabernet Sauvignon	Hilltops	NSW	Trace
672269	2002 Merlot	South Eastern Australia	SEA	Trace
844755	2002 Shiraz	Clare Valley & Langhorne Creek	SA	Trace
862526	2002 Shiraz	South Eastern Australia	SEA	Trace
761084	2002 Semillon	Hunter Valley	NSW	nd
776853	2002 Shiraz	South Eastern Australia	SEA	**1.4**
843714	2002 Cabernet Sauvignon	South Australia	SA	Trace
845036	2002 Shiraz Cabernet	South Eastern Australia	SEA	Trace
755098	2002 Shiraz	South Australia	SA	nd
840865	2002 Shiraz	New South Wales	NSW	Trace
863154	2002 Shiraz	Mudgee	NSW	nd
835225	2002 Cabernet Sauvignon	Yarra Valley	VIC	Trace
842904	2002 Grenache Shiraz	Adelaide	SA	Trace
716352	2002 Cabernet Sauvignon	Yarra Valley	VIC	Trace
X002	2002 Barbera	Orange	NSW	Trace
769800	2002 Chardonnay	Hunter Valley	NSW	nd
786391	2002 Shiraz	Geographe	WA	**1.0**
845681	2003 Cabernet Sauvignon	Mount Benson	SA	nd
873172	2003 Shiraz	Clare Valley	SA	Trace
775435	2003 Chardonnay	Coonawarra	SA	nd
864559	2003 Cabernet Sauvignon	Orange	NSW	Trace
844810	2003 Shiraz	Currency Creek	SA	Trace
787620	2003 Creek Merlot	South Eastern Australia	SEA	Trace
845747	2003 Grenache	McLaren Vale	SA	Trace

843969	2003 Shiraz	Pemberton	WA	Trace
844901	2003 Shiraz Viognier	McLaren Vale	SA	nd
837696	2003 Merlot	Orange	NSW	Trace
845668	2003 Sangiovese	Langhorne Creek	SA	Trace
763950	2003 Marsanne Viognier	Goulburn Valley	VIC	nd
763366	2003 Verdelho	Murray Darling (NSW)	NSW	nd
751418	2003 Shiraz Merlot	Riverina	NSW	Trace
844032	2003 Shiraz	Barossa	SA	Trace
776841	2003 Merlot	South Eastern Australia	SEA	Trace
832030	2003 Pinot Noir	Yarra Valley	VIC	nd
754924	2003 Shiraz Cabernet Sauvignon	Riverland	SA	**1.4**
X003	2003 Shiraz	Finniss River	SA	nd
845735	2003 Cabernet Sauvignon	McLaren Vale	SA	nd
870572	2003 Cabernet Shiraz Merlot	Pyrenees	VIC	nd
838147	2003 Merlot	Mudgee	NSW	nd
840786	2003 Shiraz	Barossa	SA	Trace
829171	2003 Shiraz	South Eastern Australia	SEA	Trace
864407	2003 Grenache	McLaren Vale	SA	nd
863014	2003 Chardonnay	Yarra Valley	VIC	nd
796402	2004 Verdelho	Hunter Valley	NSW	nd
845413	2004 Cabernet Petit Verdot	South Australia	SA	**2.9**
888692	2004 Sauvignon Blanc	King Valley	VIC	nd
891496	2004 Shiraz Cabernet Sauvignon	South Eastern Australia	SEA	**1.5**
891666	2004 Chardonnay	Pemberton	WA	nd
878431	2004 Cabernet Sauvignon	Margaret River	WA	nd
840518	2004 Shiraz Cabernet Sauvignon	South Eastern Australia	SEA	nd
829882	2004 Sauvignon Blanc	Gippsland	VIC	nd
862927	2004 Viognier	Langhorne Creek	SA	nd
832170	2004 Shiraz	Riverina	NSW	Trace
864869	2004 'Gewurztraminer Riesling Pinot Gris'	Clare Valley	SA	nd
888382	2004 White	Langhorne Creek	SA	nd

794260	2004 Colombard Chardonnay	South Eastern Australia	SEA	nd
871588	2004 Chardonnay	Padthaway	SA	nd
864353	2004 Merlot	Riverina	NSW	Trace
863142	2004 Verdelho	Mudgee	NSW	nd
864158	2004 Riesling	Eden Valley	SA	nd
836953	2004 Pinot Noir	South Eastern Australia	SEA	nd
863531	2004 Shiraz	Margaret River	WA	Trace
863981	2004 Riesling	Tasmania	TAS	nd
863051	2004 Semillon Sauvignon Blanc	Margaret River	WA	nd
651527	2004 Chardonnay	Mornington Peninsula	VIC	nd
878108	2004 Chardonnay	Coonawarra	SA	nd
891381	2004 Semillon Chardonnay	South Australia	SA	nd
856009	2004 Pinot Grigio	South Eastern Australia	SEA	nd
X001	Not listed			**1.3**
634499	Not listed			nd

*nd: Not detected (< 0.5 μg/L), **Trace: Trace levels (> 0.5 μg/L but < 1.0 μg/L)

Appendix 6: Budget reconciliation