Ansto

EM/TN-04/2003 rev. 0

Environmental
Management

Agricultural Production and Consumption and the 2001 Population Census Data in the Sydney Statistical Division

copy 2

prepared by

Renate U. DOMEL

May 2003

Environmental Management Project
Australian Nuclear Science and Technology Organisation

EM/TN-04/2002				File No. [xx/xxxx]
Revision History				
Revision	*Date*	*Change*		
0		-		
Authorship				
	Name	Position	Signature	Date
Prepared	R. Domel	Senior Research Scientist		04/06/03
Checked	G. Clark	EMAP, task leader	G.H. Clark	4/6/03
Authorised	J. Harries	EM, Project Leader	J Harries	4/6/03

EXECUTIVE SUMMARY

The determination of dose to man in any consequence analysis either from accidental release of radionuclides or from continuous releases, requires data on the food pathway in the calculations of the total dose. The study of the consequence analysis from an accidental release of radionuclides from ANSTO in the Environmental Impact Survey (EIS, 1998) for the replacement research reactor (RRR) was based on the conservative estimate that 25% of the total eaten was grown within 15 km of ANSTO (PPK, 1998). This same estimate and the dependent dose calculation from the food pathways were also used in the Preliminary Safety Analysis Report (PSAR) for the RRR.

A review of the topography and food production farming within 15 km of ANSTO was required to confirm that the likely impact of radioactive discharges from the RRR is very small or negligible via the food chain pathway. This report updates the information on food production and consumption data for the area to 50 km around ANSTO.

The population distribution estimates submitted with the PSAR were from the 1996 census and were analysed to a circumference of 25 km around ANSTO. This report presents updated population statistics from the 2001 census for the region out to a 50 km circumference from ANSTO. Population projections for every 5 years to 2021 were also requested. The analysis of the population statistics sought to identify any special needs groups within 5 km of the ANSTO site.

Agricultural production and consumption analyses for the Sydney basin region clearly highlight that the previous figure of 25% local consumption is an over estimation and highly conservative when considering the whole of the Sydney basin, but especially for the 15 km circumference around ANSTO. The food produced of the total consumed in the Sydney basin has a range for the fruit and vegetable groups grown in the Sydney region of 0 to 14%. It must also be remembered that much of this production occurs in the Gosford, Hawkesbury and Blue Mountains foothills regions – more than 50 km from ANSTO.

The poultry and egg production and consumption figures for the Sydney basin, while higher (25 to 50%), would contribute a negligible dose in a consequence analysis scenario. Most occurs at distances more than 20 km from ANSTO.

The topography and food production farming within 15 km, 25 km and 50 km around ANSTO was reviewed and analysed. The likely impact to doses from within the food chain pathway of radioactive discharges from the RRR is very low or negligible for all the areas analysed. Almost all food production farming for the Sydney basin is more than 20 km away from the site and constitutes 14% or less of that consumed by the total Sydney population. Even using the EIS and PSAR figure of 25% local consumption, calculations have shown that the contribution to dose from the food pathway for critical groups is very small to negligible.

The population for the 50 km around ANSTO represents close to 90% of the total Sydney Statistical District population. A small portion of the population number (northern part of the Illawarra SD) is additional to the Sydney SD population total. Population distribution estimates for the growing suburbs around ANSTO (Menai, Barden Ridge, Bangor, Illawong and Alfords Point) have been updated and confirmed. The population

distribution in these regions constitutes normal suburban inhabitants. There were no additional radiological critical (special needs) groups identified. This finding is consistent with the conclusions of the reports released in 2002 analysing potential critical groups and analysing the impact of liquid effluent release from ANSTO.

CONTENTS

1. INTRODUCTION

The determination of dose to man in any consequence analysis either from accidental release of radionuclides or from continuous releases, requires data on the food pathway in the calculations of the total dose. The study of the consequence analysis from an accidental release of radionuclides from ANSTO in the Environmental Impact Survey (EIS, 1998) for the replacement research reactor (RRR) was based on the conservative estimate that 25% of the total eaten was grown within 15 km of ANSTO (PPK, 1998). This same estimate and the dependent dose calculation from the food pathways were also used in the Preliminary Safety Analysis Report (PSAR) for the RRR.

A review of the topography and food production farming within 15 km of ANSTO was required to confirm that the likely impact of radioactive discharges from the RRR is very small or negligible via the food chain pathway.

This report updates the information on food production and consumption data for the area to 50 km around ANSTO. Agricultural and food consumption data were obtained from the Australian Bureau of Statistics (ABS, 1999 and 1995, respectively) for the Statistical Districts (Appendix B, Figure 1) surrounding ANSTO: Sydney (Appendix B, Figure 2 and 3) and Illawarra (Appendix B, Figures 4).

The population distribution estimates submitted with the PSAR were from the 1996 census and were analysed to a circumference of 25 km around ANSTO. This report presents updated population statistics from the 2001 census for the region out to a 50 km circumference from ANSTO. Population projections for every 5 years to 2021 were also requested.

The analysis of the population statistics sought to identify any special needs groups within 5 km of the ANSTO site.

2. AGRICULTURAL PRODUCTION AND CONSUMPTION IN THE STATISTICAL LOCAL AREAS AROUND ANSTO

2.1 Method

2.2 25 km Survey

The 25 km survey focussed on the food grown in an area of 25 km radius around ANSTO. Agricultural commodity survey data was obtained from the ABS in 2001 for the Statistical Local Areas (SLA) within the 25 km circle (Appendix B, Figure 5) which registered an agricultural commodity are listed in Appendix D, CD/Table 1. The crop estimate data available from the ABS was for the year ending March 1999.

The SLA's that had crop data included Randwick, Sutherland, Bankstown, Canterbury, Fairfield, Liverpool, Camden, Campbelltown, Wollondilly, Ashfield and Parramatta. However, these data are flawed eg Randwick was given as the location of various cereals being grown and Ashfield as a grape growing area!! Clearly, this was incorrect, and when questioned about this data, the answer from the ABS was that some respondents to the surveys had written their Sydney home addresses not their agricultural property addresses. The ABS also pointed out that the accuracy of some of the data was doubted – some of the standard error estimates are up to 98%. Caution had to be used in analyse of the data, because cropping regimes and total crop harvests can vary greatly.

An added problem was the fact that the 25 km boundary included only parts of some SLAs eg parts of Wollondilly, Camden, Campbelltown and Fairfield where there was considerable agricultural production. The ABS data for these SLAs was for the whole of the SLA. Rather than proportioning crop figures for the 25 km boundary which introduced even greater errors, it was decided to analyse a larger area – the whole of the agricultural production of the Sydney basin.

2.3 Sydney Statistical District Analysis – 50 km +

Agricultural commodities have been analysed for the whole Sydney basin ie the Sydney Statistical District. This ties in very well with the population analysis for a 50 km region around ANSTO (see 2.6 below), which encompasses a large part of the Sydney basin.

The ABS supplied the agricultural data (e-mail Wednesday 21 August 2002) for crop estimates in the Sydney basin for the year ending June 2000. The data included the Sydney basin estimates as a % of the NSW total and also as a % of the Australian total production (Appendix D, CD/Table 2). Within these data, high standard errors of the measures (%) were also reported for some agricultural commodities eg cucumber production standard error 90.3%, swede production standard error 95.1%. This, along with the different year harvests for the SLA's (1999) and the Sydney basin (2000), led to a few conflicting results in the comparison of the production in the SLA's with the Sydney basin production (a few crops harvests reported for the SLA's were larger than the total recorded for the whole Sydney basin). This, however, did not have a great impact when the commodities were grouped (see section 2.4 for an explanation of the groups). The NSW Department of Agriculture has also produced a report of the food production in the Sydney basin (Gillespie and Mason, 2002), which corroborates the current findings and the difficulty of obtaining accurate and reliable data. A summary of their findings is reproduced in Appendix C.

2.4 Illawarra Statistical District Analysis

As ANSTO is located to the south of the Sydney basin, there is a marginal overlap with the Illawarra Statistical Division at the 25 km circumference. This overlapped area (from Coledale north) is mainly escarpment where former coal mining existed. The top of the escarpment is water catchment area for the Woronora Dam. This area contains minimal agriculture – one chicken farm (Helensburgh) and some small mushroom producers, also at Helensburgh. At the 50 km boundary (Appendix B, Figure 5), more of the Illawarra Statistical District is included and considered in the results.

2.5 Sydney Food Production Compared to Sydney Consumption

The SLA and Sydney basin data were stratified into the food groups used by the RadCon model (Crawford et al, 2000), specifically: ground fruit (fruit and vegetables grown on or near to the ground), root crops (such as onions, carrots, swedes, etc), leafy vegetables (whole vegetable is eaten eg lettuce, cabbages, etc) and tree fruit (Appendix A, Table 1). Produce was put into these categories to group the method of radiological contamination for consequence analysis. The total food eaten by the Sydney population (ABS 1999, 2002), in each category, was determined and presented as a % of total NSW production and as a % of total Australian production. These 2 percentages (NSW and Australian) demonstrate how much of each food item and food group, consumed in the Sydney basin, is produced locally. In fact the Sydney basin grows only a small proportion of the national agricultural produce that is consumed in Sydney. Much of the agricultural produce sold in Sydney supermarket chains (such as Woolworths) is purchased directly from farms all over

Australia and brought to Sydney in refrigerated trucks. Some seasonal agricultural products are imported (eg strawberries from California). The analysed data are presented in Table 2 (Appendix A).

Only limited individual food consumption data were available in the ABS publication (ABS 1999). However, by sorting the food into the specific groups, the percentage of the food produced in Sydney against that consumed by the total population of Sydney was able to be calculated and is presented in Table 3 (Appendix A).

Further analyses of the SLAs were then compared with the Sydney basin agricultural commodities production (Appendix A, Table 4).

A simple calculation for each food category indicates the percentage of the food group grown in Sydney contributing to the total consumed by the Sydney population annually. The calculation is given below:

$$\frac{SP}{SC} \times 100 \quad = \quad \% \quad TC$$

where SP = total produced in Sydney of that food group per year (kg)

SC = total consumed by Sydney population (4,140,820 June 2001) of that food group per year (kg)

TC = percent food group grown in Sydney of the total consumed by Sydney population

2.6 Results

2.6.1 Food groups, Sydney production and %NSW and Australia

The analysis indicates that for the data collection years of 1999 and 2000, the percentages and species of food grown in the Sydney basin may vary from year to year, as it does for the rest of Australia, depending on climate and the economy of the produce

From the grouped data in Table 1 (Appendix A), the fruit (and/or vegetables) grown on or near the ground (ground fruit) grown in the Sydney basin average 13% of the NSW total production and 1% of the Australian total production. Strawberry production in the Sydney basin is 81% of the NSW total production but less than 1% of the total Australian production, with much of the strawberry crop sold in Sydney coming from regions in Queensland and northern NSW.

The Sydney basin also produces over 20% of the NSW total production of capsicum, cauliflower, zucchini, watermelons and tomatoes but none of these crop production totals are greater than 5% of the Australian total. For the root crops the Sydney basin production is over 50% of the total NSW production but just over 5% of the total Australian production. The results are similar for the leafy vegetables, 43% and 4% respectively of NSW and Australian production (parsley over 90% of NSW production which agrees with Appendix C.2.4), and tree fruit with 40% and 5% respectively of NSW and Australian total production.

Peaches and nectarines deserve a special mention, as these are two of the agricultural commodities which, in the Sydney basin, account for over 10% of the total Australian production (10% and 15% respectively). The Sydney basin produces only 4% of the total of NSW potatoes and 3 to 6% of the total NSW milk (3.4% from the data, and approx. 6% quoted in Appendix C.2.1).

Pork production in the Sydney basin is also 4% of the total NSW production, with lamb and beef both under 1% of total NSW production. It is the poultry production in the Sydney basin that is high, with 40% of the NSW total and 17% of the Australian total production. Eggs are similar with over 30% of NSW and over 10% of Australian Total production.

2.6.2 Illawarra agricultural production

The Illawarra produces only 1.6% of the total NSW gross value agricultural commodities. However, the most southern and western statistical local areas (Wingecarribee and Shoalhaven, which are outside the 50 km distance from ANSTO) together account for 12.2% of the NSW cattle for milk production (ABS 1999b). So, even when the larger circumference around ANSTO is considered, the impact of the food produced in the Illawarra region would be minimal.

2.6.3 Food consumption in the Sydney basin

The food consumption result for the Sydney basin is clearly variable for the different food groups – Table 2 (Appendix A). The data for this table were summarised from the ABS publication 4804.0 – National Nutrition Survey, Foods Eaten, Australia, 1995.

For the Sydney basin, the total consumption of specific foods, the Sydney basin production and the % of one to the other are presented in Table 3 (Appendix A). For the fruit and vegetables grown near or on the ground (ground fruit), around 5% of the total eaten by the Sydney population is grown in the Sydney basin. This is also true for the root crops and tubers. The Sydney basin produces more of the leafy vegetables (eg lettuces and parsley) than it requires – around 14%.

From the 1999 and 2000 data, the Sydney basin produces about 13% of the fruit that it consumes, with a high production of citrus (57%) and stone fruit (31%). The citrus and stone fruit production figures seem high. This could relate to the different production years analysed, or to the fresh fruit consumption and excludes tinned products, jams and juices which would be grown mostly outside the fruit fly zone.

The Sydney basin produces about 30% of the poultry meat that it consumes and over 40% of the eggs.

The total production within 25 km of ANSTO using the ABS data was also attempted. The production in the truly agricultural statistical local areas (SLAs – Fairfield, Liverpool, Camden, Campbelltown, Wollondilly) was compared to the production from the Sydney basin (Appendix A, Table 4.). The large errors and different production years for the 2 sets of data produced anomalies such as Camden producing 104% of the total Sydney production of cauliflowers and 279% of Chinese cabbage! Consequently, the comparison is not totally quantitative, but certainly gives an indication of the relative production of these SLA's, with leafy vegetables being at the top of the list for Camden and Wollondilly – between 50 to 100%. Fruit production is at the bottom – less than 3% for all 5 SLA's, even though the production of apples and Nashi pears is between 25 and 45% of Sydney

production for Campbelltown and Wollondilly. It must be noted that the bulk of the Wollondilly area is actually outside the 25 km circumference; none of this agricultural area is within the 15 km circumference from ANSTO.

Tuber production (potatoes) is less than 25% for the Wollondilly SLA. Ground fruit production is about 10% for the Liverpool SLA, with strawberries at just over 40%. For the Camden SLA, ground fruit production averages over 40% of the total Sydney basin production, with cauliflower being the crop produced almost solely in this SLA during this data collection period. These areas are all 20 km or greater from the ANSTO site.

The conclusions from these analyses are presented in Section 4.

3. POPULATION STATISTICS FOR THE STATISTICAL LOCAL AREAS AROUND ANSTO

3.1 Method

Population analysis has been determined for the region with a 50 km radius around ANSTO. A map was drawn with concentric circles to give zones A to K with the following distances: A 1.6 – 3.2 km; B 3.2 – 4.8 km; C 4.8 – 10 km; D 10 – 15 km; E 15 – 20 km; F 20 – 25 km; G 25 – 30 km; H 30 – 35 km; I 35 – 40 km; J 40 – 45 km; K 45 – 50 km. The circles are divided into 16 equidistant sectors, with sector 1 at the top and due north in it's centre, Figure 5 (Appendix B). This map also shows population concentrations by sectors and by collection districts.

Zones A and B have been expanded in the next 2 maps (Appendix B, Figure 6 and 7) and also show population concentrations by sectors and by census collection districts (CCD) – the seven digit numbers being the collection district number.

The population numbers and their breakdown by ages and gender for each zone, A to K, are given in a large spreadsheet (Appendix D, CD/Table 3). Extracts of the population data are presented in the results. Where a CCD spanned two segments, the population numbers were added to the segment that already had the larger population number for that CCD.

3.2 Results

The data provided for the 50 km circumference around ANSTO were summarised to give total population numbers for each segment at each 5 km progressive circumference (Appendix A, Table 5). The total population for 50 kms around ANSTO is 3.7 million people. The population total for the 50 km circumference is almost 90% of the total Sydney basin population.

Population of the Sydney Statistical Division, 31 June 2001 (ABS 2002):

Total (including visitors)	4140820

By age

0 to 4 – infants	265,175
5 to 9 (A)	269,909

10 to 14 (B)	263,742
children (A+B)	533,651
Adults (14 +)	3,341,994

The population totals for each segment were also projected for the years 2006, 2011, 2016 and 2021 using the ABS estimates. The tables are presented on the CD/Table 4 (Appendix D). The projections were made using standard techniques that the ABS employs – specialised planning and development information was not taken into account.

4. CONCLUSIONS

Agricultural production and consumption analyses for the Sydney basin region clearly highlight that the previous figure of 25% local consumption is an over estimation and highly conservative when considering the whole of the Sydney basin, but especially for the 15 km circumference around ANSTO. The food produced of the total consumed in the Sydney basin has a range for the fruit and vegetable groups grown in the Sydney region of 0 to 14%. It must also be remembered that much of this production occurs in the Gosford, Hawkesbury and Blue Mountains foothills regions – more than 50 km from ANSTO.

The poultry and egg production and consumption figures for the Sydney basin, while higher (25 to 50%), would contribute a negligible dose in a consequence analysis scenario because the grain used to feed the poultry is grown either in country NSW or interstate. Also, this is only one food of the many consumed annually by an individual. Some poultry and eggs produced free-range, but this is a small percentage of the total poultry and egg production, and mostly occurs at distances more than 20 km from ANSTO.

The topography and food production farming within 15 km, 25 km and 50 km around ANSTO was reviewed and analysed. The likely impact to doses from within the food chain pathway of radioactive discharges from the RRR is very low or negligible for all the areas analysed. This statement is justified by the results of this analysis, verifying that almost all food production farming for the Sydney basin is more than 20 km away from the site and constitutes 14% or less of that consumed by the total Sydney population. Even using the EIS and PSAR figure of 25% local consumption, calculations have shown that the contribution to dose from the food pathway for critical groups is very small to negligible (Domel, *et al*, 2002).

The population for the 50 km around ANSTO represents close to 90% of the total Sydney Statistical District population. A small portion of the population number (northern part of the Illawarra SD) is additional to the Sydney SD population total. Population distribution estimates for the growing suburbs around ANSTO (Menai, Barden Ridge, Bangor, Illawong and Alfords Point) have been updated and confirmed. The population distribution in these regions constitutes normal suburban inhabitants. There were no additional radiological critical (special needs) groups identified. This finding is consistent with the conclusions of the Critical Groups report (Domel, *et al*, 2002) and the report analysing the impact of liquid effluent release from ANSTO (Airey and Domel, 2002).

5. REFERENCES

Airey P.L. and Domel R.U. (2002). Assessment of the Radiological Health Risk associated with ANSTO Effluent Release: including the Reuse of Tertiary Treated Sewer Water and Sludge and the Impact of Effluent Entering Local Waterways with Sewer Surcharge. ANSTO EMAP/TN-02 rev 4. March, 2002.

Bray G. W. (1999) Regional Statistics, New South Wales 1999. *Australian Bureau of Statistics 1304.1*, 1999.

Domel R.U., Airey P.L., Barton R.J., G.H. Clark G.H., Ferris J.M. (2002). Critical Group Assessments for Radionuclide Discharges from ANSTO. Environmental Management Project, ANSTO EMAP/TN-01/2002 rev 6. August, 2002

McLennan W. and Podger A. (1998). National Nutrition Survey: Foods Eaten, Australia 1995. *Australian Bureau of Statistics 4804.0*, 1999.

McLennan W. (2002). Population, Australia 2001. *Australian Bureau of Statistics* .19 Nov.2002 .

APPENDIX A. *TABLES*

Table 1. Food Groups, Sydney Production, % NSW and % Australian Production

Food Group	Sydney Foods Grown	Sydney Prodn. (kg)	% NSW	% Australian
GROUND FRUIT	beans (fresh and market)	18748	1.5	0.09
	broccoli	237400	11.3	0.61
	capsicum +	211851	23.5	0.49
	cauliflower	3728200	33.1	4.9
	cucumber	326336	3.4	1.9
	marrows +	7842	11.9	0.4
	zucchini	264467	20.9	2.1
	melons (rock)	102900	0.63	0.12
	watermelons	2051700	26.8	2.4
	peas	3108	2.3	0.4
	pumpkins	932100	4.5	0.9
	corn	1159000	8.1	2.6
	tomatoes	708500	29.1	0.55
	blueberries	5349	0.37	0.28
	raspb	401	0.87	0.06
	strawb	95477	81.0	0.65
	Total	9853378		
	Average%		**12.7**	**1.2**
ROOT CROPS	leeks	219390	57.8	4.5
	onions	149990	77.9	3.4
	swedes	558900	69.4	12.7
	carrots	1405700	9.1	0.5

	Average%	2333980	**53.6**	**5.3**
LEAFY VEG.	cabbages	3072000	27.5	4.5
	ch cabb	98400	9.6	1.2
	lettuce	4243900	35.9	2.79
	parsely	105921	99.49	6.2
	Average%	7520221	**43.1**	**3.7**
TREE FRUIT	citrus	17387140	6.8	2.718
	nashi	94405	6.5	0.05
	pome	1542678	2.6	0.48
	avocado	234751	4.8	0.98
	cherries	3858	0.13	0.07
	nectarines	3726960	30.0	10.3
	peaches	4073721	32.3	14.7
	plums	209455	4.8	1.2
	kiwi fruit	10269	55.1	0.23
	Average%	27283237	**39.9**	**4.8**
TUBERS	potatoes	6541800	4.2	0.55
MILK			3.4	not given
BEEF			0.65	0.15
PORK			4.0	1.1
LAMB			<1	
POULTRY		34047090	39.8	16.9
EGGS (DOZ)		21844631	34.2	12

Table 2. Total Sydney SD Food Consumption (organised in Food Groups)

Australia: Foods Consumed	g per day per person	g per year per person	kg per year per person	Total for Sydney Population (kg)
Fruit Products and dishes				
pome fruit	43.3	15804.5	15.80	65443590
berry fruit	2.1	766.5	0.77	3173939
citrus fruit	20.1	7336.5	7.34	30379126
stone fruit	17.1	6241.5	6.24	25844928
tropical fruit	30.4	11096	11.10	45946539
other fruit	21.2	7738	7.74	32041665
mixtures	5.6	2044	2.04	8463836
dried, preserved fruit	2.7	985.5	0.99	4080778
Vegetable products and dishes				
potatoes	89.3	32594.5	32.59	134967957
cabbage, cauli, + similar	21.8	7957	7.96	32948505
carrot and root veg	21.8	7957	7.96	32948505
leaf and stalk veg	16.8	6132	6.13	25391508
peas and beans	18.7	6825.5	6.83	28263167
tomato and tomato prod.	33.4	12191	12.19	50480737
other fruiting veg.	28.9	10548.5	10.55	43679440
other veg. and combins	23.9	8723.5	8.72	36122443
dishes of mostly veg.	4.3	1569.5	1.57	6499017
Legumes and pulses	9.8	3577	3.58	14811713

NB Mushrooms were not included as a separate category in the ABS publication (ABS 1999).

Table 3. Percentage of food produced in Sydney against that consumed in Sydney

Australian: Foods Consumed (grouped as in RadCon)	Sydney Consumption	Sydney Production	Sydney Amount produced of total consumed %
Ground fruit			
berry fruit	3173939	101227	3.2
peas and beans	28263167	21856	0.1
tomato and tomato prod.	50480737	708500	1.4
other fruiting veg.	43679440	-	-
other veg. and combins	36122443	-	-
dishes of mostly veg. 1/3	12040814	-	-
cauli, + similar 1/2	16474252	-	-
Legumes and pulses	14811713	-	-
Total ground fruit	**205046505**	**9853378**	**4.8**
Root crops			
carrot and root veg	32948505	-	-
dishes of mostly veg. 1/3	12040814	-	-
Total root crops	**44989319**	**2333980**	**5.2**
Leafy veg			
cabbage	16474252	-	-
leaf and stalk veg	25391508	-	-
dishes of mostly veg. 1/3	12040814	-	-
Total leafy veg	**53906575**	**7520221**	**14.0**
Tubers			
potatoes	134967957	**6541800**	**4.8**
Tree fruit			
pome fruit	65443590	-	-

citrus fruit	30379126	17387140	57.2
stone fruit	25844928	8010136	31.0
tropical fruit	45946539	-	-
other fruit	32041665	-	-
mixtures	8463836	-	-
dried, preserved fruit	4080778	-	-
Total tree fruit	**212200462**	**27283237**	**12.9**
Poultry			
poultry meat	127537256	**34047090**	**26.7**
eggs (doz)	49689840	**21844631**	**44.0**

NB The dashes indicate that these details were not calculated.

Table 4. Comparison of agricultural production in selected statistical local areas within a 25 km circumference around Sydney, with Sydney basin production.

	Sydney Measure ()	Fairfield Measure ()	%S	Liverpool Measure()	%S	Camden Measure ()	%S	Campbelltown Measure ()	%S	Wollondilly Measure ()	%S
Tubers											
Potatoes - early/spring harvest before 31 March - Production (t)	6541.8									1500	22.9
Potatoes (main/autumn) harvested after 31 March - Production (t)										217	
Potatoes - Total production (t)										1717	
Ground fruit											
Capsicum, chillies and peppers - Production (kg)	211851.3					62135	29.3				
Cauliflower - Production (kg)	3728200					3871000	103.8			400000	10.7
Cucumbers - Production (kg)	326335.6			127000	38.9						
Marrows, squashes and zucchinis - Production (kg)	264466.6	33830	12.8	101600	38.4	59500	22.5				
Melons, water - Production (kg)	2051700										
Melons, bitter (gourd) - Production (kg)				127							
Pumpkins, triambles, trombones, etc. - Production (kg)	932100	242000	26.0			762	0.1				
Sweet corn - Production (kg)	1159000					279000	24.1				

Tomatoes - Total production (kg)	708500	7000	1.0								
Strawberries - Production (kg)	95476.7	40679	42.6								
	9853378	**1025009**	**10.4**	**236569**	**2.4**	**4272397**	**43.4**				
Mushrooms - Production (kg)	10715662					22609	0.2	28261	0.3		
Root crops											
Carrots - Production (t)	1405.7									500	35.6
Beetroot - Production (t)		20									
Parsnips - Production (t)		19									
Leafy vegetables											
Cabbages - Production (kg)	3072000	184000	6.0			1276000	41.5			1503000	48.9
Chinese cabbage (Buckchoi and Wombak) - Production (kg)	98400			612000	622.0	274550	279.0				
Lettuce - Production (kg)	4243900	138000	3.3			4193000	98.8			3350000	78.9
TOTAL Sydney production of leafy vegetables	**7520221**									**4853000**	**64.5**
Tree fruit											
Oranges, valencia - Production (kg)	5328107									151692	2.8
Oranges, total production (kg)	14033202									151692	1.1
Citrus fruit - Total production (kg)	17387140									151692	0.9

Apricots - Production (kg)								479				
Nectarines - Production (kg)	3726960							20339	0.5			
Peaches (fresh market) - Production (kg)	4073721					57292	1.4	64607	1.6			
Peaches - Total production (kg)	4079399					57292	1.4	64607	1.6			
Plums - Production (kg)	209455.3					34375	16.4	14357	6.9			
Plums and prunes - Total production (kg)	210455.3					34375	16.3	14357	6.8			
Apples (nec) - Production of fresh fruit (kg)										2748		
Apples -total production (kg)	1542678							22500	1.5	414561	26.9	
Apples - Production for processing (kg)								2000		45000		
Apples -total production of fresh fruit (kg)												
Pears (nec) - Production of fresh fruit (kg)								20570		1000		
Pears (incl Nashi) - Total production of fresh fruit (kg)	94405							27980	29.6	41100	43.5	
TOTAL Sydney production of tree fruit	**27283237**					**91667**	**0.3**	**150262**	**0.6**	**607353**	**2.2**	
Grapes, total production for winemaking/distillation (t)	1658			2		197						

Grapes, total production for other uses (t)	103							6			
Grapes, total production (fresh weight) (t)	1760			2		197	11.2	6			
Eggs produced for human consumption (Doz)	21844631	2155252	9.9	2383983	10.9	3634501	16.6				
Other interesting data											
Irrigation, vegetables - Area (ha)	1133.1	17	1.5			95	8.4			185	16.3
Irrigation, fruit (incl. nuts) - Area (ha)	1549.1					7	0.5	19	1.2		
Irrigation, grapevines - Area (ha)	254.3					44	17.3				
Irrigation - Total area reported (ha)	8219.8	62	0.8	159	1.9	1534	18.7	1597	19.4	2946	35.8
Irrigation, total area (ha)	9103.8	62	0.7	159	1.7	1534	16.9	1597	17.5	2946	32.4
Vegetables for human consumption - Area (ha)		51		75		755		0		200	
Vegetables for human consumption - Total area (ha)	1657.6	51	3.1	75	4.5	755	45.5	0		200	12.1
Vegetables, other (not elsewhere classified) - Area (ha)	110.9			18	16.2						
All fruit (excluding grapes) - Total area (ha)	2396.3	5	0.2			7	0.3	25	1.0	6	0.3
Fruit (including grapes) - Total area	2661.3	5	0.2			51	1.9	31	1.2	6	0.2

(ha)											
Horticultural crops, total area (ha)	6489.7	117	1.8	120	1.8	892	13.7	31	0.5	253	3.9
Wool production (kg)	124470.2			2577	2.1	70	0.1			4803	3.9
Honey (including honey comb), total (kg)		600									
Beeswax (kg)		20									

%S = Percent of Total Sydney Production

Table 5. Population totals for each segment of the 50 km

	A, km	B, km	C, km	D, km	E, km	F, km	G, km	H, km	I, km	J, km	K, km	
Sectors	1.6 – 3.2	3.2 - 4.8	4.8 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50	Totals
1	0	0	4100	23830	71128	102181	130945	125615	86257	14252	9075	567383
2	0	1699	12807	60596	108685	110434	101886	137689	107851	57822	14816	714285
3	0	5442	23001	71783	135629	155971	228556	204818	72205	76888	30264	1004557
4	0	3283	29709	38464	33184	17204	115239	26268	0	1278	0	264629
5	2707	5511	17259	46175	17632	815	0	0	0	0	0	90099
6	2347	3408	0	519	2091	0	0	0	0	0	0	8365
7	1236	2223	1407	39	0	0	0	0	0	0	0	4905
8	913	1868	849	0	279	0	0	0	0	0	0	3909
9	0	0	426	2316	5144	540	6326	8173	12341	9374	8994	53634
10	15	0	0	0	0	0	1748	9878	20733	34163	30567	97104
11	0	0	0	319	0	1781	0	1231	506	1913	2554	8304
12	0	0	0	6290	31875	867	1622	1371	4400	7338	1978	55741
13	0	0	433	28335	27516	20231	11213	926	2363	2033	0	93050
14	0	0	1056	28802	10040	2516	2217	1463	6369	0	0	52463
15	0	0	4260	22456	32313	7035	2804	6668	19427	68197	22786	185946
16	0	0	326	39957	105947	81308	9697	98014	120759	23056	18903	497967
Total	7218	23434	95633	369881	581463	500883	612253	622114	453211	296314	139937	3702341

APPENDIX B. FIGURES

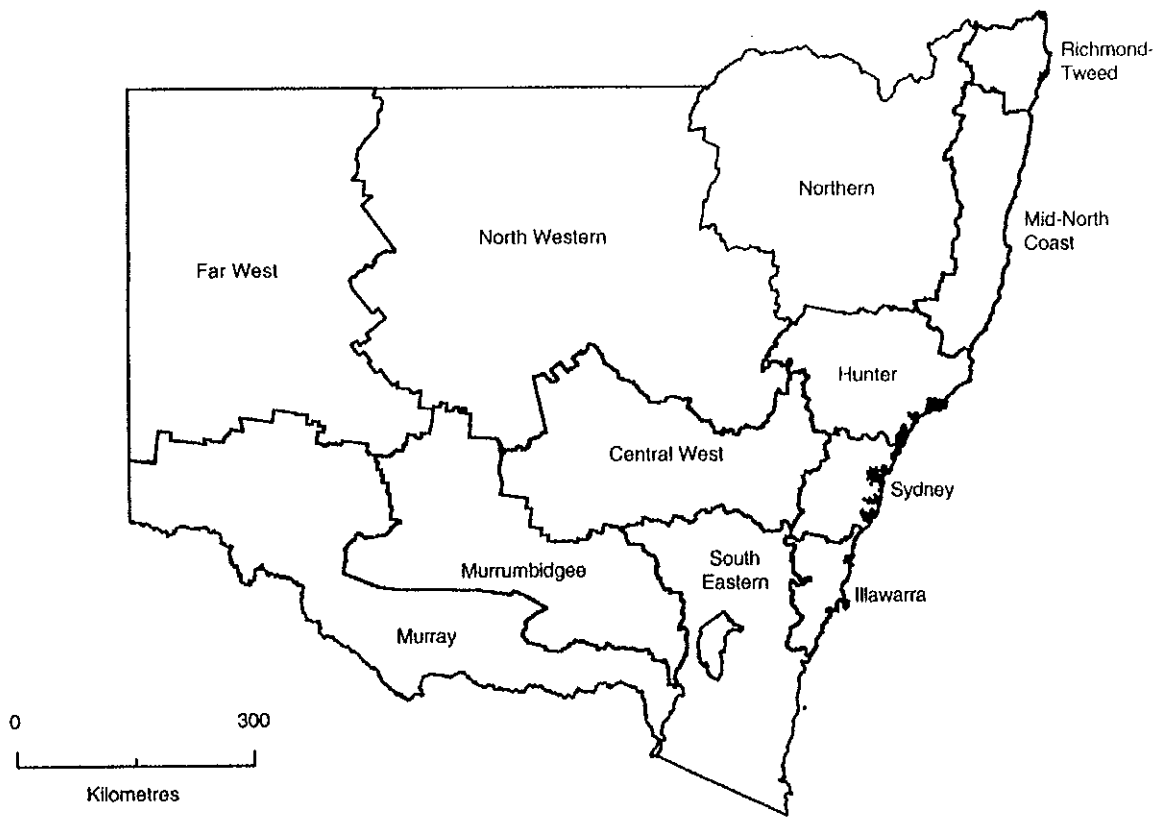

Figure 1. NSW showing Statistical Districts

Ref. ABS, 1999.

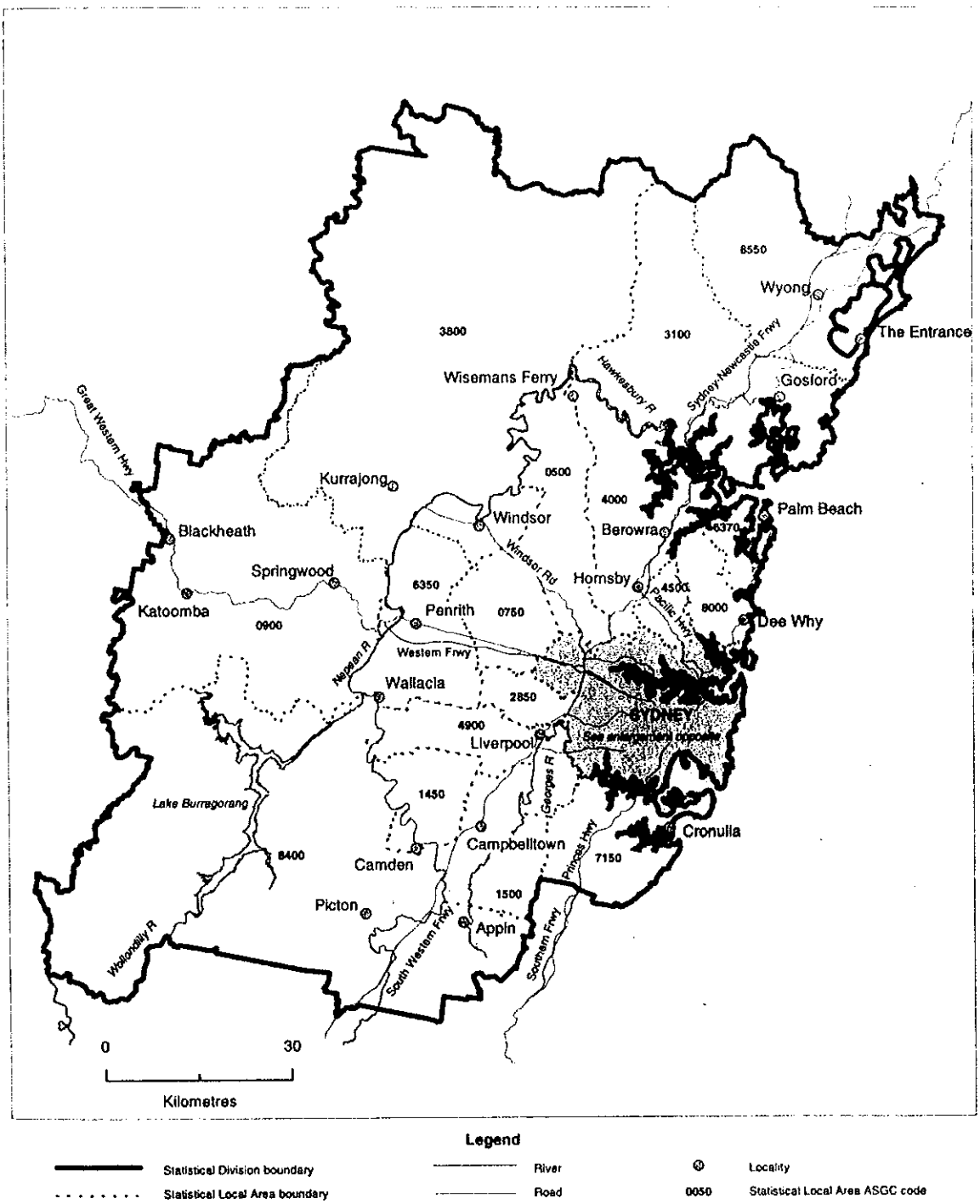

Figure 2. Sydney Statistical District showing Statistical Local Areas

Ref. ABS, 1999.

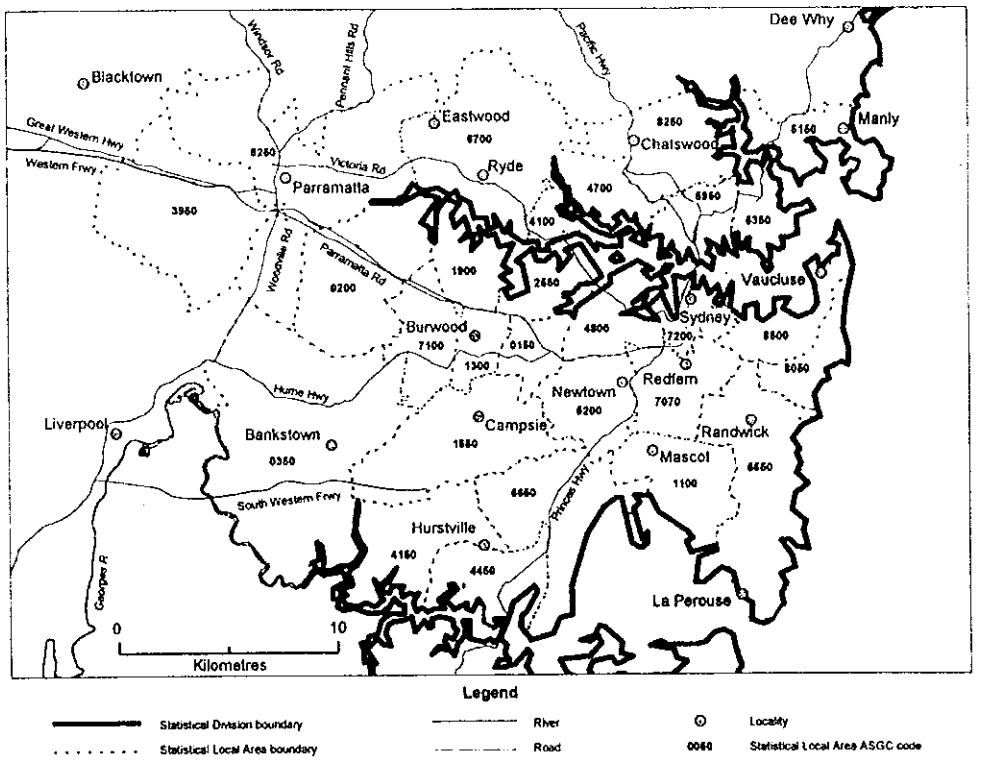

Figure 3. Inner Sydney Statistical Local Areas. Ref. ABS, 1999.

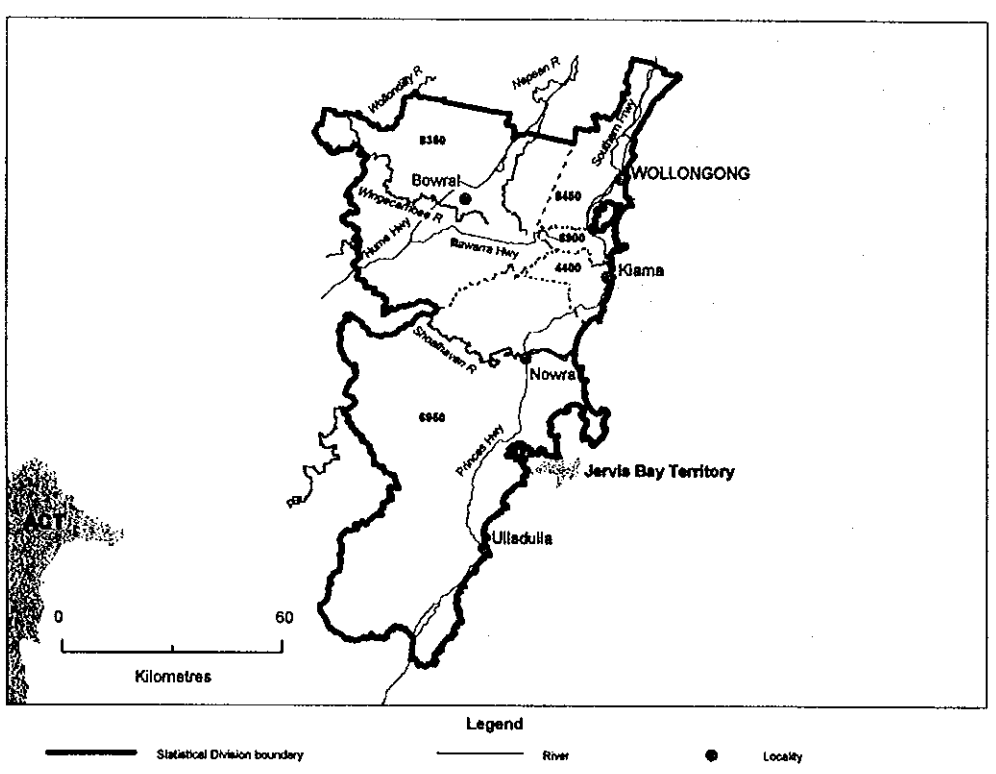

Figure 4. Illawarra Statistical District showing Statistical Local Areas. Ref ABS, 1999.

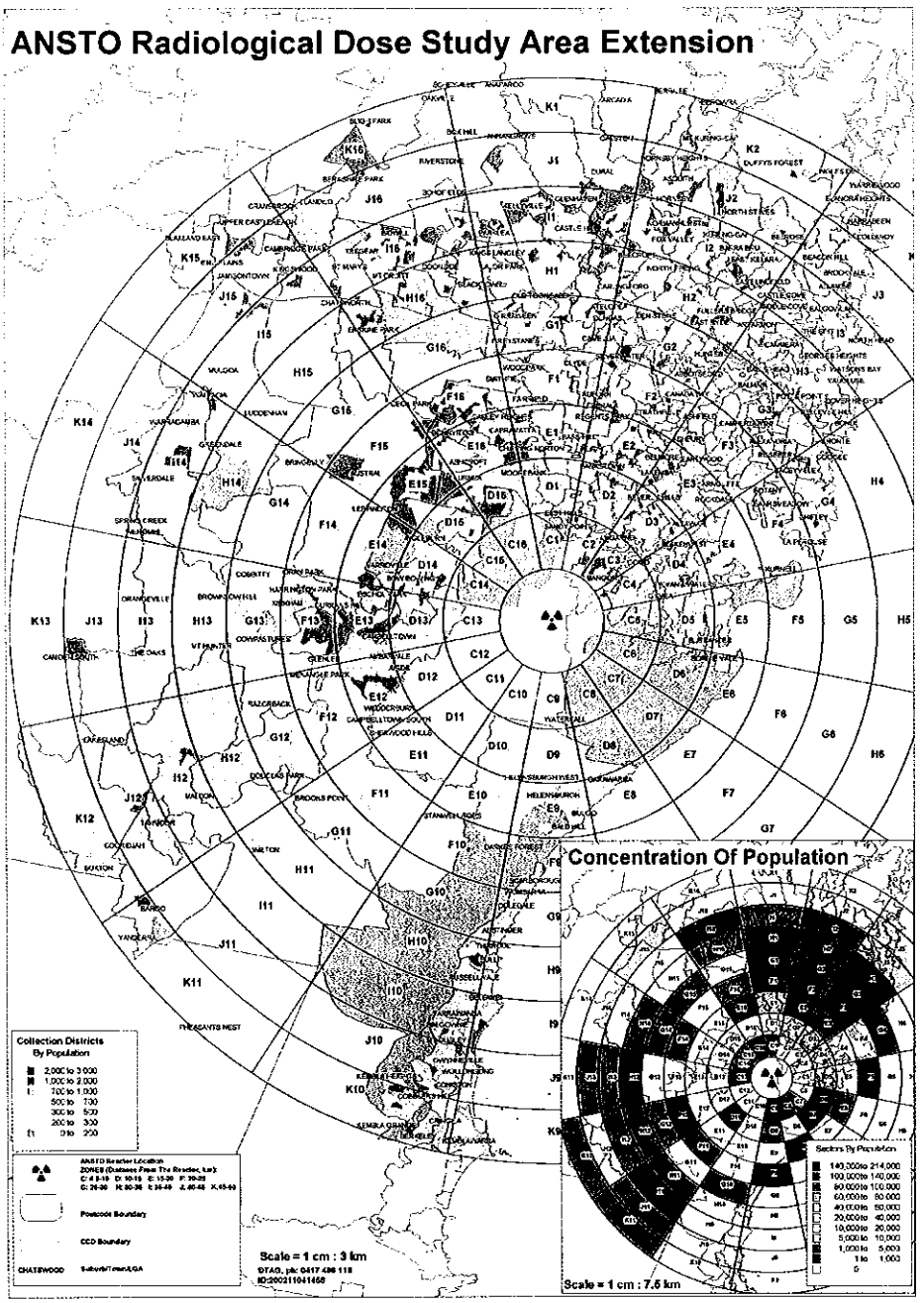

Figure 5. Population concentrations in zones out to 50 km around ANSTO

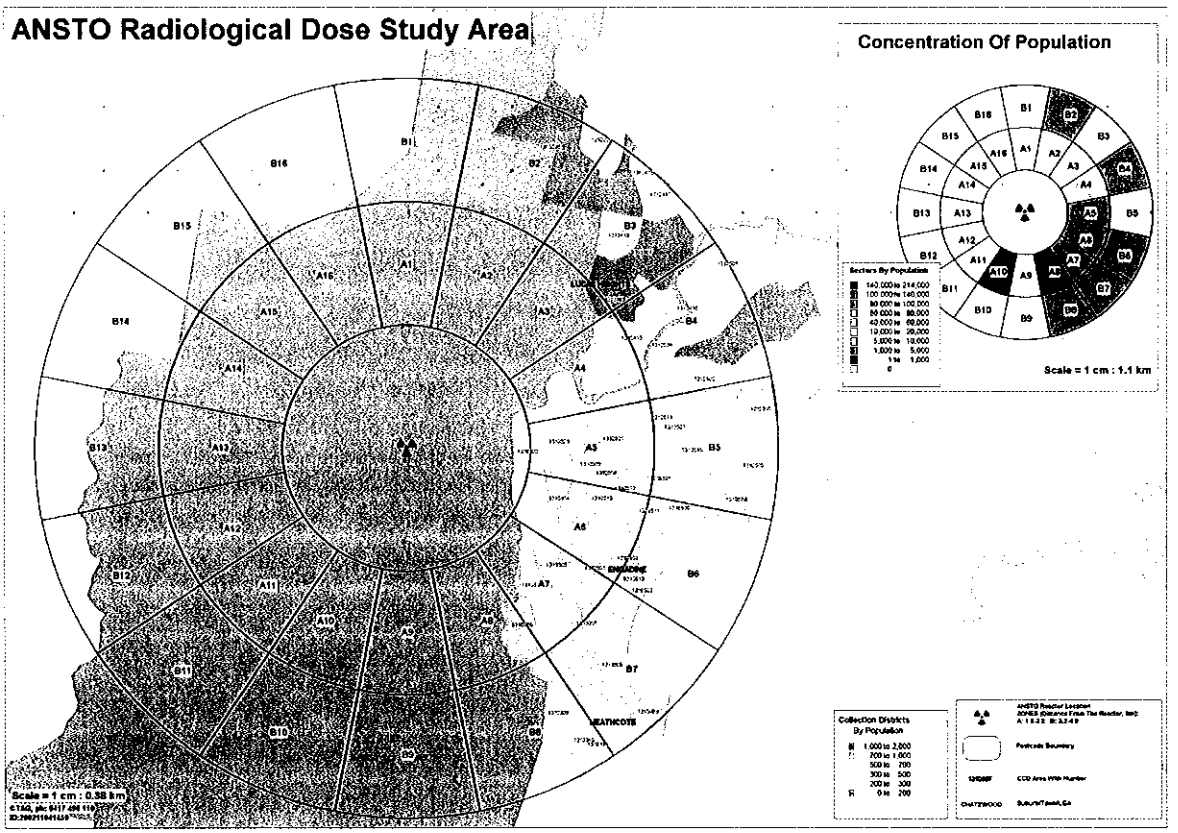

Figure 5. Population concentrations in zones A (1.6 – 3.2 km) and B (3.2 – 4.8 km) around ANSTO

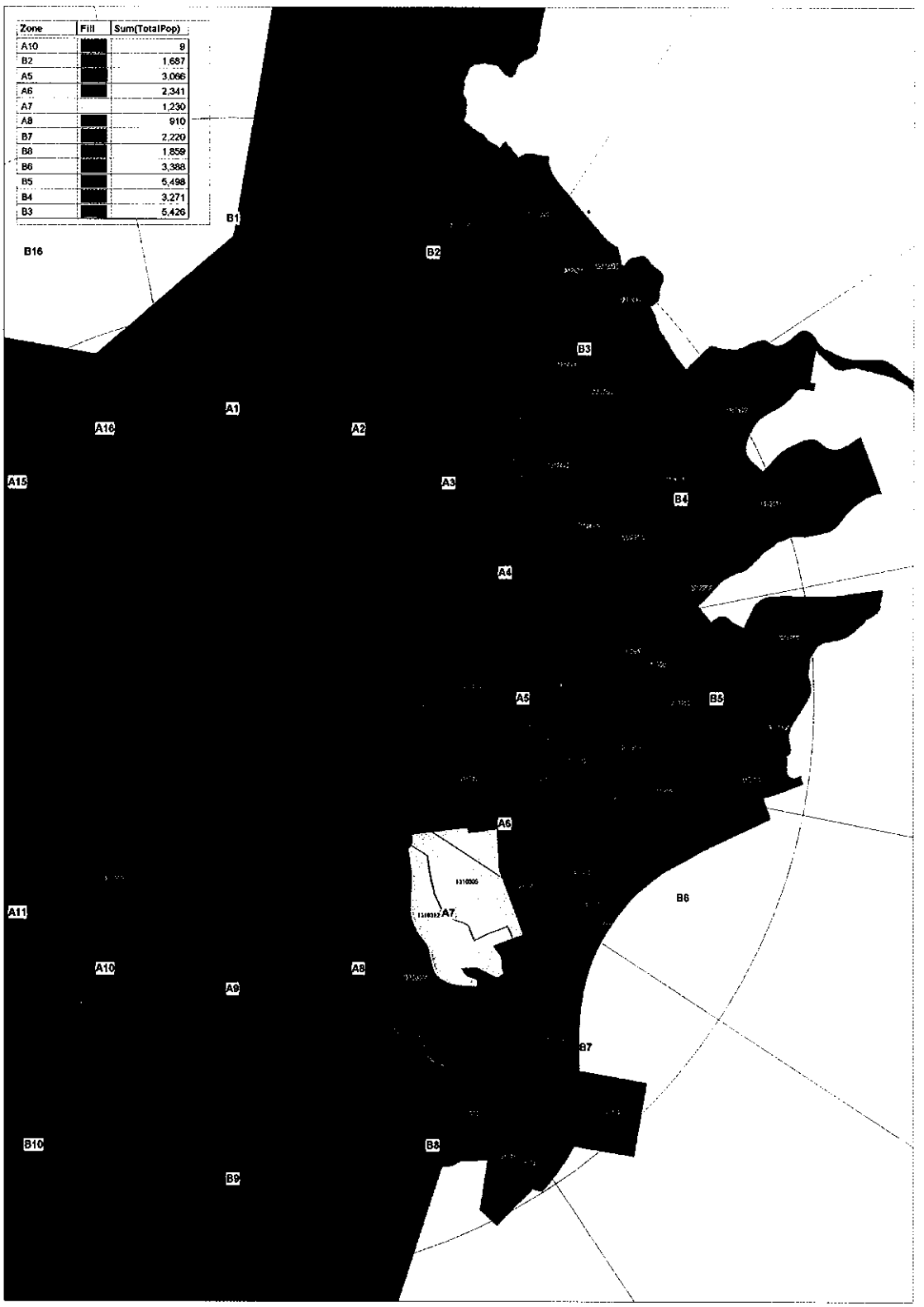

Figure 7. Population numbers for proximal CCD's in zones A (1.6 – 3.2 km) and B (3.2 – 4.8 km) around ANSTO. The colours clearly distinguish the CCDs within each sector.

APPENDIX C. SYDNEY BASIN INDUSTRY DETAILS

Provided (e-mail Thursday 27 June 2002) by David Mason, Chair, Hawkesbury Harvest

APPENDIX C..1.1 SITUATION

- The farm gate value of the food, landscape and floral agricultural industries in the Sydney basin (Greater Western Sydney plus the Hornsby Shire) is $1069+ million p.a. This figure does not include exotic industries such as deer and alpacas nor the trotting, thoroughbred and recreational horse industry which some believe could be worth at least half as much again

- $1069 million represents 14% of the State's agricultural production. The area (including that utilised by urban, industry and associated infrastructure) represents approx 2% of NSW's total land area

- The economic activity in the basin generated from the industries listed below is $4.4+ billion p.a.

- The number of on-farm jobs with those industries is 11, 490+ consisting of 7295+ NESB people, 2580+ being first generation

- The Sydney community consumes the greater majority of the fresh food, landscape and floral products produced in the basin. This represents a significant contribution to the 'food security' value which is fundamental to the 'sustainable city' concept

- Technologies, best management practices and education programs exist and are being improved upon through research and on-going revision that enable agriculture in the basin to compete with other forms of land use on a triple bottom line basis. These technologies address the need for more intensive agriculture

- Distinct areas of lands in the basin lend themselves to certain types of agriculture:

    - Turf and vegetable production on the flood plains

    - Small farm (home based small business) production, processing and marketing on the perimeter of Sydney providing for agritourism, regional industry development and marketing (including produce grown on the flood plains) as is happening with Hawkesbury Harvest

    - Land suitable for hi-tech industrial type agriculture

- Existing agriculture and the potential agriculture in the basin requires a number of things for it to become sustainable and in so doing optimise its

contribution to the quality of life of Sydney residents. It requires security of tenure (a fundamental principle of sustainability) to encourage investment in environmentally friendly practices (rather than through fear of prosecution). Security of tenure is also a prerequisite for investment in emerging agricultural technologies. The principle of equity (another fundamental principle of sustainability) for agriculture and the people involved also needs to be fully addressed. These two principles together with the principle of security of resource are essential to Sydney becoming a sustainable city through the many social economic and environmental benefits provided by sustainable agriculture

APPENDIX C..2 INDUSTRY DETAIL

APPENDIX C..2.1 Dairy Industry

- 33 dairy farms between Kurrajong and Bargo
- The labour force is 250 full time units
- The number of NESB workers across all generations is between 40 and 50
- Total milk production is 72 million litres of milk per annum worth $23 million. This represents approx 6% of the State's production
- The multiplier factor for the dairy industry is 5 thus contributing in the order of $100 million per annum to the Sydney basin economy
- Sale of adult animals and bobby calves for meat is worth another $1.5 million per annum
- There are four dairy factories within the area, two of which are the biggest liquid milk processors for Sydney and NSW and one is the main processor for short shelf life products for NSW. They rely on supply from the farms close to the Sydney area to minimise transport costs.

APPENDIX C..2.2 Mushroom Industry

- Mushrooms are the second most valuable fresh vegetable industry in Australia behind potatoes
- 26 of the state's 40 growers are located in western Sydney
- Western Sydney produces 12000 tonnes of mushrooms per annum which is 80% of the state's mushroom production
- The farm gate value of this production is $45.5 million per annum
- The multiplier factor for the mushroom industry is 5 thus contributing $227.5 million per annum to the Sydney basin economy

- Between 600 and 700 people are employed directly by the industry in western Sydney
- At least 80% of those employees are of NESB with 75% being first generation
- Sydney imports mushrooms from Victoria because of a short fall in supply. poor planning provisions has seen the demise of a significant number of mushroom farms and taken the Sydney basin from a net exporter of mushrooms to a net importer.
- The Tolson group in the Hawkesbury supplies 50% of Australia's export market. this represents 7% of the Tolson group's total production
- The mushroom industry in the Hawkesbury is as big an employer as the RAAF and UWS Richmond (individually)

APPENDIX C..2.3 Fruit Industry

- 1500 people are employed on the 600 fruit farms in the Sydney basin (including the owners and family members who work on the farms)
- At least 100 are 2nd + generation NESB
- All fruit produced in the Sydney basin is consumed in the basin
- The farm gate value of the fruit is $100 million per annum which with a conservative multiplier factor of 2 contributes in the order of $200 million per annum to the Sydney basin economy

APPENDIX C..2.4 Vegetable Industry

- The farm gate value of the vegetable industry in the Sydney basin is worth $200 million per annum with a conservative multiplier factor of 2.5 contributing up to $500 million dollars to the Sydney basin economy
- At least 3000 people are employed full time in the industry
- 85-90% of those people are of NESB
- 80% of the NESB people are first generation
- 90% of the fresh leafy vegetables and herbs consumed in Sydney are produced in Sydney

APPENDIX C..2.5 Cut Flower Industry

- The farm gate value of the cut flower industry in the Sydney basin is $300 million with a multiplier factor of at least 3.5 contributing in the order of $1 billion per annum to the Sydney economy
- In the order of 2500 – 3000 people are employed in the industry

- 80% are of 2nd + generation NESB
- Most if not all are at least of 2nd + generation
- Nearly all cutflowers grown in the Sydney basin are sold on the domestic market. Some are exported

APPENDIX C..2.6 Pig Industry

- Farm gate value of $4 million per annum representing 2% of NSW pork production
- 9 commercial producers with 1720 sows and 22,000 pigs

APPENDIX C..2.7 Poultry Meat Industry

- Farm gate value of $170 million per annum
- The multiplier factor for the poultry industry is 7. The poultry meat industry therefor contributes $1.2 billion per annum to the Sydney basin economy
- 120 contract meat chicken farmers employing at least two full time and some part time people 40% of whom would be of 2nd + generation NESB
- 5 integrated processing companies
- Represents 33% of the State's production including a substantial proportion of the State's turkey (50% +) and duck (90% +) production
- The processing companies are enforcing the upgrading of existing sheds to tunnel shedding standards

APPENDIX C..2.8 Poultry Egg Production

- Farm gate value of $45 million per annum contributing $315 million per annum to the Sydney basin economy
- 80 egg producers producing 30 million dozen eggs. Same employment and NESB proportions as for the meat chicken industry
- Pace Farm accounts for 40% of the basin's production

APPENDIX C..2.9 Turf Industry

- Farm gate value of between $60 million per annum with a multiplier fact of 5 contributing $300 million per annum to the Sydney basin economy
- At least 60 permanent growers and approx 5 opportunistic growers

- The average farm would employ approx 5 permanent and 3 casual staff
- Approx 50% would be of 2nd + generation NESB
- Almost all turf grown in the Sydney basin is used in the basin. A small proportion goes to export

APPENDIX C..2.10 *Nursery Industry*

- Farm gate value of plant material is $120 million per annum
- Number of production businesses with 1-3 staff 290
- Number of production businesses with 4-9 staff 83
- Number of production businesses with 10-20 staff 20
- Number of production businesses with 21+ staff' 12

TOTAL **405**

- Total employment of 1700+ of which at least 15% would be of NESB
- Retail value of nursery products sold in the Sydney basin is worth $550 million per annum

APPENDIX D. CD/Tables 1. to 4.

Distribution List

Name	Organisation/ Location	Number of Copies
Client	ARPANSA	1
Author		1
Checker		1
Authoriser		1
Robin Lowerson	**Environmental Management Project**	3
Lisa Day	**Safety and Reliability Library**	2
	ANSTO Library	4