AUSTRALIAN NUCLEAR SCIENCE
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LUCAS HEIGHTS SCIENCE AND TECHNOLOGY
CENTRE

Data Volume of Atmospheric Tracer Studies at Lucas Heights, NSW, Australia – 1996 to 1997

by

G.H. Clark, D.J.M. Stone, J.H. Pascoe
Environment Division

January 2000

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ABSTRACT

A perfluorocarbon atmospheric tracer system has been used to investigate atmospheric dispersion processes in the region surrounding the Lucas Heights Science and Technology Centre. Tracers have been released from two locations : a laboratory vent near the ridge of the Woronora river valley and from the HIFAR research reactor ventilation system. Most studies have been conducted during the early to late morning periods when valley influences might be expected on dispersion of the tracer plume. This report summarises the meteorological and tracer air concentration data and makes comparisons with estimates from a simple gaussian dispersion model. It is intended that the data will also be used for evaluation of more elaborate wind field and atmospheric models.

1. INTRODUCTION

As part of a study to validate atmospheric dispersion, environmental impact models in complex terrain, a number of field studies were conducted using perfluorocarbon tracers. The tracer releases were made from two locations in the Lucas Heights Science and Technology Centre (LHSTC). During 1996, two releases were made from a building (number 34) at the eastern end of the site, near the western ridge-line of the Woronora river valley in order to study the effects of the early morning, valley flow under stable atmospheric conditions. In 1997, a further six releases were made from the ventilation system associated with the HIFAR nuclear reactor containment building, at the western end of the site. Those releases allowed a study of the influence of the local buildings and the valley on dispersion patterns of tracer from a routinely monitored, radionuclide discharge point in the LHSTC.

In order to model the atmospheric dispersion processes in complex terrain, it is necessary to understand the meteorological influences at a number of locations. In Figure 1 there is map of the region that indicates the positions of the meteorological stations; the air sampler locations are also indicated by receptor index numbers above a ×. The stations at Lucas Heights Community (**cs**) and Boys Town (**bt**) Schools and that at the LHSTC (**l1**) are on the plateau above the valley with that at Shackles Estate (**se**) on the valley floor. Measurements at the Shackles Estate station confirm earlier short-term studies further down the Woronora valley (Clark 1990) that under stable conditions, atmospheric flow within the valley is de-coupled from that above the surrounding plateau. Clark (1997) has described the climatological data collected at these stations.

One aim of the atmospheric tracer studies was to investigate the interaction between the free-air flow above the plateau and the valley winds. Another aim was to directly measure the impact of releases from the LHSTC on the surrounding communities. The third aim was to use the atmospheric tracer data to validate or assign uncertainties to the predictive atmospheric dispersion models. This will be the subject of future reports when the modelling is complete.

The current report will detail the perfluorocarbon analysis results together with the prevailing meteorological conditions during the field studies conducted at Lucas Heights. The importance of various atmospheric dispersion processes to the observed tracer air concentration patterns is also discussed and recommendations are made for future studies.

2. EXPERIMENTAL METHODS

There is a family of inert chemicals called perfluorocarbons which normally exist in a liquid state but once vaporised are useful as atmospheric tracers of air movements because they exist with very low ambient levels in the natural environment (Stone and Clark 1996). Portable release systems have been developed which can be pre-programmed to turn the tracer on and off; we also have a larger system that is not programmable Up to four releases of perfluorocarbon tracer plumes can be made simultaneously from different locations. Release rates are typically between 50 and 100 g h^{-1} and releases can last up to 90 minutes. At each downwind sampling location, air containing the perfluorocarbon gases is pumped for 30 minutes through a small stainless steel tube attached to a pre- programmed sampling pump. The tubes contain a chemical adsorbant which removes the gases from the air stream. After the experiment, the perfluorocarbons are desorbed from the tubes through a Gas Chromatograph-Mass Spectrometer (GC-MS) that produces a unique signature on the chromatogram for each different perfluorocarbon. The atmospheric tracer release, sampling and analysis methods are described in Clark et al (2000).

3. TRACER SAMPLING AND ANALYSIS SPREADSHEETS

It is appropriate to discuss in some detail the summary spreadsheets which will follow and which show the atmospheric tracer sampling locations and analyses (see Table 3 below as an example). Each sampler location in the region has been assigned a receptor index (Rec. Index) (see Table 1 in Clark et al 1999). The Latitude and Longitude in UTM (m) co-ordinates in the spreadsheets are with reference to the AMG66 datum. The start time for the 30-minute sampling period is in Eastern Standard Time (EST).

The sample tubes are matched to each pump according to the pre-release calibrations. Before and after each experiment the pumps are calibrated with a bubble chamber flow-meter in which the time is measured for a 50ml flow of air using a "standard" tube (number 29) packed with adsorbent chemical. Earlier we had measured the relative flow rates through the "standard" and real sample tubes to determine the Tube Correction factor. This meant that after each experiment the sample tubes could be taken away for analysis and the pumps could be quickly re-calibrated using the "standard" tube. The calculated volume of air sampled by each pump during the 30-minute period allows the air concentration of PMCH to be determined after analysis of the sampler tubes on the GC-MS.

The relationship of PMCH air concentration in ppt (parts by volume per trillion) versus pgm^{-3} [pico (10^{-12}) grams per m^{-3}] is as follows :

1 ppt PMCH = $[(1\ pgm^{-3})/1000]*(22.4/350)$ where $pgm^{-3} = 10^{-12}\ gm^{-3}$.

where the atomic mass of PMCH is 350.

Other perfluorocarbon gases would have equations modified by their molecular weights e.g. PDCB = 300; PMCP = 300; PTCH = 450.

Ambient or background air concentrations have been estimated to be $6 \times 10^{-11}\ gm^{-3}$ (Stone and Clark (1996). However, to some extent this is determined by the GC-MS sensitivity and may vary from experiment to experiment. In addition, if two experiments or field releases of PMCH are conducted in quick succession, there may be elevated background levels due to re-circulation of perfluorocarbon tracers through the region of interest by the cyclical/diurnal weather patterns.

The atmospheric dilution factor is calculated as $\chi u/Q$ (m^{-2}) where χ is the air concentration, u is the estimated average transport or wind speed and Q is the release rate. With the plume dispersing over complex terrain where wind speeds are variable, an estimate is made of the average speed from stations between the source and receptors and through the duration of the release. This allows calculation of the dilution factors at the different receptors for each experiment. Atmospheric dilution factors then allow an estimate of the impact of other sources if information is available on the release rate of a pollutant and average wind speed across the region of interest.

4. TRACER RELEASE FROM BUILDING 34 ON AUGUST 14, 1996

As this was the first tracer field study at Lucas Heights there were a number of procedures to sort out in the tracer sampling protocols which meant that everything did not go strictly according to plan.

The release took place between 0610 and 0900 EST with sampling spread between 0720 and 1010 EST. The release was from a fume cupboard in a chemical laboratory in Building 34; the specifications for the release location and type are outlined in Table 1. The source location was chosen due to its proximity to the Woronora river valley. In order to ensure complete evaporation/vaporisation of the tracer, the fume cupboard booster fan was turned ON and OFF during the release. Such a procedure would have lead to a variable plume rise from the chimney stack. The average release rate was estimated to be 120 gh^{-1} (over 2

hours 50 minutes) from measurement of the tracer cylinder mass before and after the experiment. Such a relatively high release rate could have resulted from abnormal behaviour of the control system due to a swelling of the valve seats by the purgent, chloroform.

4.1 Meteorological Conditions

On this morning there was a strong vertical temperature gradient between the valley and plateau above. Temperatures 10m above the valley floor were a minimum of 2.5°C and on the Lucas Heights meteorological tower at 10m the minimum was 10.7°C (Table 2, Figure 2). Such a temperature gradient indicated very stable conditions and would be consistent with minimum atmospheric dispersion in the valley during this period.

Before 0600 EST, winds were from the north-east sector but then changed to the north-west at stations on the western ridge of the valley. At Boys Town in Engadine on the eastern side of the valley there was a much slower transition from east-north-east to north-west by 0745 EST. During this period, wind speeds in the valley were light at 1 ms^{-1} in a down-valley direction from the south-south-east. On the western side of the valley, wind speeds at 15.7m at the LHCS site varied from 2 to 3.5 ms^{-1}, at 10m on the LHSTC tower varied from 1.8 to 2.5 ms^{-1} and from 5.3 to 7.7 ms^{-1} at 49m. To the east of the valley in Engadine, at 18.5m there were moderate wind speeds of 4.3 to 5 ms^{-1}.

For calculation of an atmospheric dilution factor for this day, wind speeds were averaged from all plateau stations between 0615 and 0900 EST, when the tracer was being released. The average wind speed was 4.2 ms^{-1}.

The wind speed in combination with the variability of the wind direction (σ_θ) was used to determine the Pasquill atmospheric stability category using the USEPA (1987) method with a surface roughness length (z_o) of 1m. In the early part of the tracer release, at the LHSTC the most stable category F was observed at 10m with the neutral stability category D observed at 49m due to the stronger wind speeds at this altitude. At the other stations above the valley the neutral category D was indicated but within the valley the more stable category E prevailed. During this daytime release, stability categorisation scheme did not indicate a more stable category due to the meandering nature of the light winds. After 0645 EST (daytime) at the LHSTC there was much more variability in the near ground level wind directions than at 49m which lead to category A stabilities at 10m and category D stabilities at 49m. Across the network at the other stations the stabilities were from C (slightly unstable category) to D (neutral).

4.2 Atmospheric Tracer Results – a Preliminary Interpretation

Unfamiliarity with the terrain and bush trails meant slower deployment of samplers and lack of simultaneous sampling at many locations during the 30 minute period on this morning. Instead, for subsequent modelling studies, five groups of "nearly simultaneous" samples can be identified centred on the following times : 0715; 0745; 0815; 0845; 0915 EST (Table 3). The upwind/background air concentration of PMCH on this morning was 10.5 x 10^{-11} gm^{-3} by comparison with 6 x 10^{-11} gm^{-3} measured in other studies (Stone and Clark 1996).

Initially the plume appeared to be transported across the valley to impact the eastern wall of the valley some 80m above the valley floor near the intersection of the Liverpool-Heathcote Road and the Water Board pipeline road. Near river level in that region the air concentrations were only 11 to 14 times background whereas above on the valley wall they increased to factors of between 340 and 1050 above background. Later in the morning the plume appeared to become entrained in the slow down valley flow to register values of 90 to 180 times background at the Needles and further down valley at the Shackles Estate site.

Atmospheric dilution factors on this morning represented those for a transition between night and day time dispersion conditions.

5. TRACER RELEASE FROM BUILDING 34 ON AUGUST 16, 1996

This release again took place from the fume cupboard in Building 34, close to the western ridge of the Woronora valley. The average release rate calculated from weighing the

perfluorocarbon liquid cylinder before and after the release was 94 gh^{-1} which was 9% lower than the expected 103 gh^{-1} from the release system settings. The fume cupboard exhaust fan was set with the booster off. The release took place between 0720 and 0940 EST after unfavourable wind directions delayed a planned earlier start.

5.1 Meteorological Conditions

Initially winds at the planned start time of 0600 EST were from the south-south-west direction at the LHSTC with a slightly more westerly component at both the Lucas Heights Community and Boys Town schools (Figure 3 and Table 4). In the Woronora valley winds were near calm during this period (a 8888 coding in Table 4 indicates calm). During the tracer release, winds gradually turned clockwise more towards and through the south-west direction at all stations on the plateau and ridges. Wind speeds at these stations varied between 1.6 and 4.7 ms^{-1}. Within the valley, light winds meandered between north-east and south-east. For calculation of the atmospheric dilution factor on this day, wind speeds were averaged from all plateau stations on the western side of Woronora valley between 0730 and 1000 EST, when the tracer was being released. The average wind speed was 3.3 ms^{-1}.

There was an increase in temperatures from a minimum of 7.7°C in the valley to 9.9°C at 10m on the LHSTC tower and 10.8 °C on the Lucas Heights Community School tower at 15.7m above ground level. Atmospheric stability categories at LHSTC varied between the slightly stable category E and neutral category D at 49m to the neutral category D at 10m.

5.2 Atmospheric Tracer Results – a Preliminary Interpretation

In Table 5 there is a listing of the perfluorocarbon atmospheric tracer sampling and analyses. The receptor locations are plotted in Figure 4 with solid circles scaled by the air concentrations to indicate the tracer plume impact areas. The air concentration at the upwind receptor (Rec. Index 75) of 52.5 x 10^{-11} gm^{-3} was higher than the expected background levels by nearly an order of magnitude; other sites in the region where the plume did not impact had lower values with the minimum value on this day being 20 x 10^{-11} gm^{-3}. These elevated background levels may have been due to the tracer release two days previously with re-circulation of the plume over the region following sea-breezes and regional drainage winds during the interim period. The high air concentration values to the south of ANSTO at the extension of Forum Rd (Rec. Index 30) cannot be explained in terms of the meteorology on this day, but may again be due to the release several days earlier. . Alternatively they may have resulted from other analytical and/or sampling factors.

The plan to conduct half the total number of field samples in two half-hour periods was still being refined in terms of actual deployment of the samplers. Without being familiar with some of the terrain and geography of the streets and bush trails it took a lot longer to deploy the samplers than had been estimated. Still the temporal progression of sampler deployment did allow the effects of variations in wind directions on the tracer plume to be detected during this morning. Initially with the wind from the south-south-west, samplers were deployed along the eastern edge of Barden Creek and in cross-wind transects at different distances towards the Menai shopping centre. As the wind moved more towards the west, above background air concentrations were detected further in the north-east direction. In particular, higher levels were observed between 0900 and 0930 EST at Akuna Oval, Bangor (Rec Index 7). Lower values, but still above background, were also detected in the Woronora valley at Prince Edward Park (Rec Index 82) between 0845 and 0915 EST. By contrast the air concentration in Woronora Heights (Rec Index 44) was lower, although still above background.

6. TRACER RELEASE FROM HIFAR ON JUNE 11, 1997

In 1997 it was decided to change the release point for the atmospheric tracer to the active ventilation duct on the HIFAR reactor building (see Table 1). The tracer was injected into the duct flow down stream of the HEPA and other filter systems. The duct follows up the outside of the reactor containment building to a point half way across the roof towards the apex of the building. At the point of emission to the atmosphere there is a witch's hat on top which would have the effect of severely limiting any plume rise. In fact, it is expected that the plume would be entrained into any building generated turbulence and brought quickly to ground level.

On this morning the tracer release took place between 0715 and 0950 EST. This experiment consisted of a more intensive period of sampling around the LHSTC site in order to investigate the near field atmospheric dispersion behaviour of a plume from HIFAR. However, sampling also extended more generally into Engadine later in the morning after the tracer release had finished. The release system operated normally with an assumed release rate of 103 gh^{-1}; the cylinder was not weighed after the release, as a protocol developed subsequently would deem necessary.

6.1 Meteorological Conditions

During the last half of 1997 an acoustic wind profiler (called a SODAR) was installed at Lucas Heights in order to study the influence of vertical wind profiles on near ground atmospheric dispersion processes. A REMTECH brand SODAR was operated with the aim of achieving consistent data to a range of 500m above ground level. It was situated in the vicinity of the meteorological laboratory (Building 44) at the LHSTC. On this morning the wind profiler indicated light, south-west winds near the surface with stronger winds (15 ms^{-1}) from the west at 430m (Figure 5). It should be noted that as a general method of analysis, the SODAR wind speed and direction profiles were matched with the 50m data from the LHSTC meteorological tower. Any corrections were then applied through the total SODAR profile.

Prior to 0730 EST winds in the valley were very close to the stalling speed (threshold = 0.2 ms^{-1}) of the anemometer, or near calm (Figure 6, Table 6). During the sampling periods, at Shackles Estate light down valley winds were observed below 1 ms^{-1} from the south-south-east to south-west direction. By contrast, winds on the plateau that initially started in the south-west gradually turned to the west with speeds, which averaged 1.5 ms^{-1} at LHSTC (10m) and 1.7 ms^{-1} at Boys Town. Between 0715 and 0915 EST the winds at 49m on the LHSTC tower were turned more to the south-west by 20 to 40° compared to those at 10m. After 0915 EST the directions became more uniform with height as the west winds from aloft were gradually mixed through this section of the lower atmosphere (see Figure 5).

At the Lucas Heights Community School the winds were turned slightly towards the west-north-west with a higher average speed of 2.5 ms^{-1}. For the purposes of calculating the atmospheric dilution factors, the average wind speed between 0800 and 1000 EST (based on LHSTC 10 and 4m and Boys Town School) is calculated to be 2.2 ms^{-1}.

There was a very strong temperature gradient observed between the Woronora valley floor (minimum of 1.7°C) and the plateau above (5.6°C to the Lucas Heights Community School and 6.5°C to 10m on the LHSTC tower). By contrast the increase in temperature between 10 and 49m on the Lucas Heights tower was only 2.5°C. During this period the atmospheric stability changed from the slightly stable category E through neutral to the slightly unstable category C at both the 10 and 49m levels on the LHSTC meteorological tower.

6.2 Atmospheric Tracer Results – a Preliminary Interpretation

With a continuing difficulty in deployment of samplers through the far field region by only two people, instead of the preferred two atmospheric tracer sampling periods, three were identified for analysis: 0800 to 0845EST, 0900 to 0930 EST and 0930 to 1030 EST (Table 7, Figure 7). The first period was mainly concentrated in the vicinity of the LHSTC in order to investigate the effects of the source configuration and nearby buildings on plume dispersion. The highest air concentration (9.3×10^{-7} gm^{-3}) was measured near the meteorological tower (Rec. Index 51) only 187 metres downwind and after interaction of the plume with the complex of buildings. The plume then was observed to travel further to the east-north-east where the next highest value (3.1×10^{-7} gm^{-3}) was observed at the corner of Lawrence Cres and Hahn St. (Rec. Index 21). Then the plume bent slightly more to the east where at a distance of 829m and opposite the Building 64 car park (Rec. Index 62) the air concentration of PMCH was observed to be 1.5×10^{-7} gm^{-3}. This corresponded to an atmospheric dilution factor of 1.2×10^{-5} m^{-2}. The observations down the western wall of the Woronora valley and on the valley floor at this time were still near background levels.

The far field survey teams did not have time to reach their sampling locations for the pre-chosen start of 0900 EST while the release system operator, who also deployed a small network of samplers around the LHSTC, proceeded on schedule. During the second period from 0900 to 0930 EST the near ground level winds at the LHSTC moved slightly more into the west-south-west. This meant that the plume was now observed at the receptors on the corner of Hahn St. and Rutherford Avenue (Rec. Index 24) [2.8×10^{-7} gm^{-3}] and on the fence at the end of Thomson St. (Rec. Index 25) [2.3×10^{-7} gm^{-3}] with higher observed air concentrations than earlier that morning. A higher air concentration of PMCH (4.7×10^{-7} gm^{-3}) was also observed at the sampler located opposite the Building 64 car park.

Later in the morning between 0930 and 1000 EST the tracer plume was also detected at the far-field sampler locations through the Woronora valley and in Engadine. The highest value was measured at the corner of Sierra and Ridge Roads, just outside the 1.6 km exclusion zone around HIFAR. There the air concentration was 3.6×10^{-8} gm^{-3}, which corresponded to an atmospheric dilution factor of 2.85×10^{-6} m^{-2}. It appears that winds with a slightly west-south-west direction exerted greatest influence on dispersion of the tracer plume as PMCH was detected on the Needles track to the west of the Woronora river (1.4×10^{-9} gm^{-3}). Further east and later in the morning, values of 9.4×10^{-9} gm^{-3} were measured half way up the eastern valley wall and near the top of the valley wall at Kelton Place, some 3.5 km from HIFAR. This was equivalent to an atmospheric dilution factor of 7.44×10^{-7} m^{-2}.

7. TRACER RELEASE FROM HIFAR ON JUNE 23, 1997

In common with the other 1997 releases, this release took place from the HIFAR active ventilation duct. The release commenced at 0930 but at 1145 EST it was discovered the mass flow controller had again malfunctioned and the release had stopped. With a release rate of 103 gh^{-1} and measurement of the cylinder mass before and after release, it was estimated that the actual release of PMCH ceased at 1118 EST. In spite of work on the system since the last experiment, the malfunction was again due to a swollen valve seat in the mass flow controller.

Sampling commenced at the far-field locations at 1015 EST, but not until 1030 EST in the near-field around the LHSTC, due to a breakdown in communications. Unfortunately by the time all the samples were taken simultaneously in the near- and far-field locations at 1130 EST, the tracer release had finished prematurely.

7.1 Meteorological Conditions

Conditions were clear and sunny during this morning. Initially there was a very strong, stable temperature inversion (+7.7 °C per 39m) observed on the meteorological tower at the LHSTC (Figure 8, Table 8). There was also a 5 °C increase from the Shackles Estate minimum temperature to that at the Lucas Heights Community School. However, by the time the tracer release commenced the strongly stable conditions had moderated and normal daytime lapse rates and good atmospheric mixing were observed on the LHSTC tower. This was reflected in the atmospheric stabilities, which fluctuated between the slightly unstable (C) and neutral (D) categories at 10m and 49m. Such an observation indicated a well-mixed atmosphere prevailed on the plateau above the valley.

Generally winds across the region were observed from the south-west to north-west sector at all the plateau stations which favoured plume transport into the Woronora valley. At the LHSTC, winds were from the south-west to west sector with speeds varying between 1 and 2 ms^{-1} at 10m and between 1.6 and 2.8 ms^{-1} at 49m. The SODAR had some missing data through this period (Figure 9). However there was consistency in winds from the west-north-west between 150 and 350m before 0830 EST. During the release period, winds above 300m were more strongly from the north-west direction with speeds between 7 and 9 ms^{-1}. Nearer the ground there was more uniformity from a west direction through the lower 200m.

At Boys Town there was a similar trend in the wind directions to that at LHSTC with wind speeds light at between 1 and 1.5 ms^{-1}. By contrast, wind directions at the Lucas Heights Community School were turned more towards the west-north-west at speeds between 1 and 2.3 ms^{-1}. In the Woronora valley light winds were observed to fluctuate between the south-south-east and north-east directions.

For the purposes of the atmospheric dilution factor calculations an average wind speed across the region was determined to be 2 ms^{-1}.

7.2 Atmospheric Tracer Results – a Preliminary Interpretation

It is perhaps appropriate to first consider the near-field sampling to allow a more complete interpretation of the far-field results, which were taken 15 minutes earlier (Table 9, Figure 10). By contrast with the release on June 11, 1997, the air concentrations at the meteorological tower (Rec. Index 51) were higher by a factor of two. This possibly indicated a more direct sampling of the plume centre-line or more rapid mixing of the tracer into the HIFAR building wake; the air concentration was 2.2×10^{-6} gm^{-3}, representing an atmospheric dilution factor of 1.6×10^{-3} m^{-2}. The two cross-wind samples at receptors 22 and 64 were consistent with the influence of a wind from slightly south of west between 1030 and 1100 EST i.e. indicated more by the winds at 49m. The sample at the east end of Thomson St. (Rec. Index 25) was also consistent with these winds, however, that opposite the Building 64 car park (Rec. Index 62) was anomalously low.

High values were also observed in the earlier samples in Engadine. The plume appeared to follow a track between slightly to the south of the intersection of Sierra and Ridge Roads (Rec. Index 42) [1.5×10^{-7} gm^{-3}] and Illuta Place (Rec. Index 36) [1.1×10^{-7} gm^{-3}] to more directly intercept Holmlea Place (Rec. Index 34) [1.7×10^{-7} gm^{-3}]. The plume also indicated impaction on the eastern wall of the Woronora valley. The air concentration of PMCH on the Water Board road (Rec. Index 80), some 43m below Sierra and Ridge, was lower by a factor of four. Nearer the valley floor in the vicinity of the Needles (2.4km downwind) the air concentrations were approximately 2.7×10^{-9} gm^{-3}. This represents an atmospheric dilution factor of 1.9×10^{-7} m^{-2}. Higher up the valley wall, but further down wind (3.5km from HIFAR) at Kelton Place (Rec. Index 18) the air concentration was 2.3×10^{-8} gm^{-3} (atmospheric dilution factor of 1.7×10^{-6} m^{-2}).

Between 1130 and 1200 EST the wind at the LHSTC tower had changed towards the west-north-west. Given that the tracer release was estimated to have stopped at 1118 EST the highest value at the corner of Einstein and Hahn (Rec. Index 22) was probably only due to

remnants of tracer emanating from the vicinity of the buildings around HIFAR. At this location it was a factor of seven lower than that observed at the meteorological tower (Rec. Index 51) during the earlier sample period. However, as most other sampler locations also experienced similar lower air concentrations, this sample period was not considered for further analysis. The exceptions to the observed lower air concentrations were at the most distant sampler locations through the valley as the remnants of the plume were slowly advected out of the region.

8. TRACER RELEASE FROM HIFAR ON JULY 9, 1997

In an attempt to rectify problems with the release system, Teflon valve seats were fitted to the mass flow controllers. However, there were still problems that resulted in a premature end to the release. With favourable wind directions, the release took place between 1020 EST and 1315 EST, however it stopped sometime between 1215 and 1315 EST. Initially (1100 to 1130 EST) sampling was concentrated in the vicinity of the LHSTC to investigate the near-field atmospheric dispersion processes. Between 1230 and 1300 EST there was a scaled down near-field sampling program with more extensive sampling in the Woronora valley and along the eastern valley ridge-line.

8.1 Meteorological Conditions

During the release period winds were generally from the west-south-west across the region (Figure 11 and Table 10). At the LHSTC wind speeds were observed to be 3.5 ms^{-1} at 10m and 6 ms^{-1} at 49m. Average wind speeds at the Lucas Heights Community School (LHCS) were 4 ms^{-1} and at Boys Town School in Engadine, slightly higher at 5 ms^{-1}. SODAR measurements (Figure 12) indicated that there was a gradual change in wind speeds from the surface to 400m where wind speeds were measured from the west at 9 ms^{-1}. This pattern of vertical variation of the winds was consistent in time through the late morning release and indicated good atmospheric mixing through the lower boundary layer. In the valley, winds were persistent from the south-south-west at 1 to 2 ms^{-1}.

Temperatures at all stations also remained remarkably constant with time. There was a 1.6°C decrease from 13.1°C at 10m to 11.5°C at 49m on the LHSTC meteorological tower. At LHCS the temperature was 13.0°C and at Boys Town it was 12.4°C, by contrast with the 13.7°C at Shackles Estate in the Woronora valley. The Pasquill atmospheric stability category was determined to be the neutral category D at both 10 and 49m altitudes, confirming the presence of good vertical mixing of the atmosphere.

8.2 Atmospheric Tracer Results – a Preliminary Interpretation

In spite of stronger winds and neutral atmospheric stability conditions, the tracer plume from HIFAR did not seem to impact ground level as quickly as in past tests. During the first sampling period (Table 11, Figure 13), the values of PMCH air concentrations at the meteorological tower were lower [1.5 x 10^{-7} gm^{-3}] than further downwind. For example, there were similar values on Hahn St, at Lawrence Cres and Einstein Ave [3.3 x 10^{-7} gm^{-3}], a slight decrease to near the CSIRO (Rec. Index 66) [3.2 x 10^{-7} gm^{-3}] and higher values again were observed at the End of Thomson St. [3.7 x 10^{-7} gm^{-3}]. The plume seemed to follow a rather meandering trajectory through the LHSTC site with what seemed to be an anomalously low air concentration near Building 64 and very low values not far off the plume centre-line i.e. relatively close to the highest observed concentrations.

For the second sampling period between 1230 and 1300 EST, which could have occurred after the PMCH release had ceased, the results from the near-field samplers were rather difficult to interpret. The highest air concentration was measured at the most southern sampler location on the LHSTC (cnr. Einstein Ave and Hahn St.) [4.7 x 10^{-7} gm^{-3}]. Without any building or source configuration influences this would require a wind from the west-north-west which would also have caused an impact at the meteorological tower. However, such an impact was not observed and the winds varied from slightly south of west near

ground-level to between 271 and 276° at 49m. Such near ground level winds could account for the second highest air concentration which was observed near Building 23 (Rec. Index 37), very close to the source and upwind of the meteorological tower.

In the far-field samplers, the air concentrations were only significantly above background at three sampler locations. The plume appeared to impact the eastern side of the Woronora valley near the intersection of Sierra and Ridge Rds. (Rec. Index 42, altitude 113m). There the air concentration was [2.0 x 10^{-8} gm^{-3}] compared to just a little below at the gate SW of Sarbugal (Rec. Index 80, altitude 70m) were it was [1.6 x 10^{-8} gm^{-3}]. Further south behind Alpine Pl. (Rec Index 58, altitude 130m) the air concentration of PMCH was reduced to 4.5 x 10^{-9} gm^{-3}.

9. TRACER RELEASE FROM HIFAR ON AUGUST 13, 1997

In a further attempt to solve the release system problem, stainless steel valve seats replaced the Teflon valve seals in the mass flow controller and as a result the release system worked as designed. Favourable winds were observed during the early morning and a decision was made to conduct a tracer release. The release started at 1122 EST and finished at 1206 EST.. The 30-minute sample period commenced at 1130 EST. and was conducted in the "near-field", around the LHSTC.

9.1 Meteorological Conditions

As the sampling was close to the source it is sufficient to only discuss the meteorological conditions which influence the local atmospheric dispersion processes. Figure 14 and Table 12 indicate winds between 1130 and 1200 EST were from the west-south-west with speeds of 4.5 ms^{-1} at 10m and 7 ms^{-1} at 49m above ground level. For subsequent atmospheric dilution factor calculations the average wind speed between 10 and 49m was taken as 5.8 ms^{-1}. The SODAR indicated that wind directions were uniform up to an altitude of 250m above which they turned more to the north-west (Figure 15). There was a maximum in the wind speed profile at slightly above 10 ms^{-1} at 425m. Nearer ground level there was a temperature decrease of 2.2°C between 10 and 49m. The stronger winds combined with a turbulent wind direction lead to a neutral type D atmospheric dispersion stability category at both 10 and 49m.

9.2 Atmospheric Tracer Results – a Preliminary Interpretation

The atmospheric tracer was quickly mixed to ground level in the wake of the HIFAR building complex (Table 13, Figure 16). The highest air concentration was measured very close to the source, near Building 23A (Rec. Index 37) [7.9 x 10^{-7} gm^{-3}]. Other high values were also measured in the vicinity of the meteorological tower. Lower air concentrations were observed across the plume along Hahn Ave. before a secondary peak of air concentrations was observed along Roentgen Ave. This was maintained further east-north-east at the Building 64 car park (Rec. Index 62) where the PMCH air concentration was 2.3 x 10^{-7} gm^{-3}. This corresponded to an atmospheric dilution factor of 4.7 x 10^{-5} m^{-2}.

10. TRACER RELEASE FROM HIFAR ON AUGUST 28, 1997

The atmospheric tracer release system again performed well. The tracer release commenced at 0705 EST and finished at 1015 EST. Two 30 minute sampling periods were conducted at 0800 and 0945 EST. Samples were collected in both the near- and far- field locations.

10.1 Meteorological Conditions

Prior to sunrise at 0606 EST, a 4°C strong increase in temperature was observed between 10 and 49m on the meteorological tower (Figure 17 and Table 14). Between 0800 and 0830 EST, solar radiational heating of the lower atmosphere had reversed this gradient with a 2°C decrease then observed up the tower. The prevailing atmospheric stability category was mainly near the neutral category D at both levels on the tower. For the second sample period, the atmospheric stability category varied between the unstable category B and neutral category D at 10m and remained in the neutral category D at 49m.

There were considerable wind direction changes both in time and space across the region. At the LHSTC tower, wind directions were in transition from west-south-west through west during the first sample period and from the north-west during the second sample period. Between 0800 and 0830 EST wind speeds varied from 1.8 ms^{-1} at 10m to 2.5 ms^{-1} at 49m. At the LHCS the winds were also similar from around the west at 2.5 ms^{-1}. Across the valley in Engadine, winds varied from 203 to 242° with a speed of 1.5 ms^{-1}. In the Woronora valley winds were from the south-south-east at 1.1 ms^{-1}.

There was a similar confusion of wind directions and speeds evident from the SODAR profiles (Figure 18). Between 0800 and 0830 EST the winds were uniform westerlies from the surface up to 175m. Above this altitude there was a gradual change to north-west directions at 300m and then a swing back to stronger south-west winds above this level. By the time of the second sample period between 0945 and 1015 EST, winds had become uniform in height from the west-north-west to north-west direction. Similar directions were observed at Boys Town and LHCS with wind speeds generally between 2 and 3 ms^{-1}. In the valley, even with unstable to neutral atmospheric conditions, winds varied from north-east to south-south-east at 1.9 ms^{-1}.

10.2 Atmospheric Tracer Results – a Preliminary Interpretation

Apart from samples taken at the meteorological tower (Rec. Index 51) [1.6 x 10^{-6} gm^{-3}] and at the Rutherford Ave. entrance to HIFAR (Rec. Index 68) [3.5 x 10^{-7} gm^{-3}] the other air concentrations were much lower than usual for the LHSTC locations (Table 15, Figure 19); the N/A values resulted from a problem in the analyses. There were indications that the tracer plume centre-line impacted more on the locations east-north-east of HIFAR than those to the east. The magnitude of the air concentrations also indicates a possible swing of the plume across the sampler array with a relatively short impact time on the samplers as the wind direction changed. Duplicate samples at the corner of Rutherford and Hahn Aves. (Rec. Index 24) give an indication of the accuracy of the sampling and analysis techniques; the values were 9.2 and 3.7 x 10^{-7} gm^{-3}.

At the far-field sampler locations the air concentrations observed also appeared to be influenced by the shift in the winds were from the south-west to west sector. The PMCH air concentrations generally across the Menai region varied between 3 and 7 x 10^{-9} gm^{-3} except for the Menai Town Centre (Rec. Index 50) and the intersection of New Illawarra and Barden Roads (Rec. Index 39) where the values were 1.9 x 10^{-8} gm^{-3}. At the bottom of the hill, further down Barden Road under the High Tension powerline (Rec. Index 13) the value was very low at 5.4 x 10^{-10} gm^{-3}. This could have resulted from local topographic influences.

By the time of the second sampling period starting at 0945 EST, winds had continued to swing to the north-west direction. Near the LHSTC the measured air concentrations were similar in magnitude to those observed previously near Menai Town Centre. In Engadine there was a small impact on locations along the ridge-line with values between 3 and 7 x 10^{-9} gm^{-3}. Again a duplicate sample behind Alpine Place (Rec. Index 58) indicated a variation between 2.7 and 9.2 x 10^{-9} gm^{-3}.

11. TRACER RELEASE FROM HIFAR ON OCTOBER 1, 1997

An early morning tracer release that started at 0710 EST went smoothly in terms of the release mechanism behaving normally and two sampling periods being conducted during the morning. The first samples were taken at 0800 and the second commenced at 0930 EST. The person conducting the release took near-field samples but most sampling was undertaken through the valley and in Engadine.

11.1 Meteorological Conditions

Early in the morning there was a strong temperature inversion evident on the LHSTC meteorological tower with a typical increase of temperature measured from 8°C at 10m to 12.8°C at 49m (Figure 20, Table 16). The temperatures from 10m on Shackles Estate in the valley were similar to those at 10m on the LHSTC tower. By contrast, temperatures at both Boys Town and LHCS were between the 10 and 49m LHSTC values which reflected the higher measurement levels at both of these sites. By the time of the first sampling period between 0800 and 0830 EST, the temperatures had risen to nearly 16°C at 10m with a decrease to higher altitudes. This decrease in atmospheric stability indicated the onset of vertical mixing through the lower atmosphere.

The atmospheric stability dispersion categories based on the USEPA (1987) scheme also reflected the changing thermal structure in the lower atmosphere. At the 10m level on the meteorological tower the unstable (C) to neutral category (D) was observed between 0800 and 0830 EST whereas category D was estimated from the 49m wind data. Between 0930 and 1000 EST, conditions had become less stable near the ground with the most unstable category A observed at 10m. With stronger winds aloft, Pasquill category D was estimated from the 49m data.

Winds were light and variable early in the tracer release period. At LHSTC the speeds were less than 1 ms^{-1} at 10m and only 1.3 ms^{-1} at 49m. Similar observations were made at both the school sites. Initially winds were from the south-west at 10m and from the north-west at 49m at the LHSTC. Similar variability was observed at both the LHCS and Boys Town with winds gradually turning from the south-west to west-north-west during the first sample period. Wind speeds had increased to between 2 and 3 ms^{-1} across the region. As usual winds at Shackles Estate at the bottom of the valley were de-coupled from the flow above, with directions that varied from south-south-east to south at 1.3 ms^{-1}. For the purposes of estimation of atmospheric dilution factors, the average wind speed during this sample period was taken as 2.3 ms^{-1} using the LHSTC and Boys Town wind data.

By the time of the second sample period from 0930 to 1000 EST, on the plateau the north-west winds from aloft were being more strongly mixed down to the surface. Wind speeds had remained between 2 and 3 ms^{-1}. In the valley there was a gradual change in direction towards the north-east with a speed between 1.5 and 1.8 ms^{-1}. This was the first indication of the arrival of a sea breeze in the region. The wind speed for calculating the atmospheric dilution factors was estimated to be 2.6 ms^{-1}.

The influence of atmospheric mixing can be seen more clearly in the vertical wind profiles from the SODAR (Figure 21). Between 0800 and 0830 EST the winds above 100m turn through north-west to north above 250m. There appears to be a layer developing in time in which the winds start with a north-west direction near the surface and turn more to the north at the top of the layer. Above that layer there is a sharp increase in wind speeds and turning back of wind directions to the west and south-west. This layer reached an altitude of 550m by 1015 EST and developed beyond the range of the SODAR soon after. After 1100 EST winds up to 600m had become more uniform from the north-north-west to north direction. The gradual turning of the wind with time could exert an important influence on the near ground level tracer plume dispersion.

11.2 Atmospheric Tracer Results – a Preliminary Interpretation

At the five near-field samplers within the LHSTC (Table 17, Figure 22), between 0800 and 0830 EST there was an indication of a narrow plume with major impact at only two locations. At the meteorological tower the air concentration was 5.3 x 10^{-6} gm^{-3} and on the corner of Einstein and Hahn Avenues it had decreased to 1.2 x 10^{-6} gm^{-3}; all other locations recorded less than 2.5 x 10^{-8} gm^{-3}. A wind direction from west-north-west might lead to such an observation. This corresponds to a direction inferred from interpolation between the 10m and 49m observations on the meteorological tower.

The distribution of air concentrations along the ridge-line in Engadine also reflected a similar wind direction influence. The highest values between Range Place (Rec. Index 17) and Ferntree Reserve (Rec. Index 32) were observed to be approximately 3 x 10^{-7} gm^{-3} which corresponds to an atmospheric dilution factor of 2.4 x 10^{-5} m^{-2}. Even though there were slightly unstable C to neutral category D atmospheric dispersion conditions, there were no significant levels measured in the valley below Ferntree Reserve at the Woronora bridge (Rec. Index 47) where the air concentration was 1.6 x 10^{-9} gm^{-3}.

Between 0930 and 1000 EST there was no significant impact of the plume on the LHSTC. Across the valley there seemed to be a bifurcation of the plume with one maximum of air concentrations observed downwind to the south-east of HIFAR and another in the east-north-east direction. The highest air concentration was observed at the bottom of Kelton Place (Rec. Index 18) with 4.4 x 10^{-7} gm^{-3} which corresponded to an atmospheric dilution factor of 4.0 x 10^{-5} m^{-2}. This was a surprising result given that the site is east-north-east of HIFAR and the winds were turning through the north-west at the plateau stations. Other significant values were observed at Holmlea Place (Rec. Index 34; 2.9 x 10^{-7} gm^{-3}) which is in a similar direction to Kelton Place. More in line with the wind direction were the observed air concentrations at Fairview Ave (Rec. Index 28; 1.4 x 10^{-7} gm^{-3}) and Ferntree Reserve (Rec. Index 32; 1.8 x 10^{-7} gm^{-3}).

The air concentrations of tracer in the valley increased as the atmosphere had become more unstable and dispersive. Even on the floor of the valley near the Needles (Rec. Index 54) the air concentration was 5 x 10^{-8} gm^{-3}. This indicated some entrainment of the tracer plume moving across the valley into a general down valley flow.

12. DISCUSSION OF 1996 AND 1997 TRACER FIELD STUDIES

The atmospheric tracer studies conducted to date from the LHSTC site are summarised in Table 18. These results and more general conclusions are that :

1. Most studies to date have been conducted in the morning period usually around the transition between nocturnal to daytime atmospheric dispersion conditions.
2. As a result, atmospheric stability conditions mostly varied from neutral to unstable i.e. good for increased atmospheric dispersion.
3. New experimental techniques had to be developed for the Lucas Heights field studies. These involved the release system, sampling and analytical methods. It took some time to refine the techniques before results of consistent quality were obtained.

It is of interest to now look at how the atmospheric dispersion models used in estimating the impact of routine discharges would compare with the atmospheric tracer results. This class of model (like PC-Cream) is usually based on the Gaussian dispersion model which relies on meteorological data from the source location. Therefore, the wind speed and atmospheric stability data from the LHSTC meteorological tower at 10 and 49m are used in the following calculations. In addition, an average wind speed across the region (defined as the Atmospheric Dilution Wind Speed, Udil, in Table 18) is used for comparison. Field studies where there were sufficient cross-wind samples to allow measurement of a horizontal profile of the tracer air concentrations are now analysed in more detail.

In order to eliminate any influence of wind directions at the source, which might not be appropriate to the downwind dispersion of the tracer plume, only the centre-line air concentrations were calculated with the Gaussian model. This eliminates the need to consider the overall question of the horizontal variation of the wind field and its influence on dispersion patterns, which is the subject of the broader model validation study. These centre-line concentrations were then compared with the maxima tracer concentrations on the cross-plume arc of samplers. The 1997 tracer releases from HIFAR were found suitable for these analyses. Even though the release from HIFAR was from the roof level (23m) it was observed from the tracer data that the plume was quickly brought to ground level. Therefore, a ground level release was also modelled. Initial enhanced dilution due to building wake effects was not included in the model, as it has so far not been used in any of the routine environmental impact models used at Lucas Heights (Petersen 1994, Simmonds et al 1995).

The results of these comparisons are shown in Table 19. Some background information is required to interpret this table. Two atmospheric stability categories are sometimes analysed with the model because meteorological data collected each 15 minutes indicated variation during the 30 minute tracer sampling period. In addition, two release heights are modelled, one from the surface (0m) and the other from an elevated location (23m). With some atmospheric stabilities the plume centre-line may not be modelled to impact ground level at sampler locations close to the source (like the meteorological tower). This would lead to lower predicted air concentrations at ground level at these locations. The air concentration columns headed U10m (wind speed at 10m), U49m (wind speed at 49m) and Udil (atmospheric dilution wind speed from Table 18) use these respective wind speeds in the model calculations. The locations of the source and receptors in this table are according to the AMG66 datum.

It is useful to separate discussion into the near- and far- field regions. The near-field region embraces tracer measurements out to the LHSTC boundary. In general, the tracer air concentrations in the near field region are lower than those predicted by the Gaussian model for all stabilities, wind speeds and release heights. The exceptions are the slightly more stable atmospheric stability categories on June 11 and 23 with an assumed release from 23m. This shows that there is some enhancement of atmospheric dispersion and increased dilution of the plume near the source, probably due to building influences and the chimney top behaviour.

At the far-field locations across the valley and at Menai Town Centre, there is generally good agreement between the tracer and Gaussian model predicted air concentrations. Thus, even though there is an increased initial dilution of the plume, the subsequent dispersion further downwind is diminished to that predicted by the prevailing stability category. One explanation is that when the plume is transported across the Woronora valley, it is not subject to the same near surface atmospheric turbulence. This could lead to a more stable atmospheric dispersion category on this part of the trajectory. There may also be a different stability regime between the LHSTC and Menai which could lead to lack of horizontal homogeneity in the atmospheric dispersion field. Such features will be further investigated in the validation study of the wind field models.

13. ATMOSPHERIC TRACER RESULTS - ERROR ANALYSIS

The accuracy of the finally calculated tracer air concentrations is a function of many variables. First, the pumps that are used for the sampling have press fitted tube fittings that are subject to some stress when being deployed and retrieved. The batteries in the pumps are re-chargeable and will start to degrade with time thus causing air pumping volumes to decrease. The calibration procedures are designed to minimise these problems. The effects of the pumps on the accuracy of the tracer air concentrations has been analysed in more detail during a recent multi-tracer release experiment conducted at Yennora in western Sydney. Deployment of duplicate pumps at the same location indicated that the air concentrations were consistent to ± 10%.

Analysis of the perfluorocarbon gases on the GC-MS depends first on the ability to desorb the chemicals from the Haysep-B adsorption materials in the sample tubes. Repeat desorption of the same tube indicates an efficiency usually in excess of 99.9% for the first desorption. With a very complex electro-mechanical device like a GC-MS there are multiple opportunities for minor variations to occur in the analysis procedures which when integrated could cause some larger uncertainties in the results. Consistency checks between pairs of multiple tracers that were released simultaneously through the same syringe in a portable release system indicated agreement to within 8%. Such agreement can possibly be further improved by running the same "standard" gas sample at regular intervals through analysis of a batch of samples. This method will allow for compensation of any drift of the GC-MS machine sensitivity. Agreement to better than 8% between multiple tracers gives some confidence in the subsequent use of the technique to differentiate the effects of different stack releases on downwind receptors.

The final tracer concentration depends on the calibration curves developed from the Standard Gas which has been obtained from Brookhaven National Laboratory, New York, U.S.A.. The calibration gas has been quoted by the supplier to be accurate to ± 5%. Overall, the final air concentrations measured using this technique are estimated to be accurate to ± 15%.

14. FUTURE FIELD STUDIES

Although the main purpose of the tracer releases from the LHSTC was to collect atmospheric dispersion data suitable for assessment of the emergency environmental impact atmospheric impact computer models, they are also important for looking at the relative impacts of routine discharges from different sources on downwind receptors. Therefore, future field tests will also involve simultaneous release of four tracers from different sources in the LHSTC. The sources identified to be of interest are HIFAR, the Building 2/54 chimney stack, the ventilation stack on Building 23A and the stack on Building 20 in the Waste Management area. A typical maximum release time of 100 minutes for the portable/syringe release systems and the time for a tracer plume to reach those locations may restrict the downwind extent of sampling.

To date the field tests have mainly been conducted in daylight during the early to late morning time periods. It is also the intention to conduct further studies into conditions when well developed, light wind nocturnal drainage winds might be observed. These conditions are more likely to occur during the winter months and it is the intention to conduct another intensive campaign during the year 2000. Of course there will be additional logistical difficulties in deployment of samplers on bush tracks at night, but these will probably mainly involve a longer lead in to the start time for sampling from the decision time to conduct an experiment.

15. CONCLUSIONS

The atmospheric tracer studies conducted so far at Lucas Heights provide the start of a unique database of atmospheric dispersion measurements. Some of the studies will be suitable for comparison with a range of atmospheric dispersion models which can account for complex meteorology and topography through the surrounding area. Comparison with the more simple, continuous Gaussian model has so far shown that in the near-field region to the boundary of the LHSTC, there is generally a more rapid dispersion of plumes to ground level than would be predicted with an elevated release. This most probably indicates the influence of the chimney stack emission behaviour as well as that of the atmospheric turbulence generated from the surrounding building complex. However, further downwind across the Woronora valley, there is generally good agreement between the tracer air concentration

measurements and the predictions from the simple model. Most of the studies to date have been conducted in early morning near daytime conditions when the strongest influence of complex terrain of local wind and dispersion patterns may have diminished. Future studies will also focus on nocturnal conditions when the Woronora river valley might be expected to exert a stronger influence on atmospheric dispersion patterns.

16. REFERENCES

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Location	Building 34	HIFAR
Longitude (^{o}E)	150.9898	150.9794
Latitude (^{o}S)	34.0481	34.0531
Easting (m)	314450	313500
Northing (m)	6230679	6230100
Altitude (m)	144	156
Stack height (m)	7.61	23
Stack diameter (m)	0.37	N/A
Efflux velocity (ms^{-1})	12.7/6.72*	N/A

Tracer release source specifications

Table 1

*Release on 14/8/96 = 12.7 ms^{-1}; Release on 16/8/96 = 6.72 ms^{-1}

N/A = see the text for why these data are not applicable

02/04/99 08:37:59

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
140896	15	12.7	3.0	319.0	14.3	8.4	315.4	11.9	3.3	298.0	12.4	2.1	303.9	5.4	0.9	225.5	0.0	0
140896	30	13.3	3.0	315.2	14.3	7.9	313.2	12.1	3.5	307.9	12.7	3.2	322.1	5.2	0.8	225.4		
140896	45	13.1	2.6	314.4	14.1	7.2	308.9	12.8	3.5	295.8	13.0	3.1	326.7	4.9	0.6	219.1		
140896	100	13.3	2.4	301.9	14.1	6.2	305.7	12.7	3.1	290.1	13.4	3.0	324.5	4.7	0.6	222.4		
140896	115	12.8	1.9	280.3	13.6	5.1	297.5	13.0	3.0	286.2	13.4	2.6	319.1	4.6	0.6	207.7		
140896	130	12.3	1.9	265.7	13.2	4.5	294.0	13.1	3.0	269.9	13.0	1.8	276.8	4.4	0.7	221.6		
140896	145	11.7	2.1	246.1	13.5	4.4	290.4	12.9	3.1	258.9	12.6	1.9	261.0	4.3	0.8	219.9		
140896	200	11.7	1.7	254.8	13.7	4.1	299.6	12.2	3.2	236.9	12.8	1.7	273.5	4.1	0.7	215.5	0.0	0
140896	215	12.0	1.8	303.4	14.8	5.4	314.6	12.7	2.3	266.4	13.3	2.0	311.9	3.8	0.4	197.6		
140896	230	12.3	1.5	324.3	15.9	6.3	315.8	12.7	1.8	310.1	13.6	2.2	326.0	3.6	0.6	206.0		
140896	245	10.7	1.1	336.7	15.0	5.7	331.5	13.2	2.5	315.7	13.1	2.4	116.5	3.6	0.6	220.0		
140896	300	10.9	1.7	321.2	16.2	6.8	323.6	12.2	2.1	350.4	13.7	3.0	310.2	3.4	0.6	205.6		
140896	315	11.3	1.6	319.0	14.8	6.0	337.4	13.0	2.6	344.9	12.7	3.4	36.7	3.4	0.8	217.8		
140896	330	11.5	1.5	42.7	15.0	5.4	336.6	13.2	2.2	329.3	12.9	3.5	60.4	3.2	0.8	207.7		
140896	345	11.8	1.1	46.0	13.7	4.8	344.4	12.8	2.1	310.8	13.3	3.5	40.1	3.2	1.0	213.8		
140896	400	11.3	0.9	46.6	13.0	4.0	284.4	12.2	1.6	310.0	13.4	3.1	27.9	3.1	0.7	211.7	0.0	0
140896	415	10.4	1.1	47.6	12.6	3.5	98.3	12.2	1.6	13.0	13.2	3.8	31.0	3.0	0.6	221.1		
140896	430	10.7	1.4	31.5	12.3	4.4	102.1	11.8	1.2	68.9	13.1	4.0	34.5	2.8	0.5	209.3		
140896	445	10.4	1.5	30.3	12.4	5.6	89.5	11.6	1.4	46.7	13.0	4.1	40.5	2.8	0.7	216.2		
140896	500	9.7	1.2	29.1	13.1	6.2	89.1	11.6	1.7	31.2	12.9	4.3	47.8	2.7	0.6	220.6		
140896	515	9.5	1.7	314.0	13.3	6.3	240.0	12.2	2.2	60.5	12.3	3.4	43.2	2.6	0.7	209.7		
140896	530	10.3	1.9	303.0	13.1	6.0	256.0	12.7	2.6	63.9	11.8	3.3	26.5	2.6	0.9	216.8		
140896	545	10.9	1.8	325.7	12.9	5.6	298.8	12.4	2.4	281.8	11.7	4.0	41.1	2.5	0.7	210.1		
140896	600	11.3	2.0	322.0	12.7	5.3	314.8	12.1	2.2	324.1	12.0	4.3	84.3	2.5	0.8	216.4	0.0	0
140896	615	11.0	1.9	323.5	12.4	5.4	337.3	11.5	1.8	315.6	12.3	4.7	71.0	2.4	0.6	208.7		
140896	630	10.8	2.1	307.0	12.1	6.2	335.8	10.6	1.9	320.3	12.4	4.9	79.7	2.3	0.7	212.1		
140896	645	10.7	1.9	303.6	12.1	6.5	334.5	10.1	2.2	325.2	12.4	4.7	166.1	2.4	0.6	222.7		
140896	700	11.0	2.4	315.3	12.3	7.3	333.1	10.2	3.8	333.9	12.2	4.0	242.0	2.4	0.5	199.9		
140896	715	11.8	2.5	313.5	12.9	7.7	332.5	10.7	3.6	333.4	12.5	3.5	301.9	2.5	0.9	184.2		
140896	730	12.5	2.5	323.5	12.7	6.9	333.4	11.1	3.4	333.4	13.0	5.0	290.8	3.2	1.0	172.6		
140896	745	12.9	2.3	322.1	12.6	5.9	330.0	11.7	3.3	333.3	13.1	4.5	310.0	3.9	1.5	165.3		
140896	800	13.1	2.4	319.3	12.6	6.0	324.0	12.1	2.9	332.4	13.1	4.2	330.9	4.5	1.6	159.9	0.0	0
140896	815	14.0	2.3	323.0	13.4	5.6	319.6	12.7	3.4	330.5	13.2	4.1	330.3	5.5	1.6	161.7		
140896	830	15.1	2.8	322.8	14.2	6.4	319.1	13.3	3.7	327.4	13.7	5.0	331.9	6.6	1.3	165.7		
140896	845	15.7	3.6	323.1	14.9	8.1	317.8	14.0	3.9	326.3	14.6	4.5	332.8	8.5	0.7	170.0		
140896	900	16.4	3.5	320.9	15.6	8.4	312.7	15.4	3.7	319.4	15.8	4.7	324.4	10.7	0.6	139.6		
140896	915	17.3	3.6	319.4	16.1	7.9	310.7	16.7	5.2	314.3	16.7	5.9	314.7	12.5	0.6	142.1		
140896	930	17.9	3.4	317.9	16.6	6.9	305.2	17.3	5.4	311.2	17.0	5.8	313.1	15.4	0.6	90.7		
140896	945	18.4	3.0	316.4	16.8	6.3	303.6	17.9	4.7	308.7	17.5	6.1	311.3	17.1	1.1	157.3		
140896	1000	18.8	4.1	306.0	17.5	6.9	295.7	18.2	5.1	307.2	17.9	5.3	308.7	18.5	1.7	158.4	0.0	0
140896	1015	19.6	4.5	296.7	18.3	6.8	291.4	18.6	4.9	306.8	18.5	5.6	305.2	19.2	2.2	161.3		
140896	1030	20.2	3.7	304.7	18.7	6.2	296.3	19.4	4.6	302.0	19.0	5.3	305.5	19.8	2.3	139.3		
140896	1045	20.7	3.2	308.6	19.2	5.6	297.2	20.3	4.9	290.7	19.4	5.1	309.6	20.7	2.0	158.3		
140896	1100	21.7	5.2	290.8	20.1	10.5	283.8	21.1	4.8	299.7	20.1	6.1	295.7	21.6	2.5	157.7		
140896	1115	22.0	5.1	291.4	20.4	9.3	284.4	21.6	7.1	288.7	20.7	7.3	289.2	22.0	3.3	150.7		
140896	1130	22.7	4.8	289.3	21.1	10.2	282.3	22.1	7.3	291.9	21.2	7.9	285.4	22.7	3.7	158.1		
140896	1145	23.2	5.0	289.6	21.6	9.7	280.4	22.5	8.9	296.6	21.6	6.7	289.1	23.3	3.5	160.0		
140896	1200	23.2	6.1	290.1	21.6	11.9	282.2	22.6	9.0	295.6	21.8	8.0	293.3	23.5	3.4	156.9	0.0	0

Table 2

Rec. Index	Location	Latitude N UTM	Longitude E UTM	Start Time	Pump	Tube	Flow Before	Flow After	Tube Correction	Volume per 30 min	Chromatogram Area	Air Concentration (ppt)	Air Concentration (pg/Nm3)	Atmos. Dil. Factor
57	NW corner boundary fence, LHRL	6230223	313287	0705	12	11	33.44	31.16	0.867	2416	0.344	0.02940	458.9	5.78E-08
75	Top of Old Illawarra Rd near Liverpool/ Heathcote	6229894	312720	0705	11	2	35.71	36.91	0.813	2015	0.075	0.00670	105.2	1.33E-08
6	Above Woronora Bridge across Heathcote Rd	6228653	314926	0720	6	43	34.93	35.03	0.879	2262	1.036	0.09660	1,510	1.90E-07
4	100m from Int. Water Board and Heathcote Rds	6228026	315190	0730	3	21	34.22	34.22	0.830	2183	68.220	7.05050	110,165	1.39E-05
8	Ansto pipeline track at river level	6229594	314797	0742	8	7	33.93	34.01	0.820	2173	0.796	0.07700	1,204	1.52E-07
9	Ansto pipeline track west and above river	6229815	314044	0742	7	26	31.97	32.35	0.853	2387	1.034	0.09140	1,428	1.80E-07
4	100m from Int. Water Board and Heathcote Rds	6228026	315190	0752	18	10	35.45	35.09	0.818	2087	21.490	2.31260	36,135	4.55E-06
1	"Central" position downwind of B.34	6230509	314465	0755	14	15	35.18	35.25	0.820	2096	3043.300	328.26000	5,129,000	6.46E-04
2	"E" position downwind of B.34	6230643	314564	0755	15	8	34.03	34.24	0.790	2083	1.867	0.19000	2,969	3.74E-07
3	"S" position downwind of B.34	6230518	314391	0755	13	9	35.35	35.30	0.889	2265	1934.700	193.09000	3,017,000	3.80E-04
43	Int. Water Board and Needles Rd, above river	6230644	315749	0810	10	1	38.32	45.75	0.816	1747	7.129	0.90480	14,137	1.78E-06
33	Int. ANSTO track/Water Board Pipeline	6229719	315038	0812	1	32	33.85	34.04	0.874	2317	34.750	3.37670	52,761	6.65E-06
54	Needles Rd, east side of River	6230689	315849	0815	20	22	36.54	36.64	0.865	2128	11.756	1.23460	19,290	2.43E-06
53	Needles Rd above northside of river	6231069	315867	0820	19	13	35.60	35.16	0.888	2259	3.085	0.29510	4,611	5.81E-07
76	Turning circle on Sarbugal Pass-above Needles	6231019	315492	0830	2	14	33.07	33.42	0.909	2461	7.132	0.64260	10,041	1.27E-06
83	River below Sarbugal Parking area	6231137	315515	0850	4	27	35.69	36.13	0.839	2103	3.860	0.40030	6,255	7.88E-07
72	Shackles Estate at river level	6232804	317144	0855	16	34	33.60	34.23	0.901	2391	4.090	0.37380	5,841	7.36E-07
84	River level near Water Board Submarine pipeline	6230888	316203	0915	5	25	35.43	35.02	0.895	2287	8.372	0.81420	12,721	1.60E-06
35	House below Bundanoon Rd, east side of river	6231451	316728	0916	17	20	35.20	35.23	0.824	2106	1.179	0.11830	1,848	2.33E-07
72	Shackles Estate at river level	6232804	317144	0940	9	17	34.16	34.46	0.767	2012	0.206	0.02060	322.4	4.06E-08

PMCH Release 1, 14/08/96, Lucas Heights

Table 3

02/04/99 08:28:46

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
160896	15	13.2	1.6	195.7	13.2	4.0	203.8	12.9	3.2	196.2	13.1	2.2	206.3	12.1	0.4	172.8	0.0	0
160896	30	13.2	1.5	190.2	13.4	4.0	201.0	12.9	2.8	187.5	13.1	2.4	204.4	12.1	0.5	173.6		
160896	45	13.1	1.6	196.2	13.5	4.1	193.3	12.9	2.3	188.5	13.4	2.4	211.1	12.0	0.5	187.0		
160896	100	13.1	1.4	183.7	13.5	3.6	188.6	13.2	2.7	178.6	13.3	2.0	193.6	12.0	0.4	206.7		
160896	115	13.1	1.3	163.5	13.4	3.2	185.6	13.4	2.5	174.2	13.6	2.1	195.5	12.0	0.3	189.2		
160896	130	13.1	1.4	187.5	13.4	3.7	189.1	13.5	2.3	175.2	13.6	2.2	198.6	11.9	0.5	187.1		
160896	145	12.9	1.5	183.9	13.4	3.7	198.5	13.2	2.1	188.7	13.5	2.0	208.3	11.9	0.4	173.5		
160896	200	13.0	1.4	187.9	13.3	3.3	201.4	13.2	1.8	200.2	13.5	2.2	209.1	11.9*****		8888.0	0.0	0
160896	215	13.0	1.4	200.8	13.4	3.2	208.7	13.3	1.6	225.8	13.6	2.0	211.4	11.8	0.3	181.9		
160896	230	12.9	1.7	193.4	13.3	3.8	204.4	13.2	1.5	202.6	13.5	2.4	204.2	11.8	0.5	208.3		
160896	245	12.8	1.8	200.9	13.2	4.0	203.0	12.9	1.8	197.0	13.4	2.5	213.6	11.5	0.3	184.7		
160896	300	13.0	1.5	191.7	13.1	3.4	200.2	12.9	1.9	198.8	13.3	2.4	214.4	11.1*****		8888.0		
160896	315	13.1	2.3	210.3	13.1	4.7	212.4	13.2	2.2	212.2	13.3	2.7	215.4	10.9	0.3	8888.0		
160896	330	13.5	2.5	222.8	13.2	5.8	225.3	13.3	1.8	217.2	13.2	2.8	224.5	10.8*****		8888.0		
160896	345	13.3	2.2	197.7	13.1	4.6	209.7	13.1	1.9	170.0	13.0	2.7	207.5	10.8*****		8888.0		
160896	400	13.1	1.6	144.2	12.8	2.8	163.8	13.1	2.1	158.6	13.0	2.6	184.9	10.8*****		8888.0	0.0	0
160896	415	12.9	1.5	145.4	12.6	2.9	155.3	13.1	2.1	168.8	13.1	2.4	198.3	10.5*****		8888.0		
160896	430	12.3	1.5	154.2	12.4	3.3	163.0	13.0	2.1	169.8	12.7	2.5	205.3	10.4*****		8888.0		
160896	445	12.2	1.7	177.8	12.3	4.0	191.7	12.7	2.0	168.1	12.7	3.0	212.9	10.1*****		8888.0		
160896	500	12.1	2.0	191.8	12.4	4.1	196.6	12.4	1.9	177.6	12.3	2.7	205.2	9.9*****		8888.0		
160896	515	11.7	2.0	170.3	12.2	4.1	188.7	11.9	1.6	188.2	12.2	2.8	201.9	9.6*****		8888.0		
160896	530	11.5	1.9	176.7	11.9	4.1	181.2	11.7	1.7	207.7	12.2	2.7	203.6	9.2*****		8888.0		
160896	545	11.4	1.7	186.0	11.4	4.0	186.1	11.7	2.2	204.9	12.0	2.1	222.2	8.9	0.3	257.2		
160896	600	11.0	2.0	204.2	11.5	4.3	198.1	11.5	2.1	231.8	11.3	1.9	248.2	8.7	0.4	246.9	0.0	0
160896	615	10.9	1.7	186.1	11.4	4.1	189.2	11.4	2.5	206.4	11.2	2.1	229.0	8.3*****		8888.0		
160896	630	10.0	2.2	183.7	11.4	5.1	189.3	10.9	2.4	209.6	10.9	2.6	216.1	8.2	0.3	8888.0		
160896	645	10.0	2.1	188.2	10.9	5.0	192.8	10.4	2.9	206.5	10.5	2.6	213.5	8.0*****		8888.0		
160896	700	9.7	1.9	182.5	10.7	4.7	191.0	10.1	3.2	200.7	10.3	3.0	213.0	7.7*****		8888.0		
160896	715	9.9	2.0	185.5	10.8	4.8	194.5	10.2	3.6	203.7	10.5	3.3	207.6	7.7*****		8888.0		
160896	730	10.9	1.6	194.4	11.2	4.2	203.1	10.6	3.6	200.8	10.7	3.2	217.0	8.4	0.4	157.1		
160896	745	11.4	1.8	193.5	11.4	4.3	200.7	10.9	3.6	203.0	10.9	2.7	216.2	8.7	0.6	143.2		
160896	800	12.5	2.3	202.3	11.8	4.8	205.0	11.3	3.1	201.5	11.0	2.9	216.6	9.9	0.7	56.6	0.0	0
160896	815	13.5	2.8	214.3	12.3	4.9	214.4	11.9	2.1	215.3	11.6	2.7	223.9	11.3	0.4	104.6		
160896	830	14.2	2.8	213.1	12.8	4.6	216.8	12.7	1.9	207.1	12.4	3.3	226.1	12.9	0.5	68.3		
160896	845	14.3	2.9	215.4	12.9	4.8	212.5	13.5	1.8	223.7	12.7	3.6	224.3	13.8	0.4	94.0		
160896	900	14.5	3.3	223.7	13.2	5.2	223.5	14.1	2.7	228.3	13.4	4.0	243.5	14.4	0.9	28.6		
160896	915	15.2	3.1	231.6	13.6	4.9	230.9	14.7	3.4	242.4	13.9	3.7	242.9	14.5	1.4	149.1		
160896	930	15.4	3.3	236.3	13.7	5.5	236.0	14.8	4.7	251.9	14.2	4.0	258.3	15.5	1.6	161.8		
160896	945	15.5	3.5	239.7	13.8	5.6	237.9	15.0	4.5	249.2	14.5	3.8	245.9	16.2	1.8	170.9		
160896	1000	15.9	3.3	255.6	14.0	5.2	250.7	15.2	4.3	247.3	14.7	3.6	250.6	16.4	2.1	178.9	0.0	0
160896	1015	16.2	3.1	258.0	14.2	5.1	253.9	15.3	4.5	247.0	14.8	4.5	258.4	16.7	2.0	174.1		
160896	1030	16.4	2.8	254.0	14.4	4.6	246.5	15.6	4.0	278.3	14.9	4.2	273.6	16.8	2.3	174.0		
160896	1045	16.6	2.9	254.8	14.4	4.7	252.2	15.7	3.9	261.5	15.0	4.0	262.8	16.9	2.3	174.7		
160896	1100	17.0	2.6	255.6	14.9	4.0	248.8	15.9	3.8	250.4	15.3	3.8	247.6	17.0	2.2	168.4		
160896	1115	16.9	2.7	250.8	14.7	4.3	249.1	16.1	3.4	258.3	15.4	3.7	261.0	17.2	1.9	164.2		
160896	1130	17.0	2.7	254.0	15.0	4.1	254.9	16.3	3.7	263.2	15.9	3.3	272.9	17.4	2.1	179.7		
160896	1145	17.4	2.7	261.3	15.2	4.1	265.6	16.5	3.0	264.0	15.9	3.6	262.7	17.7	1.8	164.8		
160896	1200	17.5	2.5	259.2	15.3	4.1	259.8	16.9	3.0	254.1	16.1	2.9	271.3	17.9	1.7	164.7	0.0	0

Table 4

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram	Air Concentration		Atmos. Dil.
Index		N UTM (m)	E UTM (m)	Time			Before	After	Correction	per 30 min	Area	(pg/Nm^3)	(ppt)	Factor
7	Akuna Oval, Bangor	6233659	318740	0800	18	22	35.09	34.86	0.865	2226	0.444	207.8	0.013	2.63E-08
13	Barden Rd, under HT powerline	6233104	316728	0800	17	20	35.23	35.48	0.824	2098	39.141	22,238	1.423	2.81E-06
27	EDL/Old LH Tip, north of HT powerline	6232819	314967	0800	3	36	34.22	34.36	0.932	2446	2.989	1,372	0.088	1.73E-07
45	LH Community School	6231834	315741	0800	16	25	34.23	35.43	0.895	2313	3.176	1,543	0.099	1.95E-07
50	Menai Town Centre	6234243	316755	0800	20	13	36.64	36.75	0.888	2178	16.557	8,925	0.571	1.13E-06
59	Old LH tip, L.H. Reservoir Tank visible	6232127	315694	0800	2	32	33.42	33.10	0.874	2365	47.278	23,868	1.528	3.02E-06
75	Top of Old Illawarra Rd near Liverpool/ Heathcote	6229894	312720	0800	7	11	32.35	32.32	0.867	2413	1.151	524.8	0.034	6.63E-08
78	Valley under HT powerline, opp. Cement Pl	6231426	314700	0800	1	27	34.04	34.55	0.839	2202	405.5	221,663	14.186	2.80E-05
54	Needles, east side of River	6230689	315849	0802	15	1	34.24	34.28	0.816	2144	0.969	494.2	0.032	6.25E-08
15	Barden Trig	6233869	314877	0815	19	10	35.16	35.34	0.818	2089	0.648	332.6	0.021	4.20E-08
34	Holmlea Pl, Nth Engadine	6230274	315892	0815	14	Ha I	35.25	35.16	0.761	1945	3.504	2,026	0.130	2.56E-07
18	Kelton Pl, Nth Engadine	6231187	316828	0821	13	43	35.30	34.91	0.879	2254	0.597	282.5	0.018	3.57E-08
44	Jaeger Pl, Woronora Heights	6232051	317330	0826	12	Ha IV	31.16	30.90	0.778	2257	3.230	1,609	0.103	2.03E-07
5	20m from New Illawarra Rd, Centre plume	6230857	314495	0830	9	15	34.46	34.29	0.820	2147	1748.0	980,663	62.762	1.24E-04
61	On Blue Trail, West of plume centre	6231121	314781	0830	8	9	34.01	33.93	0.889	2355	6.788	3,258	0.209	4.12E-07
86	S N. Illaw. Rd, under HT, E of plume centre	6230778	314565	0830	10	35	34.92	35.09	0.729	1874	2886.0	1,854,768	118.705	2.34E-04
77	Valley NE Barden Trig, under HT powerline	6234044	315328	0832	4	8	36.13	35.68	0.790	1980	0.408	213.0	0.014	2.69E-08
82	Prince Edward Park, Woronora	6232628	319100	0845	11	37	36.91	37.15	0.821	1995	4.420	2,497	0.160	3.16E-07
7	Akuna Oval, Bangor	6233659	318740	0900	18	21	35.09	34.86	0.830	2136	29.311	16,295	1.043	2.06E-06
27	EDL/Old LH Tip, north of HT powerline	6232819	314967	0900	3	17	34.22	34.36	0.767	2013	0.402	206.1	0.013	2.60E-08
75	Top of Old Illawarra Rd near Liverpool/ Heathcote	6229894	312720	0900	6	2	35.03	34.92	0.813	2092	0.598	304.8	0.020	3.85E-08
50	Menai Town Centre	6234243	316755	0901	20	14	36.64	36.75	0.909	2229	0.454	212.6	0.014	2.69E-08
45	LH Community School	6231834	315741	0910	5	34	35.02	35.25	0.901	2308	9.391	4,681	0.300	5.92E-07
5	20m from New Illawarra Rd, Centre plume	6230857	314495	0920	9	Ha II	34.46	34.29	0.857	2244	27.107	14,327	0.917	1.81E-06
61	On Blue Trail, West of plume centre	6231121	314781	0920	8	Ha III	34.01	33.93	0.984	2607	11.947	5,325	0.341	6.73E-07
86	S N. Illaw. Rd, under HT, E of plume centre	6230778	314565	0920	10	19	34.92	35.09	0.900	2314	5828.4	3,034,309	194.196	3.83E-04
15	Barden Trig	6233869	314877	0930	19	Ha V	35.16	35.34	0.748	1910	1.090	626.8	0.040	7.92E-08
77	Valley NE Barden Trig, under HT powerline	6234044	315328	0930	4	7	36.13	35.68	0.820	2055	0.396	198.5	0.013	2.51E-08
30	Extension Forum Rd, Heathcote near HT	6227586	315408	0935	16	12	31.16	30.90	0.852	2471	0.847	372.6	0.024	4.71E-08
30	Extension Forum Rd, Heathcote near HT	6227586	315408	1100	17	28	35.23	35.48	0.852	2169	4.946	2,573	0.165	3.25E-07

PMCH Release 2, 16/08/96 Lucas Heights

Table 5

02/04/99 08:41:54

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
110697	15	9.0	1.4	213.6	12.8	5.1	238.6	11.8	3.6	215.8	11.1	1.9	232.2	4.4	0.2	218.3	0.0	0
110697	30	7.3	1.2	201.7	12.4	4.2	233.1	11.7	3.4	214.8	11.5	2.4	226.0	4.2	0.3	210.2		
110697	45	6.6	1.5	227.0	12.3	4.1	240.7	11.6	3.1	224.6	11.7	2.6	227.7	4.1	0.4	233.4		
110697	100	9.4	1.5	241.5	12.3	4.5	246.4	11.6	2.1	243.1	11.2	2.5	228.4	3.9*****		8888.0		
110697	115	8.7	1.1	213.3	12.2	4.7	246.4	10.9	1.6	260.3	11.4	2.4	228.0	3.7	0.3	202.4		
110697	130	7.2	1.3	209.4	13.2	5.6	253.7	10.4	1.9	236.4	11.3	2.4	218.3	3.6	0.3	244.8		
110697	145	6.8	1.8	222.3	13.4	6.2	251.4	9.7	3.3	214.0	10.3	2.7	209.0	3.6	0.6	253.5		
110697	200	7.7	1.9	222.2	13.2	5.9	251.7	10.0	3.6	212.1	10.7	2.7	217.3	3.5	0.3	245.6	0.0	0
110697	215	7.9	1.9	222.0	13.0	5.7	250.5	10.4	3.2	208.8	10.9	2.6	219.3	3.2*****		8888.0		
110697	230	8.5	1.9	215.5	13.3	5.6	252.5	10.5	3.2	210.1	10.9	2.5	220.7	3.0	0.3	201.5		
110697	245	9.4	1.9	217.6	13.2	5.3	246.2	10.8	3.8	216.4	10.7	2.4	217.3	2.9	0.3	222.3		
110697	300	9.8	1.9	221.5	13.2	5.4	243.9	11.7	3.5	222.0	10.5	2.4	217.0	2.8	0.2	216.6		
110697	315	10.1	1.7	230.3	13.6	4.7	254.9	11.9	3.3	225.2	10.8	2.2	221.9	2.8	0.3	251.8		
110697	330	9.6	1.5	228.6	13.8	5.4	255.3	11.4	2.5	230.0	11.0	2.3	215.7	2.7	0.4	212.7		
110697	345	8.7	1.8	231.4	13.5	5.5	245.6	10.7	3.3	218.8	10.5	2.3	206.5	2.7	0.3	204.3		
110697	400	9.4	1.5	222.3	12.8	5.0	236.9	11.2	3.0	223.0	11.2	2.4	216.3	2.7	0.4	234.6	0.0	0
110697	415	8.6	1.6	217.4	12.8	5.5	235.9	9.6	2.9	211.7	10.7	2.5	212.2	2.6	0.2	8888.0		
110697	430	8.4	1.3	218.2	13.3	4.3	233.0	8.9	1.9	224.7	11.7	2.6	217.6	2.6	0.2	222.7		
110697	445	8.8	1.1	224.8	12.9	3.3	234.5	9.1	1.1	266.3	12.0	2.4	217.6	2.5	0.3	219.6		
110697	500	8.1	1.2	195.6	12.4	4.2	220.6	8.7	2.0	216.0	10.9	2.7	206.9	2.5	0.4	211.9		
110697	515	8.2	1.5	225.1	11.7	4.2	218.3	8.4	2.6	220.8	10.2	2.5	199.1	2.4	0.3	247.2		
110697	530	8.8	1.6	220.5	11.3	4.1	217.9	8.8	2.7	210.4	9.8	2.5	196.3	2.2	0.3	242.4		
110697	545	8.8	1.8	218.6	11.5	4.8	214.4	8.8	2.8	199.2	10.1	2.3	193.9	2.0*****		8888.0		
110697	600	9.3	1.8	224.0	11.4	4.4	223.7	9.0	1.8	230.7	10.9	2.2	200.5	1.9	0.2	252.8	0.0	0
110697	615	9.2	1.4	226.2	11.3	4.6	228.7	9.8	1.9	240.6	11.2	2.5	208.4	1.9	0.3	210.4		
110697	630	9.2	1.0	233.4	11.2	3.7	227.3	9.1	1.6	269.6	11.1	2.5	207.5	1.8*****		8888.0		
110697	645	9.2	1.4	228.8	11.0	3.8	225.8	7.8	2.0	279.6	11.0	2.2	210.6	1.8	0.3	220.6		
110697	700	8.5	0.9	236.0	10.8	3.1	222.8	7.5	1.8	271.5	10.9	2.1	199.3	1.8	0.3	234.9		
110697	715	8.2	1.1	242.2	10.7	3.2	223.4	8.0	2.0	282.2	10.8	1.9	209.4	1.7	0.3	233.4		
110697	730	8.6	1.0	258.8	10.8	3.2	232.5	7.3	2.7	281.4	10.4	1.9	223.3	1.9	0.3	252.8		
110697	745	8.9	1.1	294.6	10.9	3.1	239.1	7.9	3.0	272.8	10.8	1.9	237.3	2.5	0.6	185.2		
110697	800	9.9	1.6	277.5	11.0	3.6	239.4	8.7	3.0	264.1	11.1	1.6	251.9	3.1	0.7	167.5	0.0	0
110697	815	10.8	1.6	273.9	11.4	3.7	239.3	9.3	2.8	272.0	11.3	1.4	245.6	4.0	1.0	165.5		
110697	830	11.0	1.4	259.1	11.5	3.5	234.8	9.8	2.5	268.2	11.4	1.6	235.3	4.5	0.9	177.0		
110697	845	11.4	1.5	279.7	11.6	2.9	245.2	9.8	2.4	283.7	11.4	1.5	243.6	5.0	1.1	176.8		
110697	900	11.5	1.9	272.4	11.6	3.8	247.1	10.2	2.7	265.7	10.6	1.9	264.9	5.7	0.8	213.6		
110697	915	11.8	1.9	261.7	11.7	4.3	244.9	11.2	2.5	272.2	10.8	1.8	260.3	6.8	0.8	183.1		
110697	930	13.0	2.0	258.2	11.6	3.5	251.0	11.7	2.1	286.2	11.6	1.9	265.9	7.8	0.9	168.6		
110697	945	13.9	1.6	260.3	12.0	2.8	254.7	12.3	1.9	292.7	12.6	1.3	263.5	9.1	0.8	153.2		
110697	1000	14.4	2.2	273.2	12.4	3.2	266.3	13.0	1.8	299.6	13.3	1.5	262.0	10.6	0.5	130.1	0.0	0
110697	1015	14.6	2.5	279.9	12.5	4.0	281.0	13.4	3.1	287.1	13.6	2.3	278.3	12.3	0.9	148.6		
110697	1030	14.9	2.3	266.4	12.7	3.6	276.8	14.1	3.0	274.7	13.9	2.2	284.5	13.3	1.1	147.6		
110697	1045	15.3	2.4	261.7	13.1	3.3	263.3	14.5	2.8	269.0	14.2	2.4	282.9	14.2	1.4	147.1		
110697	1100	15.4	2.4	280.8	13.3	3.3	279.6	14.6	3.2	287.0	14.4	3.0	283.6	14.6	1.5	146.6		
110697	1115	15.3	2.3	274.8	13.3	3.3	280.0	14.4	3.3	277.7	14.5	2.5	278.7	14.9	1.2	166.6		
110697	1130	15.6	2.1	286.5	13.5	3.0	281.0	14.9	2.7	283.9	14.6	2.3	285.8	15.5	1.4	165.8		
110697	1145	15.7	2.2	274.2	13.7	3.0	273.3	15.5	2.9	261.6	14.8	2.3	279.9	16.4	1.0	172.2		
110697	1200	15.7	2.1	282.1	13.7	3.5	283.5	15.2	3.2	283.0	14.8	2.1	284.6	16.1	1.4	172.9	0.0	0

Table 6

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram area		Air Concentration		Atmos.Dil.	
Index		N UTM m	E UTM m	Time			Before	After	Correction	per 30 min	PMCH	PDCH	(ppt)	(pg/m3)	Factor	Comments
10	ANSTO swimming pool	6230509	314308	0800	6	22	38.59	40.11	0.914	2090	0.083	0.4779	0.0042	65	4.99E-09	
75	Top of Old Illawarra Rd near Liverpool/Heathcote	6229894	312720	0800	7	43	36.59	37.89	0.930	2248	0.044	0.6767	0.0024	37	2.88E-09	
63	On Old Illawarra road opp. Building 9, ANSTO	6230379	313748	0800	8	26	38.94	40.00	0.909	2073	0.000	0.0000	0.0009	13	1.04E-09	
40	Int. New Illawarra/ANSTO Entrance Rds.	6230689	314191	0800	9	Ha V	38.59	39.76	0.845	1941	0.091	0.4442	0.0048	75	5.75E-09	
26	E. side Carpark/Child Care Centre, ANSTO	6230615	314257	0800	10	17	39.40	40.36	0.835	1884	0.049	0.1399	0.0031	49	3.74E-09	v. low PDCH
71	Power pylon, behind Building 34	6230680	314533	0800	11	Ha IV	41.06	42.91	0.893	1914	0.120	0.3490	0.0061	95	7.34E-09	
65	Opp. Bulding 67, outside fence, ANSTO	6230268	314299	0800	12	11	38.18	39.06	0.965	2249	0.947	0.5601	0.0356	557	4.28E-08	
51	Meteorological Tower, ANSTO	6230063	313683	0800	13	19	32.77	33.77	1.090	2949	1138.544	1.3183	59.3038	926,623	7.13E-05	** initial flow
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	0800	14	9	40.10	41.26	0.987	2184	22.077	0.7181	1.3816	21,587	1.66E-06	
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	0800	15	25	39.42	39.35	0.952	2175	134.266	1.1581	9.3245	145,695	1.12E-05	
25	E. end of Thomson Ave., ANSTO	6230298	314289	0800	16	Ha I	38.15	39.55	0.854	1978	0.509	0.7081	0.0222	347	2.67E-08	
14	Barden Ridge oval, near LHCS	6236975	315851	0800	17	13	40.29	41.59	0.986	2168	0.016	0.5715	0.0014	22	1.70E-09	
21	Cnr Lawrence/Hahn Ave., ANSTO	6230122	313849	0800	18	15	39.48	40.72	0.919	2063	271.539	0.5941	20.0786	313,728	2.41E-05	
52	Near Water Tank/Reservoir, Lucas Heights	6231387	315225	0800	19	S1	38.87	40.03	1.072	2446	0.006	0.5804	0.0009	15	1.14E-09	low PDCH
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	0800	20	12	40.96	42.07	1.002	2172	0.426	0.9554	0.0170	266	2.05E-08	Bad pumping?
43	Int. Water Board and Needles Rd, above river	6230644	315749	0815	2	2	38.07	39.50	0.918	2130	0.065	0.5050	0.0034	52	4.03E-09	
56	Needles Tack, half way down W side OH power	6230893	315752	0815	21	S3	35.60	36.38	1.091	2728	0.011	0.7272	0.0010	16	1.20E-09	low PDCH
55	Needles road, int. track, west side of river	6230503	315838	0815	22	S4	37.50	38.68	1.061	2507	0.127	0.8383	0.0049	77	5.90E-09	
54	Needles Rd, east side of River	6230689	315849	0815	23	10	41.33	43.27	0.871	1853	0.029	0.8392	0.0023	35	2.72E-09	
76	Turning circle on Sarbugal Pass-above Needles	6231019	315492	0830	3	7	39.34	40.67	0.918	2065	0.112	0.5531	0.0054	84	6.44E-09	
51	Meteorological Tower, ANSTO	6230063	313683	0900	13	35	33.77	34.77	0.803	2109	518.744	0.5356	37.6813	588,770	5.14E-05	** calibn bad??
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	0900	14	36	41.26	42.41	0.990	2130	23.296	0.9360	1.5046	23,509	2.05E-06	
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	0900	15	37	39.35	39.28	0.997	2282	448.040	0.9172	30.0487	469,511	4.10E-05	
25	E. end of Thomson Ave., ANSTO	6230298	314289	0900	16	Ha II	39.55	40.95	0.983	2198	208.530	1.1513	14.4293	225,457	1.97E-05	
21	Cnr Lawrence/Hahn Ave., ANSTO	6230122	313849	0900	18	A1	40.72	41.95	1.021	2223	480.861	1.5271	33.1224	517,537	4.52E-05	
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	0900	20	S2	42.07	43.17	1.147	2422	321.901	0.7983	17.9402	280,315	2.45E-05	
43	Int. Water Board and Needles Rd, above river	6230644	315749	0930	2	S6	39.50	40.92	1.111	2487	0.044	1.0090	0.0022	34	2.99E-09	
76	Turning circle on Sarbugal Pass-above Needles	6231019	315492	0930	3	S7	40.67	41.99	1.112	2421	0.106	0.9293	0.0044	68	5.94E-09	
34	Holmlea Pl., North Engadine	6230274	315892	0930	6	20	40.11	41.62	0.973	2143	2.542	2.5299	0.0990	1,546	1.35E-07	v. high PDCH
32	Ferntree Reserve, Engadine	6229034	315350	0930	7	14	37.89	39.19	0.998	2331	0.102	0.8981	0.0044	69	6.00E-09	
28	End of Fairview Ave, Engadine	6228276	315298	0930	8	28	40.00	41.06	0.973	2161	0.095	1.2426	0.0045	70	6.09E-09	
42	Int. Sierra/Ridge rds., Engadine	6230299	315228	0930	9	21	39.76	40.92	0.917	2046	32.728	0.9432	2.2759	35,561	3.11E-06	
36	Illuta Pl., Engadine	6229792	315207	0930	10	34	40.36	41.32	0.985	2171	0.148	0.1355	0.0065	101	8.84E-09	v. low PDCH
56	Needles Tack, half way down W side OH power	6230893	315752	0930	21	1	36.38	37.16	0.935	2289	2.682	0.7713	0.0978	1,527	1.33E-07	
55	Needles road, int. track, west side of river	6230503	315838	0930	22	8	38.68	39.86	0.917	2102	2.218	0.6552	0.0882	1,378	1.20E-07	
54	Needles Rd, east side of River	6230689	315849	0930	23	S5	43.27	45.20	1.249	2541	0.151	1.1355	0.0056	88	7.67E-09	
18	Bottom, Kelton Pl.,Nth Engadine **	6231187	316828	0945	11	32	42.91	44.76	0.904	1856	9.735	1.2868	0.6019	9,405	8.22E-07	
44	Jaeger Pl., Woronora Heights (S.N.43603)	6232051	317330	0945	12	33	39.06	39.94	0.867	1975	0.030	0.3571	0.0022	34	2.95E-09	
84	River level, below water pump station	6230888	316203	0945	19	27	40.03	41.18	0.926	2052	6.935	0.6208	0.3343	5,224	4.56E-07	
79	Water Board Rd., towards Bundanoon Rd.	6230969	316609	1000	17	Ha III	41.59	42.89	1.093	2329	11.749	0.6846	0.6128	9,576	8.37E-07	

PMCH Release 3, 11/06/97, Lucas Heights

02/05/99 07:55:42

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
230697	15	6.5	1.8	181.5	12.7	4.0	239.3	9.8	3.4	202.1	10.2	2.0	203.2	5.7	0.7	264.1	0.0	0
230697	30	6.4	1.6	202.2	13.0	3.6	248.3	9.2	3.4	202.4	10.2	2.0	208.3	5.6	0.7	262.8		
230697	45	6.5	1.9	209.4	13.0	3.3	252.4	9.1	3.6	201.3	9.9	2.2	195.7	5.5	0.6	259.4		
230697	100	6.4	1.8	193.1	12.8	3.5	241.9	9.0	4.0	199.7	9.4	2.6	191.8	5.4	0.6	245.0		
230697	115	6.1	1.5	200.3	12.8	3.7	239.4	8.6	3.8	199.8	9.3	2.7	196.1	5.3	0.7	257.0		
230697	130	6.4	1.7	216.1	12.8	4.1	244.6	8.8	3.8	199.5	9.1	2.7	196.5	5.3	0.8	254.7		
230697	145	6.7	1.8	211.6	12.8	4.3	246.3	8.6	3.8	200.5	9.1	2.6	195.9	5.2	0.5	270.1		
230697	200	6.3	1.7	212.4	12.8	4.4	246.1	8.7	3.7	201.8	9.1	2.5	198.6	5.1	0.5	265.8	0.0	0
230697	215	6.3	1.8	207.3	12.6	4.8	236.6	8.7	3.8	200.7	9.4	2.6	196.4	5.1	0.5	266.9		
230697	230	6.2	1.7	204.8	12.5	5.0	230.8	8.4	3.8	198.7	9.0	2.8	194.3	5.0	0.5	267.1		
230697	245	6.2	1.6	208.8	12.7	5.1	231.0	8.4	3.9	197.2	8.8	2.7	193.1	4.9	0.4	268.5		
230697	300	6.7	1.4	196.7	12.5	4.9	225.4	9.0	4.1	195.1	8.6	2.5	192.0	4.8	0.2	254.3		
230697	315	6.4	1.4	214.1	13.0	4.7	230.0	9.4	4.1	197.1	9.7	2.7	197.4	4.8	0.3	264.6		
230697	330	7.3	1.8	212.7	12.7	4.9	230.9	9.3	3.9	198.4	9.6	3.0	198.3	4.8	0.3	261.8		
230697	345	7.9	1.9	215.0	12.6	4.8	230.9	8.9	3.9	198.6	9.5	2.9	194.2	4.8	0.3	264.0		
230697	400	7.5	1.7	217.3	12.9	4.8	230.9	8.9	3.8	198.5	9.4	2.9	197.4	4.7	0.3	270.9	0.0	0
230697	415	7.2	1.7	216.3	13.1	4.5	233.4	9.0	3.8	198.4	9.6	2.9	198.0	4.5	0.3	266.6		
230697	430	7.0	1.8	215.3	13.1	4.2	236.5	9.1	3.8	200.9	9.6	2.6	201.9	4.4	0.3	259.5		
230697	445	6.8	1.9	222.4	12.4	4.2	236.6	8.9	3.7	202.5	9.8	2.9	198.4	4.4	0.4	258.5		
230697	500	6.1	1.6	200.6	12.8	4.3	230.5	8.3	4.0	198.5	9.9	3.1	198.7	4.3	0.4	261.2		
230697	515	5.7	1.4	202.5	13.2	3.9	230.6	9.3	4.0	198.9	10.1	3.0	199.5	4.2	0.5	266.5		
230697	530	6.1	1.6	199.8	13.3	3.6	235.7	9.2	4.2	198.6	9.7	2.6	198.5	4.1	0.3	260.9		
230697	545	6.3	1.7	198.3	13.4	3.5	234.1	9.0	4.3	197.5	9.4	2.6	197.3	4.0	0.4	257.5		
230697	600	5.8	1.7	201.1	13.5	3.2	230.3	9.5	4.4	199.1	9.7	3.0	194.2	4.0	0.4	259.6	0.0	0
230697	615	5.7	1.6	214.9	13.4	3.4	233.7	9.1	4.3	199.1	9.5	2.5	201.2	3.9	0.4	256.4		
230697	630	6.2	1.8	216.6	12.9	4.0	234.7	8.3	4.0	199.6	9.7	2.4	199.0	3.9	0.4	260.5		
230697	645	6.4	2.1	219.5	13.0	4.3	232.3	8.1	4.2	198.9	8.6	2.7	198.4	3.8	0.4	259.9		
230697	700	6.9	2.1	215.5	13.2	4.4	231.9	8.2	4.5	195.9	8.6	2.7	195.2	3.8	0.3	269.3		
230697	715	5.9	1.5	214.1	13.1	4.7	224.1	8.8	4.4	198.8	8.9	2.8	194.1	3.8	0.4	266.8		
230697	730	6.1	1.9	219.8	13.4	4.3	226.1	8.5	4.2	197.4	9.0	2.6	199.6	3.9	0.4	274.4		
230697	745	7.0	1.8	222.6	13.4	4.3	224.3	9.2	4.5	196.9	9.3	2.8	196.9	4.2	0.4	183.6		
230697	800	7.7	1.6	225.4	13.4	4.6	222.3	8.9	4.4	195.0	9.1	2.7	195.8	4.8	0.8	190.3	0.0	0
230697	815	8.4	1.3	214.2	13.6	4.4	220.1	9.3	4.2	196.3	9.0	2.4	189.3	5.4	1.0	190.4		
230697	830	9.6	1.2	228.8	13.0	4.1	220.2	9.7	3.9	196.2	9.4	2.3	195.4	6.2	1.1	189.7		
230697	845	11.2	1.3	236.7	12.1	3.4	233.9	9.7	2.5	211.6	9.8	2.4	194.2	6.9	1.3	188.6		
230697	900	12.5	1.2	233.5	12.0	2.9	242.2	11.7	0.8	252.0	10.4	2.1	195.1	8.1	0.9	202.7		
230697	915	13.4	1.5	227.5	12.4	3.5	237.1	12.3	0.2	247.1	10.9	1.7	198.9	9.2	0.8	178.4		
230697	930	14.4	1.2	224.9	12.8	2.9	238.0	13.2	0.2	306.3	11.8	1.4	205.2	10.0	1.0	152.0		
230697	945	15.3	0.9	248.4	13.3	1.6	250.4	13.2	1.0	306.1	12.8	1.1	226.2	10.5	1.2	150.8		
230697	1000	15.2	1.5	297.0	13.4	1.8	258.5	13.7	1.4	306.4	13.8	1.3	226.2	11.4	1.1	150.6	0.0	0
230697	1015	15.0	1.6	274.2	13.2	2.2	259.0	14.4	1.8	299.9	14.3	1.1	268.1	12.4	0.7	124.2		
230697	1030	15.4	1.9	274.1	13.6	2.7	262.9	14.8	2.0	281.7	14.6	1.4	261.7	14.2	0.6	62.5		
230697	1045	15.9	2.0	260.5	13.8	2.8	256.3	15.2	2.3	281.6	15.1	1.0	273.1	15.4	0.7	84.5		
230697	1100	16.3	2.0	271.9	14.2	2.6	268.2	15.7	2.3	283.8	15.6	1.3	275.8	16.6	0.7	160.8		
230697	1115	16.9	1.8	263.5	14.8	2.4	261.2	16.5	1.8	265.3	15.9	1.6	266.7	17.1	1.0	178.6		
230697	1130	17.1	2.1	270.9	15.1	2.6	276.8	16.7	1.8	251.2	16.2	1.9	256.4	17.4	1.0	195.4		
230697	1145	17.5	1.9	286.6	15.3	2.7	288.2	17.1	1.8	273.8	16.6	1.6	265.6	17.8	0.9	175.8		
230697	1200	17.6	2.1	276.7	15.4	3.0	279.0	17.2	2.0	274.4	16.7	1.7	252.1	17.8	1.1	192.6	0.0	0

Table 8

Rec. Index	Location	Latitude N UTM m	Longitude E UTM m	Start Time	Pump	Tube	Flow Before	Flow After	Tube Correction	Volume per 30 min	Chromatogram area PMCH	Chromatogram area PDCH	Air Concentration (ppt)	Air Concentration (pg/m3)	Atmos.Dil. Factor	Comments
43	Int. Water Board and Needles Rd, above river	6230644	315749	1015	2	S6	40.92	40.92	1.111	2444	1.18141	1.3535	0.1326	2,072	1.45E-07	
41	Int. Sarbugal Pass track/Water Board road	6230562	315525	1015	3	S7	41.99	42.29	1.112	2375	2.83840	1.8303	0.3303	5,160	3.61E-07	
42	Int. Sierra/Ridge rds., Engadine	6230299	315228	1015	6	22	41.62	41.79	0.914	1972	53.54550	0.9364	9.8508	153,919	1.08E-05	
34	Holmlea Pl., North Engadine	6230274	315892	1015	9	Ha V	40.92	40.79	0.845	1861	55.64700	0.8080	10.8478	169,497	1.18E-05	Bad flow??
36	Illuta Pl., Engadine	6229792	315207	1015	10	17	41.32	49.74	0.835	1651	32.50540	0.8747	7.1449	111,639	7.80E-06	Bad flow??
32	Ferntree Reserve, Engadine	6229034	315350	1015	11	Ha IV	44.76	48.03	0.893	1732	0.20796	2.6329	0.0310	484	3.38E-08	
28	End of Fairview Ave, Engadine	6228276	315298	1015	12	11	39.94	39.91	0.965	2175	0.40100	2.0921	0.0493	770	5.39E-08	
56	Needles Tack, half way down W side OH power	6230893	315752	1015	17	Ha III	42.89	42.80	1.093	2296	2.20730	0.7344	0.2653	4,145	2.90E-07	
55	Needles road, int. track, west side of river	6230503	315838	1015	19	27	41.18	41.14	0.926	2025	1.71220	0.9395	0.2329	3,639	2.54E-07	
44	Jaeger Pl., Woronora Heights (S.N.43603)	6232051	317330	1015	21	S3	37.16	37.24	1.091	2640	0.39650	1.8435	0.0402	627	4.39E-08	
80	Water Board road, further SW of Sarbugal track	6230399	315099	1015	22	S4	39.86	39.98	1.061	2392	16.90010	2.1232	2.5622	40,034	2.80E-06	
54	Needles Rd, east side of River	6230689	315849	1015	23	S5	45.20	45.30	1.249	2484	1.36330	3.1038	0.1508	2,356	1.65E-07	
18	Bottom, Kelton Pl.,Nth Engadine	6231187	316828	1020	14	9	42.41	42.44	0.987	2094	11.09890	0.7911	1.4706	22,978	1.61E-06	
26	E. side Carpark/Child Care Centre, ANSTO	6230615	314257	1030	7	43	39.19	39.02	0.930	2140	0.25370	1.3038	0.0310	484	3.38E-08	
25	E. end of Thomson Ave., ANSTO	6230298	314289	1030	8	26	41.06	40.95	0.909	1995	217.37920	0.9470	39.5450	617,891	4.32E-05	
51	Meteorological Tower, ANSTO	6230063	313683	1030	13	35	34.77	34.73	0.803	2080	802.40380	8.5128	140.0410	2,188,140	1.53E-04	
63	On Old Illawarra road opp. Building 9, ANSTO	6230379	313748	1030	15	25	39.28	39.35	0.952	2179	1.20570	0.7947	0.1518	2,372	1.66E-07	
64	Opp D3 on Hahn Ave., ANSTO	6230194	313841	1030	16	Ha II	40.95	41.00	0.854	1876	482.98690	1.1927	93.4574	1,460,273	1.02E-04	
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	1030	18	15	41.95	42.00	0.919	1970	4.49680	0.8759	0.6319	9,873	6.90E-07	
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	1030	20	S2	43.17	43.23	1.147	2390	135.55600	0.9376	20.5883	321,693	2.25E-05	
43	Int. Water Board and Needles Rd, above river	6230644	315749	1130	2	2	40.92	99.99	0.918	9999	1.52360	3.0086	0.0419	655	4.81E-08	
41	Int. Sarbugal Pass track/Water Board road	6230562	315525	1130	3	7	42.29	42.59	0.918	1947	1.64370	2.6923	0.2324	3,632	2.67E-07	
42	Int. Sierra/Ridge rds., Engadine	6230299	315228	1130	6	14	41.79	41.96	0.953	2048	3.98550	1.4944	0.5385	8,414	6.18E-07	
26	E. side Carpark/Child Care Centre, ANSTO	6230615	314257	1130	7	20	39.02	38.84	0.944	2182	0.16440	0.5962	0.0190	297	2.18E-08	
25	E. end of Thomson Ave., ANSTO	6230298	314289	1130	8	21	40.95	40.83	0.892	1963	0.55500	1.7941	0.0764	1,194	8.76E-08	
34	Holmlea Pl., North Engadine	6230274	315892	1130	9	21	40.79	40.65	0.917	2027	3.61800	2.1198	0.4939	7,717	5.66E-07	Bad flow??
36	Illuta Pl., Engadine	6229792	315207	1130	10	32	49.74	58.16	0.982	1638	2.47000	1.6196	0.4163	6,505	4.77E-07	Bad flow??
32	Ferntree Reserve, Engadine	6229034	315350	1130	11	33	48.03	51.30	0.869	1575	0.66560	1.9345	0.1148	1,794	1.32E-07	
28	End of Fairview Ave, Engadine	6228276	315298	1130	12	33	39.91	39.87	0.867	1956	0.47490	2.9153	0.0653	1,021	7.49E-08	
51	Meteorological Tower, ANSTO	6230063	313683	1130	13	19	34.73	34.69	1.090	2826	4.67540	0.2191	0.4581	7,158	5.25E-07	
18	Bottom, Kelton Pl.,Nth Engadine	6231187	316828	1130	14	36	42.44	42.46	0.990	2099	8.53100	0.6097	1.1271	17,611	1.29E-06	
63	On Old Illawarra road opp. Building 9, ANSTO	6230379	313748	1130	15	37	39.35	39.42	0.997	2278	0.30826	1.7953	0.0358	559	4.10E-08	
64	Opp D3 on Hahn Ave., ANSTO	6230194	313841	1130	16	Ha I	41.00	41.04	0.983	2157	0.55850	0.9879	0.0700	1,094	8.03E-08	
76	Turning circle on Sarbugal Pass-above Needles	6231019	315492	1130	17	13	42.80	42.70	0.986	2076	0.94077	0.7779	0.1239	1,936	1.42E-07	
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	1130	18	A1	42.00	42.05	1.021	2187	3.16150	3.7724	0.3998	6,246	4.58E-07	
55	Needles road, int. track, west side of river	6230503	315838	1130	19	S1	41.14	41.09	1.072	2347	3.54045	3.5704	0.4174	6,521	4.79E-07	
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	1130	20	12	43.23	43.29	1.002	2085	115.40550	1.9867	20.0918	313,935	2.30E-05	
17	Behind 4 Range Pl., under pylon, Engadine	6229516	315212	1130	21	1	37.24	37.32	0.935	2257	0.20170	0.9283	0.0230	359	2.64E-08	
80	Water Board road, further SW of Sarbugal track	6230399	315099	1130	22	8	39.98	40.09	0.917	2061	2.68365	4.3903	0.3596	5,619	4.12E-07	
54	Needles Rd, east side of River	6230689	315849	1130	23	10	45.30	45.39	0.871	1729	3.49610	2.2838	0.5594	8,741	6.42E-07	

PMCH Release 4, 23/06/97, Lucas Heights

Table 9

02/08/99 15:33:55

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
90797	15	13.2	1.7	332.3	13.1	4.8	344.3	13.8	3.7	311.5	14.0	3.5	312.6	8.5	0.4	202.8	0.0	0
90797	30	13.0	2.0	331.1	13.3	5.6	345.2	13.7	3.9	319.0	13.8	3.7	314.4	8.5	0.4	181.3		
90797	45	13.0	2.0	330.6	13.4	5.7	343.0	13.5	3.4	320.4	13.8	3.7	316.7	8.4	0.5	186.2		
90797	100	12.9	2.2	338.2	13.4	5.6	341.9	13.6	3.2	316.9	13.8	4.2	315.0	8.3	0.5	179.8		
90797	115	12.9	2.2	339.2	13.3	5.5	336.8	13.5	3.0	316.4	13.9	4.2	317.7	8.3	0.5	177.9		
90797	130	12.9	2.1	334.8	13.2	5.4	332.8	13.3	2.5	315.1	13.8	4.4	323.7	8.2	0.4	204.8		
90797	145	13.0	2.2	329.5	13.4	5.7	332.1	13.3	2.4	312.1	13.9	4.2	322.9	8.2	0.6	182.1		
90797	200	13.3	2.0	330.3	13.9	6.1	330.2	13.5	2.8	309.3	14.1	4.0	325.9	8.2	0.6	173.6	0.0	0
90797	215	14.2	2.7	325.1	14.4	6.6	332.0	13.8	3.6	310.3	14.5	4.0	321.2	8.1	0.6	170.1		
90797	230	14.7	3.0	328.4	14.7	6.8	330.9	13.9	3.6	308.0	14.7	4.5	320.1	8.0	0.4	198.5		
90797	245	14.7	3.1	329.5	14.5	6.6	334.1	14.0	3.8	308.7	14.8	4.3	318.3	8.1	0.4	199.7		
90797	300	14.6	2.6	327.9	14.4	6.5	333.9	14.2	4.2	310.0	14.6	3.7	318.0	8.1	0.4	212.3		
90797	315	14.6	2.8	332.7	14.4	6.8	335.7	14.4	4.1	311.1	14.7	4.4	319.3	8.3	0.4	179.8		
90797	330	14.5	2.7	330.4	14.5	7.0	332.5	14.4	4.1	308.6	14.7	4.2	315.2	8.4	0.6	214.9		
90797	345	14.6	2.9	326.6	14.8	7.4	329.9	14.3	4.4	310.6	14.9	4.5	312.9	8.6	0.6	189.5		
90797	400	14.7	3.1	332.0	14.8	7.3	333.0	14.2	4.1	311.7	14.9	4.2	311.8	8.7	0.5	191.5	0.0	0
90797	415	14.3	2.9	331.0	14.4	6.7	332.9	14.1	4.3	310.2	14.8	4.5	313.8	8.8	0.5	192.7		
90797	430	13.9	2.4	326.6	14.0	6.3	333.5	13.9	3.8	306.2	14.4	3.9	310.9	8.8	0.6	124.6		
90797	445	13.7	2.3	326.9	13.8	5.9	331.3	13.6	3.4	304.4	14.1	3.4	312.7	8.7	0.3	197.9		
90797	500	13.3	2.2	321.2	13.6	5.5	329.4	13.5	3.0	299.1	13.9	3.2	315.7	8.6	0.3	197.4		
90797	515	13.1	2.2	321.2	13.8	6.0	329.0	13.3	2.8	296.9	13.9	3.2	312.8	8.6	0.4	192.6		
90797	530	13.0	2.3	326.9	13.8	6.2	333.2	13.3	3.0	298.9	13.7	3.1	316.8	8.5	0.3	183.2		
90797	545	12.9	2.1	318.6	13.6	5.9	331.7	13.1	2.9	299.4	13.5	2.6	310.4	8.4	0.3	186.5		
90797	600	13.0	2.5	301.2	13.4	5.3	321.7	13.0	2.7	290.2	13.0	2.0	298.0	8.4	0.3	239.3	0.0	0
90797	615	13.0	2.3	295.6	13.3	4.9	316.3	13.0	2.8	278.7	12.8	1.5	290.4	8.4	0.3	228.6		
90797	630	13.1	2.6	304.6	13.6	5.6	316.9	13.0	3.4	268.3	12.7	2.2	294.4	8.4	0.3	192.2		
90797	645	13.3	2.2	316.1	13.8	5.2	314.0	13.3	3.7	277.5	13.0	2.1	287.3	8.4	0.5	193.2		
90797	700	13.2	1.8	267.5	13.4	3.7	293.2	13.5	2.8	270.6	12.7	1.8	242.3	8.4	0.4	187.6		
90797	715	12.9	2.0	259.9	13.6	4.0	277.0	13.9	2.8	258.9	12.9	1.9	257.0	8.4	0.4	96.3		
90797	730	13.4	1.8	262.0	13.7	3.9	276.2	13.7	2.6	262.6	12.5	1.7	253.9	8.5	0.4	6.1		
90797	745	13.3	1.8	259.0	13.6	4.8	267.0	13.9	2.6	258.6	12.8	2.6	253.2	8.5	0.4	226.2		
90797	800	13.4	2.2	266.4	13.1	5.3	272.9	13.9	3.1	249.0	12.9	2.7	257.9	8.7	0.4	351.9	0.0	0
90797	815	13.4	1.6	278.0	12.6	3.8	272.7	13.9	3.2	265.5	12.6	2.0	264.7	9.0	0.4	10.3		
90797	830	13.3	1.8	258.4	12.4	4.2	264.4	13.7	2.8	252.5	12.9	3.1	252.9	9.2	0.4	212.2		
90797	845	13.3	3.0	241.1	12.3	5.1	250.8	13.5	2.8	245.2	12.9	3.7	237.6	9.6	0.5	11.8		
90797	900	13.3	3.6	238.0	12.1	6.0	249.4	13.4	3.9	241.5	12.7	4.7	239.0	10.0	0.7	179.3		
90797	915	13.3	5.0	237.9	12.1	7.8	247.2	13.5	4.8	237.7	12.8	5.8	236.2	10.9	1.0	193.6		
90797	930	13.4	4.5	238.1	12.1	6.9	249.9	13.5	5.7	232.9	12.8	5.7	237.3	12.8	1.5	195.4		
90797	945	13.5	4.1	241.4	12.1	6.4	253.3	13.5	6.0	237.0	12.8	5.1	239.1	13.8	2.2	196.2		
90797	1000	13.4	3.9	245.2	12.0	5.6	253.7	13.4	6.0	242.0	12.7	5.0	248.4	14.1	2.7	192.0	0.0	0
90797	1015	13.2	3.7	259.8	11.8	5.6	266.3	13.2	5.4	247.4	12.6	5.8	257.6	14.0	2.5	192.5		
90797	1030	13.3	3.7	269.2	11.8	6.1	273.5	13.2	4.6	265.5	12.5	4.9	261.0	14.1	2.3	187.3		
90797	1045	13.2	4.0	265.6	11.7	6.7	274.3	13.2	4.3	262.7	12.5	4.7	261.4	14.1	2.1	184.4		
90797	1100	13.1	3.4	264.0	11.6	5.1	276.3	13.1	4.1	265.4	12.4	5.1	265.5	13.9	1.3	180.3		
90797	1115	13.1	3.0	260.0	11.6	4.8	267.9	13.1	3.5	246.9	12.4	4.1	263.5	13.8	1.0	193.1		
90797	1130	13.1	3.3	263.3	11.6	5.1	272.1	13.0	3.1	257.7	12.4	4.5	262.1	13.6	0.9	198.1		
90797	1145	13.0	3.5	258.2	11.6	5.6	268.7	13.0	3.3	257.8	12.3	5.3	261.4	13.5	0.7	198.9		
90797	1200	13.1	3.6	257.5	11.5	5.9	266.3	13.0	3.7	253.4	12.3	5.7	260.0	13.7	1.3	187.5	0.0	0

Table 10

02/08/99 15:33:55

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
90797	1215	13.1	4.2	258.7	11.6	6.5	266.8	13.0	4.0	255.2	12.4	5.9	256.6	13.9	2.1	183.9		
90797	1230	13.2	3.9	261.0	11.6	6.4	270.6	13.0	4.4	257.1	12.4	5.9	258.0	13.9	1.9	181.8		
90797	1245	13.4	3.1	266.0	11.7	5.4	275.6	13.2	3.9	263.8	12.4	5.0	263.9	14.0	1.6	183.1		
90797	1300	13.6	3.3	259.6	11.8	5.3	271.0	13.4	3.9	261.5	12.6	5.0	258.4	14.2	1.8	178.7		
90797	1315	13.5	3.8	263.8	11.9	5.5	272.2	13.5	4.6	260.0	12.7	5.2	262.2	14.4	1.8	177.1		
90797	1330	13.7	3.1	271.9	12.0	5.7	284.6	13.5	4.0	264.8	12.7	5.4	268.8	14.4	2.0	176.2		
90797	1345	13.8	3.6	273.9	12.2	6.2	283.9	13.6	3.6	262.9	12.8	4.9	270.1	14.4	1.5	175.6		
90797	1400	13.8	3.6	267.9	12.2	6.1	278.3	13.6	4.3	259.6	12.9	6.8	266.0	14.4	1.5	184.0	0.0	0
90797	1415	13.7	4.8	259.4	12.1	7.8	269.0	13.9	5.2	273.0	12.8	6.9	262.3	14.6	2.0	180.5		
90797	1430	13.7	4.8	256.6	12.0	7.7	270.7	13.8	5.8	261.2	12.8	6.6	264.7	14.7	1.9	179.2		
90797	1445	13.7	4.3	266.6	12.0	7.5	278.3	13.6	7.1	260.1	12.6	6.6	266.1	14.3	2.3	188.9		
90797	1500	13.6	5.4	269.1	11.9	9.0	276.2	13.5	7.1	258.1	12.7	7.8	266.5	14.0	2.5	188.1		
90797	1515	13.4	5.9	262.6	11.7	9.4	272.5	13.3	7.0	259.8	12.6	7.6	267.0	13.8	2.5	191.6		
90797	1530	13.1	5.5	261.3	11.6	8.6	272.5	13.2	5.6	258.4	12.4	7.8	265.1	13.4	1.7	189.3		
90797	1545	13.1	4.7	264.6	11.6	7.6	275.2	13.2	5.3	266.4	12.4	6.3	269.7	13.1	1.5	189.7		
90797	1600	12.9	4.4	267.1	11.4	8.0	275.4	13.0	4.8	266.5	12.3	6.9	266.9	12.8	1.3	191.8	0.0	0
90797	1615	12.7	4.0	273.4	11.3	7.7	281.5	12.8	4.5	275.6	12.1	6.9	267.7	12.4	1.4	177.6		
90797	1630	12.5	3.1	277.8	11.1	6.1	287.0	12.4	5.6	285.8	11.9	6.7	268.5	12.4	2.4	171.8		
90797	1645	11.9	4.0	276.2	10.8	7.2	283.8	11.9	6.0	278.1	11.6	6.3	267.8	12.4	2.3	172.6		
90797	1700	11.4	6.3	263.9	10.5	10.8	276.2	11.6	6.1	262.1	11.2	7.8	271.7	11.9	1.6	192.4		
90797	1715	11.0	4.3	270.0	10.1	8.4	279.5	11.2	6.0	263.4	10.8	8.0	266.7	10.8	0.8	218.1		
90797	1730	10.9	4.7	276.3	10.0	8.9	285.8	10.6	4.5	275.5	10.6	8.1	271.4	9.9	0.8	208.5		
90797	1745	10.8	3.8	285.8	9.8	7.8	292.3	10.2	5.1	284.2	10.5	7.3	268.7	9.7	1.2	197.1		
90797	1800	10.3	3.7	282.1	9.6	7.9	289.4	10.4	5.9	279.6	10.4	6.9	273.3	10.5	1.6	183.4	0.0	0
90797	1815	10.5	5.3	279.4	9.6	10.6	286.5	10.5	6.5	274.2	10.2	7.9	270.9	10.3	1.2	185.2		
90797	1830	10.3	4.1	273.1	9.4	8.3	285.3	10.4	5.6	271.4	10.1	7.9	268.7	9.8	1.0	211.4		
90797	1845	10.2	4.9	277.1	9.3	9.6	286.2	10.4	6.8	276.2	9.9	8.1	270.1	10.4	1.8	178.9		
90797	1900	10.2	5.0	271.5	9.3	9.1	281.3	10.3	5.9	272.9	9.8	7.1	266.6	10.7	1.8	174.4		
90797	1915	10.0	4.3	266.3	9.1	8.2	277.3	10.2	5.3	272.4	9.6	5.5	262.2	10.2	1.0	174.9		
90797	1930	9.9	3.7	260.6	9.0	6.7	273.2	10.1	3.5	271.6	9.6	4.5	264.4	9.4	0.4	304.2		
90797	1945	9.8	3.7	265.3	9.0	6.7	274.1	9.9	2.7	272.9	9.5	4.4	267.3	7.9	0.4	217.6		
90797	2000	9.7	3.4	254.9	8.9	6.0	267.3	9.8	2.8	269.4	9.4	4.3	252.3	7.1	0.4	166.4	0.0	0
90797	2015	9.5	3.0	250.4	8.7	5.3	259.0	9.7	2.3	251.9	9.6	4.8	244.7	6.4	0.4	41.7		
90797	2030	9.4	3.0	244.7	8.6	5.8	255.8	9.7	3.3	254.2	9.3	3.7	246.0	6.2	0.6	245.4		
90797	2045	9.3	3.4	246.6	8.6	6.6	257.6	9.6	3.0	249.9	9.2	4.7	244.8	6.7	0.4	248.5		
90797	2100	9.2	3.8	249.9	8.4	6.9	261.6	9.3	2.3	256.5	8.9	2.7	246.7	6.2	0.4	244.3		
90797	2115	9.2	2.7	236.1	8.3	4.3	249.9	9.1	2.2	247.8	8.8	2.6	236.8	5.8	0.5	220.3		
90797	2130	8.7	1.3	218.6	8.0	2.6	240.3	9.1	2.3	242.4	8.8	2.5	234.2	5.5	0.4	212.3		
90797	2145	8.6	2.2	254.8	8.0	3.7	258.0	9.0	3.4	248.1	8.5	3.2	256.2	5.5	0.9	215.7		
90797	2200	8.4	2.2	266.4	8.0	4.4	272.9	8.6	4.2	262.1	7.8	3.6	264.2	6.8	1.1	212.5	0.0	0
90797	2215	8.4	2.5	288.4	8.0	4.6	285.3	8.6	4.5	266.8	7.7	3.2	267.6	7.5	1.2	209.1		
90797	2230	8.3	2.2	280.5	7.9	4.3	286.5	8.5	3.4	251.6	7.6	2.6	244.7	7.2	0.7	214.8		
90797	2245	7.6	2.0	229.1	7.8	3.8	254.1	8.6	3.0	237.9	8.2	3.8	236.5	6.1	0.3	226.3		
90797	2300	7.8	3.3	247.4	7.7	6.7	254.8	8.6	3.7	242.1	8.3	4.8	243.6	5.3	0.3	258.8		
90797	2315	8.4	2.8	241.9	7.9	6.0	251.1	8.4	3.2	252.5	8.5	5.5	249.4	4.9*****		8888.0		
90797	2330	8.4	2.5	246.8	7.9	5.1	253.8	8.0	2.9	263.5	8.6	5.3	247.9	5.0	0.6	248.2		
90797	2345	8.6	3.3	235.1	8.1	5.8	244.6	8.5	3.7	249.1	8.8	5.9	249.3	5.8	0.9	231.1		
90797	2400	8.7	3.6	236.8	8.1	6.5	244.6	8.7	3.9	249.7	8.9	6.3	243.3	6.7	0.7	253.6		

Table 10 contd.

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram area		Air Concentration		Atmos. Dil
Index		E UTM m	N UTM m	Time			Before	After	Correction	per 30 min	PMCH	PDCH	(ppt)	(pg/m3)	Factor
10	ANSTO swimming pool fence	314308	6230509	1100	9	21	41.99	41.99	0.917	1965	55.64700	0.8080	10.9745	171,476	2.40E-05
11	B.34 fence, ANSTO	314418	6230666	1100	10	17	43.09	42.97	0.835	1746	0.12493	0.3811	0.0223	348	4.86E-08
21	Cnr. Hahn/Lawrence ST., ANSTO	313849	6230122	1100	14	9	43.49	43.55	0.987	2041	110.43791	0.1247	20.9631	327,548	4.58E-05
22	Cnr. Einstein/Hahn Sts., ANSTO	313849	6230010	1100	20	36	44.14	44.23	1.017	2072	114.96914	0.7398	21.5027	335,979	4.70E-05
23	Cnr. Roentgen/Curie Ave., ANSTO	314014	6230119	1100	17	13	43.75	43.81	0.986	2027	57.34429	0.1451	10.9658	171,341	2.40E-05
24	Cnr. Rutherford/Hahn Ave., ANSTO	313826	6230264	1100	16	Ha II	42.09	42.24	0.983	2098	30.48029	0.6170	5.6353	88,051	1.23E-05
25	E. end of Thomson Ave., ANSTO	314289	6230298	1100	11	Ha IV	45.53	46.06	0.893	1755	107.75901	0.2802	23.7898	371,715	5.20E-05
26	E. side Carpark/Child Care Centre, ANSTO	314257	6230615	1100	8	26	41.69	41.76	0.909	1961	0.09337	0.4675	0.0150	234	3.28E-08
37	Inside HIFAR security fence, NE B.23A, ANSTO	313602	6230123	1100	13	19	42.42	42.42	1.090	2313	25.55616	0.8723	4.2882	67,004	9.37E-06
40	Int. New Illawarra/ANSTO Entrance Rds.	314191	6230689	1100	7	43	40.23	40.12	0.930	2083	0.10494	0.5403	0.0158	247	3.45E-08
51	Meteorological Tower, ANSTO	313683	6230063	1100	15	25	44.62	44.62	0.952	1920	48.34553	0.5484	9.7606	152,509	2.13E-05
62	On fence opp. Building 64 carpark, ANSTO	314327	6230157	1100	12	33	42.36	42.08	0.869	1852	0.02329	2.0921	0.0045	71	9.93E-09
63	On Old Illawarra road opp. Building 9, ANSTO	313748	6230379	1100	6	22	42.48	42.60	0.914	1934	0.10737	0.5163	0.0174	272	3.80E-08
64	Opp D3 on Hahn Ave., ANSTO	313841	6230194	1100	18	15	43.43	43.35	0.919	1906	53.92296	0.6730	10.9654	171,335	2.40E-05
66	Opp. Int Roentgen/Thomson, near CSIRO delivery	313998	6230266	1100	19	S1	42.16	42.19	1.072	2288	120.10500	0.7721	20.3409	317,827	4.44E-05
68	Parking Bay, Rutherford Ave, near HIFAR ent.	313620	6230176	1100	22	8	41.04	41.16	0.917	2008	0.73513	0.4248	0.1517	2,371	3.31E-07
69	Parking lot north of B.1, ANSTO	313941	6230395	1100	3	S7	42.98	43.04	1.112	2327	1.84873	0.8981	0.3163	4,942	6.91E-07
74	Tap/hose on grass NE B.76, ANSTO	314108	6230421	1100	21	S3	38.38	38.38	1.091	2558	0.60927	0.5951	0.0719	1,124	1.57E-07
75	Top of Old Illawarra Rd near Liverpool/Heathcote	312720	6229894	1100	23	S5	46.95	46.90	1.249	2396	0.05014	0.6514	0.0069	107	1.50E-08
51	Meteorological Tower, ANSTO	313683	6230063	1130	15	37	44.62	44.62	0.997	2011	20.44384	0.3872	3.9469	61,670	9.48E-06
54	Needles, river level, east side of river	315849	6230689	1130	21	1	38.38	38.38	0.935	2193	0.17389	0.4136	0.0244	382	5.87E-08
16	Behind 10 Jaeger Pl., Woronora Heights	317280	6232051	1230	12	11	42.08	41.80	0.965	2071	0.04598	0.5169	0.0074	115	1.77E-08
17	OH Pylon #217, behind 4 Range Pl., Engadine	315212	6229516	1230	8	28	41.76	41.83	0.973	2095	0.07888	0.4994	0.0120	187	2.88E-08
18	Bottom, Kelton Pl.,Nth Engadine	316828	6231187	1230	11	32	46.06	46.59	0.904	1756	0.02169	0.2267	0.0045	71	1.09E-08
21	Cnr. Hahn/Lawrence ST., ANSTO	313849	6230122	1230	14	S2	43.55	43.60	1.201	2481	41.15392	0.2900	6.4330	100,515	1.55E-05
22	Cnr. Einstein/Hahn Sts., ANSTO	313849	6230010	1230	20	12	44.23	44.34	1.002	2036	157.48380	2.8390	29.9591	468,112	7.20E-05
24	Cnr. Rutherford/Hahn Ave., ANSTO	313826	6230264	1230	16	Ha I	42.24	43.38	0.854	1795	8.57441	0.4176	1.8606	29,072	4.47E-06
28	End of Fairview Ave, Engadine	315298	6228276	1230	6	20	42.60	42.71	0.973	2053	0.05833	0.3601	0.0092	144	2.22E-08
32	Ferntree Reserve, Engadine	315350	6229034	1230	7	14	40.12	40.01	0.998	2242	0.10662	0.4531	0.0149	233	3.58E-08
37	Inside HIFAR security fence, NE B.23A, ANSTO	313602	6230123	1230	13	35	42.42	42.42	0.803	1704	66.42733	0.7442	15.1113	236,114	3.63E-05
41	Int. Sarbugal Pass track/Water Board road	315525	6230562	1230	17	Ha III	43.81	43.87	1.093	2244	0.10035	0.2247	0.0140	219	3.37E-08
42	Int. Sierra/Ridge rds., Engadine	315228	6230299	1230	9	Ha V	41.99	42.00	0.845	1811	5.92522	0.2713	1.2781	19,971	3.07E-06
54	Needles, river level, east side of river	315849	6230689	1230	23	10	46.90	46.95	0.871	1671	0.13120	0.4164	0.0244	381	5.86E-08
55	Needles road, int. track, west side of river	315838	6230503	1230	19	27	42.19	42.21	0.926	1975	0.25052	0.3947	0.0387	605	9.31E-08
56	Needles Tack, half way down W side OH power	315752	6230893	1230	22	S4	41.16	41.28	1.061	2317	0.08628	0.4104	0.0118	184	2.83E-08
58	OH Pylon #216, behind 9 Alpine, Pl, Engadine	315179	6229971	1230	10	34	42.97	42.85	0.985	2066	1.47412	0.3669	0.2860	4,469	6.87E-07
64	Opp D3 on Hahn Ave., ANSTO	313841	6230194	1230	18	A1	43.35	43.26	1.021	2122	45.20171	0.7230	8.2590	129,046	1.98E-05
80	Water Board road, further SW of Sarbugal track	315099	6230399	1230	3	7	43.04	43.10	0.918	1918	5.17412	0.4060	1.0550	16,484	2.54E-06

PMCH Release 5, 09/07/97, Lucas Heights

Table 11

02/08/99 15:44:50

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
130897	15	8.2	1.8	255.5	8.1	4.1	272.4	8.4	1.9	246.5	8.4	2.3	244.9	3.7	0.3	211.8	0.0	0
130897	30	7.9	2.3	252.6	8.3	4.8	267.3	8.3	2.0	252.3	8.2	2.5	255.9	3.5	0.2	220.3		
130897	45	7.9	2.2	254.0	8.2	4.6	267.5	8.2	2.3	256.2	8.0	2.4	257.2	3.3*****		8888.0		
130897	100	7.7	2.3	255.6	8.1	4.8	274.2	8.2	3.0	255.1	7.4	2.6	255.6	3.4	0.3	224.6		
130897	115	7.7	2.3	263.5	8.2	4.9	277.3	8.2	2.9	261.3	6.9	2.5	256.3	3.4	0.2	264.7		
130897	130	7.6	2.1	258.2	8.0	4.8	276.1	7.8	2.5	272.4	7.0	2.1	257.9	3.0	0.4	220.6		
130897	145	7.4	1.8	266.1	7.7	4.3	283.1	7.8	2.8	273.6	7.3	2.7	265.2	3.0	0.3	250.0		
130897	200	7.0	1.9	291.5	7.6	4.4	292.4	7.3	3.0	278.7	7.1	3.0	274.5	3.0	0.3	44.1	0.0	0
130897	215	6.9	1.9	284.8	7.1	4.2	293.7	6.8	2.8	274.0	6.5	2.8	276.7	2.7	0.3	205.8		
130897	230	6.7	1.7	279.7	7.0	4.2	291.6	7.1	3.3	272.8	6.4	2.3	272.4	2.6	0.4	215.3		
130897	245	6.2	1.5	292.8	6.9	4.4	292.8	7.2	3.7	271.9	5.7	2.1	281.6	2.5	0.3	215.6		
130897	300	5.9	1.7	262.6	6.8	4.7	296.4	7.3	3.5	275.5	6.5	3.2	272.2	2.5	0.2	8888.0		
130897	315	6.1	1.4	275.4	7.0	4.8	301.7	6.6	2.0	280.9	6.2	1.9	271.5	2.4	0.3	213.9		
130897	330	6.3	1.7	291.6	7.6	5.2	298.0	6.8	3.5	283.3	6.0	2.3	270.5	2.2	0.4	218.9		
130897	345	6.9	2.4	295.9	7.2	4.1	291.9	6.8	4.1	269.5	5.4	2.7	267.2	2.1	0.2	8888.0		
130897	400	7.1	1.5	274.7	6.7	3.2	276.1	6.9	3.7	265.4	5.6	3.0	260.4	2.0*****		8888.0	0.0	0
130897	415	6.7	1.4	241.6	6.4	2.9	267.3	7.2	3.3	264.9	6.0	3.3	257.4	1.9*****		8888.0		
130897	430	6.3	1.9	249.7	6.3	4.3	272.2	7.3	2.4	247.0	7.0	3.4	257.5	1.9	0.3	217.9		
130897	445	6.1	2.0	251.2	7.1	5.1	276.7	6.9	2.9	259.2	6.8	3.0	257.6	1.9	0.2	204.7		
130897	500	6.3	2.3	269.4	7.1	5.7	276.8	7.1	3.2	257.2	6.9	3.4	262.2	2.0	0.5	216.8		
130897	515	6.4	2.2	268.3	7.2	5.6	279.1	6.9	2.6	259.9	7.0	3.5	262.8	2.0	0.3	214.2		
130897	530	6.4	2.0	274.0	7.0	5.6	282.3	6.6	2.8	268.0	6.9	3.7	264.6	1.8	0.4	214.3		
130897	545	6.0	2.0	249.2	7.0	6.0	273.5	6.7	2.5	240.4	6.9	3.6	252.4	1.6	0.4	220.3		
130897	600	5.7	1.9	237.0	6.4	5.1	262.6	6.8	2.9	240.6	6.6	2.7	247.9	1.5	0.4	234.9	0.0	0
130897	615	5.1	1.5	223.5	6.2	4.7	256.5	7.0	3.0	239.8	6.5	2.3	245.2	1.5	0.4	211.7		
130897	630	5.5	1.5	255.3	6.2	4.3	270.6	7.1	2.6	258.8	6.6	2.4	256.0	1.3	0.2	8888.0		
130897	645	5.7	1.7	274.9	6.3	5.3	283.1	6.9	2.3	271.3	6.9	2.3	264.2	1.0	0.2	246.8		
130897	700	5.9	2.5	269.4	6.5	6.4	282.9	6.4	2.1	285.9	6.5	2.8	268.8	1.0*****		8888.0		
130897	715	6.3	2.1	271.6	6.3	5.5	280.5	6.2	1.4	306.5	6.3	2.3	273.3	1.3	0.2	130.1		
130897	730	7.0	1.9	276.5	6.2	4.8	287.0	6.3	1.6	330.9	6.6	1.8	284.9	1.6	0.6	155.4		
130897	745	7.6	1.5	315.6	6.3	2.8	290.8	6.4	1.3	323.1	6.8	1.8	297.4	1.9	1.0	158.6		
130897	800	8.2	1.7	273.2	6.6	3.9	287.5	6.7	0.6	335.9	7.0	1.8	274.6	2.4	1.0	161.5	0.0	0
130897	815	9.0	2.1	269.8	7.2	4.1	277.8	7.8	0.6	342.9	7.4	2.4	262.1	4.3	0.5	87.5		
130897	830	9.9	2.4	276.3	8.0	4.3	286.1	8.2	1.4	345.9	8.0	2.1	268.0	6.3	0.6	44.0		
130897	845	10.6	2.5	278.8	8.6	4.3	289.7	8.8	1.5	319.9	8.7	2.8	263.2	7.7	0.3	87.6		
130897	900	11.3	2.7	268.6	9.2	3.9	279.0	10.2	1.5	305.5	9.5	3.3	265.2	9.6	0.4	36.3		
130897	915	11.9	3.3	262.1	9.8	5.3	267.3	11.6	2.8	269.2	10.3	3.7	252.8	10.5	0.7	37.0		
130897	930	12.3	3.2	264.5	10.2	4.9	269.4	12.1	4.1	250.8	10.9	4.0	262.7	11.9	0.8	165.2		
130897	945	12.7	3.8	257.9	10.6	5.8	266.4	12.6	3.8	245.1	11.6	3.8	265.6	13.4	1.9	174.9		
130897	1000	13.2	4.1	266.3	11.0	6.4	274.0	12.8	4.6	252.1	12.2	4.9	258.1	13.9	2.1	176.6	0.0	0
130897	1015	13.9	3.2	254.9	11.8	4.8	261.9	13.6	4.0	251.6	12.8	4.7	256.7	14.4	2.2	180.5		
130897	1030	14.6	3.5	263.8	12.3	5.7	271.6	13.9	5.5	256.9	13.2	5.1	256.5	15.1	2.5	185.5		
130897	1045	14.9	4.6	259.3	12.7	6.7	265.8	14.3	5.9	258.9	13.4	5.4	248.4	15.7	2.2	184.5		
130897	1100	15.1	5.1	257.2	12.9	7.7	264.5	14.8	5.2	254.1	13.8	5.9	250.5	16.3	2.3	186.4		
130897	1115	15.4	5.3	253.5	13.3	7.9	262.8	15.1	5.2	241.0	14.2	5.3	248.3	16.8	1.9	186.8		
130897	1130	16.0	4.4	254.8	14.0	6.6	264.4	15.6	5.8	267.5	14.9	4.3	249.8	17.0	2.9	186.7		
130897	1145	16.5	4.3	249.5	14.4	6.7	259.0	16.0	5.3	259.9	15.3	5.8	246.6	17.2	3.2	183.1		
130897	1200	16.8	4.6	264.9	14.5	7.5	271.2	16.4	5.5	257.3	15.6	5.2	245.4	17.5	2.7	187.9	0.0	0

Table 12

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram area		Air Concentration		Atmospheric
Index		N UTM m	E UTM m	Time			Before	After	Correction	per 30 min	PMCH	PDCH	(ppt)	(pg/m3)	Dilution Factor
26	E. side Carpark/Child Care Centre, ANSTO	6230615	314257	1130	6	22	42.71	42.39	0.914	1933	0.2018	0.3229	0.0350	547	1.11E-07
11	B.34 fence, ANSTO	6230666	314418	1130	7	43	40.01	39.97	0.930	2093	0.0195	0.2683	0.0038	59	1.21E-08
40	Int. New Illawarra/ANSTO Entrance Rds.	6230689	314191	1130	9	21	42.00	42.02	0.917	1965	0.3129	0.5090	0.0530	828	1.68E-07
75	Top of Old Illawarra Rd near Liverpool/Heathcote	6229894	312720	1130	10	17	42.85	42.85	0.835	1754	0.2665	0.2088	0.0507	792	1.60E-07
63	On Old Illawarra road opp. Building 9, ANSTO	6230379	313748	1130	11	HalV	46.59	52.84	0.893	1617	0.4518	0.1720	0.0925	1,445	2.93E-07
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	1130	13	19	42.42	42.42	1.090	2313	29.3930	0.4224	5.3802	84,066	1.70E-05
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	1130	14	9	43.60	43.26	0.987	2045	24.8030	0.4609	5.1334	80,209	1.63E-05
37	Inside HIFAR security fence, NE B.23A, ANSTO	6230123	313602	1130	15	25	44.62	44.62	0.952	1920	228.3200	0.4868	50.3247	786,324	1.59E-04
73	Strassman Cres, NE of Bldg 23B	6230045	313630	1130	16	Ha1	42.38	41.79	0.854	1826	81.5760	0.2099	18.9058	295,403	5.99E-05
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	1130	17	35	43.87	43.67	0.883	1816	63.6030	0.3752	14.8274	231,677	4.70E-05
21	Cnr Lawrence/Hahn Ave., ANSTO	6230122	313849	1130	18	15	43.26	50.59	0.919	1763	18.1334	0.5067	4.3554	68,053	1.38E-05
20	Chadwick St., NE of cnr of Bldg 16	6230387	314187	1130	19	S2	42.21	42.00	1.147	2452	3.2589	0.5220	0.5635	8,804	1.78E-06
51	Meteorological Tower, ANSTO	6230063	313683	1130	20	12	44.34	44.33	1.002	2034	111.4120	0.4764	23.1828	362,231	7.34E-05
66	Opp. Int Roentgen/Thomson, near CSIRO delivery	6230266	313998	1130	22	A1	41.28	41.31	1.068	2328	176.9076	0.5679	32.1677	502,621	1.02E-04
23	Cnr. Roentgen/Curie Ave., ANSTO	6230119	314014	1130	23	HalI	46.85	46.86	1.046	2009	125.9710	0.4411	26.5367	414,637	8.41E-05

PMCH Release 6, 13/08/97, Lucas Heights

Table 13

14:34 14/10/99

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02/05/99 08:05:23

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
280897	15	7.5	1.2	177.2	9.9	4.4	205.5	10.0	4.0	196.4	9.2	2.1	196.0	5.4	0.4	271.0	0.0	0
280897	30	7.5	1.5	172.3	9.6	4.5	203.2	9.8	3.6	197.0	9.4	2.2	192.9	5.2	0.3	206.1		
280897	45	7.6	1.4	171.3	9.4	4.4	206.8	9.6	3.5	199.0	9.4	2.4	193.0	5.0	0.3	245.0		
280897	100	7.6	1.0	168.1	9.3	3.9	206.1	9.6	3.5	199.9	9.3	2.0	191.8	4.7*****		8888.0		
280897	115	7.6	1.0	170.0	9.0	3.5	202.4	9.7	3.9	199.3	9.2	2.0	191.2	4.6	0.2	8888.0		
280897	130	7.9	1.8	166.1	8.9	3.1	193.7	9.6	3.6	198.5	9.1	2.4	187.4	4.5	0.2	239.4		
280897	145	8.0	1.9	169.9	8.6	3.4	200.1	9.4	4.0	196.1	9.1	2.6	197.4	4.6	0.3	238.9		
280897	200	8.0	1.5	168.8	8.2	3.4	199.9	9.2	4.4	196.1	8.9	2.9	198.3	4.4	0.2	225.2	0.0	0
280897	215	8.1	1.2	181.0	8.1	3.1	204.8	9.1	4.4	194.9	8.8	2.6	198.2	4.3*****		8888.0		
280897	230	8.0	1.2	183.4	8.1	3.5	204.1	8.9	4.2	197.9	8.6	2.3	194.6	4.2	0.3	231.6		
280897	245	7.8	1.3	184.9	8.1	2.9	208.4	9.0	4.1	199.5	8.4	2.1	192.2	4.1*****		8888.0		
280897	300	7.9	1.6	185.7	8.3	2.9	211.3	8.9	3.8	198.9	8.4	2.0	193.6	4.0	0.2	241.4		
280897	315	7.6	2.1	189.5	9.0	3.3	210.4	8.9	4.1	198.6	8.4	1.6	198.1	3.9*****		8888.0		
280897	330	7.6	2.0	215.1	9.5	3.5	221.2	8.9	4.2	199.7	8.4	1.9	204.3	4.0	0.3	223.2		
280897	345	7.9	1.5	208.3	9.0	3.6	221.3	8.7	4.1	200.1	8.0	2.4	204.6	4.0	0.3	206.9		
280897	400	7.9	1.5	219.2	9.0	4.0	222.1	8.6	3.7	203.2	8.0	2.7	199.4	3.9	0.2	238.3	0.0	0
280897	415	8.0	1.6	224.8	8.7	3.7	225.8	8.4	3.6	204.5	7.9	2.5	203.5	3.8	0.2	257.0		
280897	430	8.0	1.6	227.8	8.4	3.9	226.3	8.4	3.6	202.1	7.9	2.2	197.3	3.9	0.4	241.8		
280897	445	7.7	1.8	219.7	8.5	4.0	223.0	8.3	3.9	199.4	7.9	2.5	193.3	4.0	0.3	240.6		
280897	500	7.4	1.7	206.6	9.5	4.3	226.7	8.5	3.8	199.9	7.7	2.5	193.2	3.8*****		8888.0		
280897	515	6.6	1.9	216.8	10.0	4.3	229.2	8.5	3.9	200.1	7.6	2.5	198.2	3.6*****		8888.0		
280897	530	7.3	2.0	221.7	10.1	4.2	235.3	8.1	3.9	199.7	7.6	2.2	197.4	3.7	0.3	245.2		
280897	545	7.4	2.2	219.5	10.5	3.9	240.2	8.1	3.8	200.6	7.5	2.1	190.1	3.6	0.2	8888.0		
280897	600	6.2	1.9	208.8	10.6	3.5	241.7	8.2	3.8	201.9	7.6	2.2	189.1	3.5	0.2	254.8	0.0	0
280897	615	6.0	1.7	212.9	10.4	3.6	240.1	8.2	3.8	199.6	7.5	2.1	191.2	3.5	0.2	8888.0		
280897	630	5.9	1.8	212.4	10.3	3.6	241.0	7.9	3.8	201.7	7.4	2.1	189.8	3.4	0.2	221.6		
280897	645	5.9	1.8	216.1	10.5	3.6	244.6	7.9	3.8	200.6	7.6	2.3	194.1	3.5	0.4	218.9		
280897	700	5.9	1.9	217.7	9.9	3.8	240.7	8.0	3.7	201.9	7.7	2.2	191.6	3.7	0.8	199.9		
280897	715	7.2	2.1	223.7	9.5	3.8	237.7	7.8	3.5	201.8	7.8	1.9	188.7	4.2	1.0	195.7		
280897	730	8.6	2.1	217.9	9.3	3.5	237.4	7.9	3.2	201.3	8.1	2.0	191.3	4.9	1.2	191.0		
280897	745	9.7	1.8	221.1	9.5	3.2	242.4	8.2	2.8	203.9	8.5	2.1	191.3	5.8	1.3	188.4		
280897	800	11.0	1.5	221.3	10.0	2.8	249.8	9.0	1.6	210.9	9.0	1.8	192.6	6.9	1.2	184.5	0.0	0
280897	815	12.4	1.6	242.9	10.6	2.4	262.3	11.3	1.6	267.3	9.7	1.3	203.3	7.8	1.1	167.4		
280897	830	13.0	2.0	267.2	10.9	2.7	276.6	12.4	2.5	277.9	10.9	1.0	241.8	8.8	1.1	162.8		
280897	845	13.0	2.3	282.8	11.0	2.9	283.8	12.8	2.5	279.4	11.8	1.3	283.5	10.3	0.9	142.6		
280897	900	13.3	1.9	297.5	11.2	2.5	294.3	12.9	2.6	284.5	12.2	1.8	292.9	12.4	0.7	111.5		
280897	915	13.3	2.4	293.0	11.3	2.9	294.5	13.3	2.6	292.0	12.7	1.6	294.3	13.8	1.6	159.4		
280897	930	13.4	2.5	297.8	11.6	2.9	304.4	13.6	2.5	286.9	13.2	2.0	310.7	14.3	1.4	188.4		
280897	945	13.9	2.4	313.5	12.2	2.7	317.1	13.8	2.8	296.2	13.4	1.8	301.4	15.0	1.3	71.2		
280897	1000	14.0	2.5	309.5	12.3	2.8	316.0	13.9	3.0	307.5	13.8	1.9	303.3	14.8	2.0	50.5	0.0	0
280897	1015	14.4	2.4	305.3	12.5	2.9	317.4	14.2	2.8	294.5	14.3	2.4	305.9	15.1	1.7	160.9		
280897	1030	15.0	2.4	310.0	13.0	3.1	324.9	14.6	3.0	282.0	14.4	2.5	307.5	15.6	1.4	116.8		
280897	1045	15.5	2.5	327.9	13.5	3.2	334.6	15.3	2.4	256.9	14.7	2.6	316.4	16.1	1.6	91.2		
280897	1100	16.2	2.1	321.2	14.2	2.7	330.6	16.0	2.8	325.1	15.3	2.7	309.2	16.4	1.5	78.5		
280897	1115	16.5	2.7	322.6	14.8	3.4	344.7	16.1	2.9	266.4	15.6	3.5	307.7	16.9	1.9	68.5		
280897	1130	17.3	2.5	3.5	15.3	3.1	336.8	16.6	3.0	344.8	15.9	3.5	312.1	17.0	2.1	70.6		
280897	1145	17.4	3.4	328.2	15.3	4.7	343.0	17.0	3.7	25.5	16.4	3.3	319.1	17.6	1.8	82.1		
280897	1200	17.5	3.4	337.7	15.6	4.8	341.7	17.2	3.8	21.9	16.8	3.8	339.8	18.3	1.5	55.4	0.0	0

Table 14

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram area		Air Concentration		Atmospheric
Index		N UTM m	E UTM m	Time			Before	After	Correction	per 30 min	PMCH	PDCH	(ppt)	(pg/m3)	Dilution Factor
68	Parking Bay, Rutherford Ave, near HIFAR ent.	6230176	313620	0800	16	HaI	42.56	42.56	0.854	1806	221.9980	0.3737	22.413	350,200	2.57E-05
51	Meteorological Tower, ANSTO	6230063	313683	0800	13	35	37.13	37.06	0.803	1948	45.6150	0.9548	102.500	1,601,569	1.18E-04
63	On Old Illawarra road opp. Building 9, ANSTO	6230379	313748	0800	22	S4	40.86	41.22	1.061	2327	0.2492	0.2304	2.103	32,865	2.41E-06
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	0800	14	9	43.73	44.07	0.987	2023	24.1650	0.3590	2.223	34,738	2.55E-06
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	0800	15	25	48.77	48.77	0.952	1757	56.3230	0.2491	5.889	92,023	6.75E-06
69	Parking lot north of B.1, ANSTO	6230395	313941	0800	18	A1	43.61	43.78	1.021	2103	26.6470	1.2580	2.354	36,778	2.70E-06
74	Tap/hose on grass NE B.76, ANSTO	6230421	314108	0800	20	S2	44.60	44.79	1.213	2443	17.3020	1.5684	1.331	20,794	1.53E-06
40	Int. New Illawarra/ANSTO Entrance Rds.	6230689	314191	0800	23	10	47.56	47.71	0.871	1646	0.0561	0.1412	0.718	11,221	8.24E-07
11	B.34 fence, ANSTO	6230666	314418	0800	21	1	37.75	38.62	0.935	2204	0.0241	0.2284	0.257	4,021	2.95E-07
60	Old tip near Pylon (view of water reservoir)	6232053	314841	0800	25	7	47.36	47.35	0.983	1868	0.0181	0.2045	0.242	3,775	2.77E-07
29	End of Windle Rd, Menai (view power line)	6233519	315534	0800	11	HaIV	43.87	44.68	0.893	1815	2.6660	0.3493	0.324	5,069	3.72E-07
49	McKenzie Pl/Power line, Menai	6234951	315570	0800	12	11	42.86	42.63	0.965	2032	1.3552	0.5220	0.277	4,326	3.18E-07
48	Lucas Heights CS, opp boom gate to W of bldgs.	6231734	315760	0800	19	S1	42.60	42.62	1.072	2264	0.0503	0.1610	0.473	7,389	5.42E-07
39	Int. Barden Rd/New Illawarra Rd, Menai	6233202	316015	0800	6	20	43.28	43.62	0.973	2015	13.0219	0.8033	1.227	19,166	1.41E-06
67	Opp. Int. David Rd/Underwood Pl, Barden Ridge	6232301	316414	0800	17	HaIII	44.45	44.34	1.093	2216	0.0239	0.2035	0.254	3,973	2.92E-07
13	Barden Rd, under HT powerline	6233104	316728	0800	10	34	32.41	32.41	0.985	2735	0.2419	0.4668	0.034	536	3.93E-08
50	Menai Town Centre	6234243	316755	0800	7	43	40.70	40.68	0.93	2057	13.4727	0.5918	1.242	19,401	1.42E-06
12	Bangaroo Rd/Power line, Menai	6234031	317982	0800	8	26	42.23	42.35	0.909	1934	0.4207	0.4437	0.087	1,366	1.00E-07
7	Akuna Oval, Bangor	6233659	318740	0800	9	HaV	42.31	42.40	0.845	1796	3.6283	0.5382	0.425	6,647	4.88E-07
51	Meteorological Tower, ANSTO	6230063	313683	0945	13	19	37.06	36.99	1.090	2650	N/A	N/A			
24	Cnr. Rutherford/Hahn Ave., ANSTO	6230264	313826	0945	15	37	48.77	48.77	0.997	1840	7.3479	0.4502	0.783	12,232	1.11E-06
21	Cnr Lawrence/Hahn Ave., ANSTO	6230122	313849	0945	16	HaII	42.56	42.57	0.983	2078	0.0420	0.3337	0.463	7,237	6.58E-07
22	Cnr. Einstein/Hahn Sts., ANSTO	6230010	313849	0945	14	36	44.07	44.41	0.990	2014	7.3412	0.4458	0.715	11,165	1.01E-06
25	E. end of Thomson Ave., ANSTO	6230298	314289	0945	20	12	44.79	44.98	1.002	2009	14.4060	0.4923	1.356	21,184	1.93E-06
62	On fence opp. Building 64 carpark, ANSTO	6230157	314327	0945	18	15	43.78	43.95	0.919	1886	1.8260	0.4655	0.231	3,614	3.28E-07
58	OH Pylon #216, behind 9 Alpine, Pl, Engadine	6229971	315179	0945	9	21	42.40	42.48	0.917	1945	1.5487	0.1330	0.586	9,150	8.32E-07
38	Int Ferntree hill Rd and pipeline road	6228521	315169	0945	23	S5	47.71	47.86	1.249	2352	0.7470	0.2358	0.130	2,035	1.85E-07
58	OH Pylon #216, behind 9 Alpine, Pl, Engadine	6229971	315179	0945	8	28	42.35	42.48	0.973	2065	0.2387	0.2143	0.175	2,734	2.48E-07
42	Int. Sierra/Ridge rds., Engadine	6230299	315228	0945	10	17	32.41	32.41	0.835	2319	0.1530	2.3459	0.219	3,421	3.11E-07
28	End of Fairview Ave, Engadine	6228276	315298	0945	6	22	43.62	43.95	0.914	1879	4.3477	0.0400	0.476	7,441	6.76E-07
32	Ferntree Reserve, Engadine	6229034	315350	0945	7	14	40.68	40.66	0.998	2209	0.0962	0.2508	0.064	996	9.05E-08
41	Int. Sarbugal Pass track/Water Board road	6230562	315525	0945	25	S7	47.35	47.33	1.196	2274	0.0636	1.6153	0.008	129	1.17E-08
54	Needles Rd, east side of River	6230689	315849	0945	17	13	44.34	44.23	0.986	2004	N/A	N/A			
34	Holmlea Pl., North Engadine	6230274	315892	0945	11	32	44.69	45.49	0.904	1804	0.0637	0.2222	0.115	1,790	1.63E-07
55	Needles road, int. track, west side of river	6230503	315838	0945	19	27	42.62	42.64	0.926	1955	0.1573	0.3261	0.030	465	4.23E-08
18	Bottom, Kelton Pl.,Nth Engadine	6231187	316828	0945	12	33	42.63	42.39	0.867	1836	0.0179	0.3344	0.029	446	4.05E-08
81	Water Board road, NE of Ferntree, below pylon	6229031	315166	0945	22	8	41.22	41.57	0.917	1994	0.0701	0.2223	0.011	168	1.53E-08

PMCH Release 7, 28/078/97, Lucas Heights

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Table 15

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02/08/99 15:32:52

		LH Met Tower 10m			LH Met Tower 49m			L.H. Comm. School			Boys Town School			Shackles Estate			WRAPS LH#1	
Date	Time (EST)	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	T	uav	thet	uav	thet
11097	15	8.7	1.4	9999.0	13.9	1.2	111.8	11.4	3.3	205.7	11.7	2.4	190.6	8.9	0.6	270.0	0.0	0
11097	30	8.6	1.7	9999.0	14.0	1.5	112.5	11.5	3.0	203.8	12.9	2.0	175.0	8.9	0.7	280.3		
11097	45	8.8	1.7	9999.0	14.0	1.3	100.9	11.9	2.4	198.6	13.7	1.6	166.6	8.7	0.5	274.3		
11097	100	8.9	1.5	9999.0	14.0	1.5	88.8	12.2	2.0	189.1	14.0	1.3	118.3	8.6	0.4	270.6		
11097	115	9.1	1.1	9999.0	14.1	1.0	55.1	12.6	1.7	199.8	12.6	1.3	180.6	8.5	0.5	263.6		
11097	130	8.8	1.3	9999.0	14.1	1.0	38.0	12.4	2.1	202.1	12.1	1.1	184.6	8.4	0.6	276.2		
11097	145	8.4	1.6	9999.0	14.1	1.1	34.2	12.3	2.0	204.3	12.5	1.0	173.9	8.4	0.6	275.0		
11097	200	8.4	1.5	9999.0	14.1	1.4	24.4	12.4	1.7	204.8	12.6	1.1	183.0	8.3	0.5	269.3	0.0	0
11097	215	8.4	1.3	9999.0	14.0	1.2	21.0	12.3	1.8	203.4	12.9	0.8	171.9	8.2	0.6	276.0		
11097	230	8.2	1.1	9999.0	13.8	1.2	351.2	12.3	2.0	212.0	12.5	1.3	199.3	8.1	0.6	268.6		
11097	245	8.1	1.2	9999.0	13.6	0.9	304.3	11.7	2.5	209.9	11.7	1.6	187.6	8.0	0.7	277.3		
11097	300	7.9	1.6	9999.0	13.4	0.8	266.3	11.5	2.8	210.8	11.6	2.1	182.4	8.0	0.6	275.8		
11097	315	7.9	1.7	9999.0	13.4*****		9999.0	11.5	2.7	206.7	12.4	2.0	179.3	7.9	0.7	279.2		
11097	330	7.8	1.5	9999.0	13.3	1.1	226.2	11.5	2.9	205.9	12.1	2.0	185.0	7.8	0.7	273.2		
11097	345	7.7	1.7	9999.0	12.9	1.5	194.6	11.2	3.0	207.1	11.5	2.1	188.1	7.7	0.6	280.6		
11097	400	8.1	1.8	9999.0	12.7	1.6	185.1	11.6	3.0	206.4	12.7	2.0	185.4	7.6	0.3	267.4	0.0	0
11097	415	8.3	1.8	9999.0	12.8	1.6	183.7	11.1	2.8	205.5	13.0	1.9	190.9	7.5	0.4	270.6		
11097	430	9.0	1.3	9999.0	12.8	1.1	192.6	11.1	3.0	207.7	12.5	1.5	194.7	7.4	0.5	264.3		
11097	445	9.0	1.1	9999.0	12.7	0.9	187.3	11.4	3.3	203.6	10.9	2.1	189.6	7.4	0.6	269.2		
11097	500	8.0	1.3	9999.0	12.7	1.0	185.0	10.7	3.5	205.7	10.6	2.4	188.6	7.3	0.2	280.0		
11097	515	7.7	1.7	9999.0	12.6	1.1	187.6	10.7	3.5	207.0	11.4	2.2	187.3	7.3	0.4	272.4		
11097	530	7.8	1.4	9999.0	12.7	1.0	186.4	11.8	2.9	209.1	11.4	2.0	188.4	7.2	0.5	272.8		
11097	545	7.7	1.3	9999.0	12.9	0.8	174.3	12.3	2.4	202.6	12.6	1.6	194.3	7.2	0.3	275.6		
11097	600	7.8	1.5	9999.0	13.1	0.6	147.2	12.3	2.1	205.1	12.9	1.4	188.6	7.2	0.4	253.6	0.0	0
11097	615	8.3*****		9999.0	13.5	0.7	2.0	12.1	1.8	206.2	13.2	1.1	174.2	7.4	0.6	233.8		
11097	630	9.3	1.0	188.7	13.5	1.1	0.5	12.2	1.6	213.4	12.6	1.1	211.8	7.7	1.2	210.4		
11097	645	10.4	0.9	208.5	13.5	1.3	336.7	12.7	1.1	232.1	13.0	0.8	250.7	8.3	1.2	200.0		
11097	700	11.2	0.9	224.3	13.4	1.3	322.8	12.4	0.8	264.0	12.8	1.0	209.8	9.2	1.1	193.8		
11097	715	12.7	0.3	214.0	13.4	1.6	324.2	13.1	1.1	310.7	12.9	1.0	227.6	10.0	1.5	177.9		
11097	730	14.7	0.9	301.6	13.4	1.7	306.3	13.6	1.0	302.8	13.6	0.9	271.1	11.1	1.2	180.7		
11097	745	15.4	1.4	269.7	13.7	2.0	278.3	14.7	1.4	293.1	14.3	1.3	272.9	12.1	1.3	171.1		
11097	800	15.9	1.7	265.0	14.0	2.5	283.2	15.5	2.1	297.3	14.7	1.6	279.5	13.3	1.1	171.2	0.0	0
11097	815	15.9	2.1	296.9	13.9	2.9	295.8	15.5	2.8	295.6	15.1	1.7	287.2	14.8	1.1	159.7		
11097	830	15.9	2.1	284.1	14.1	2.6	288.8	15.8	2.4	293.5	15.5	2.1	294.5	16.6	1.5	175.9		
11097	845	16.5	1.7	274.8	14.7	2.0	291.0	16.5	1.7	276.5	15.8	2.4	296.8	17.3	1.6	176.5		
11097	900	16.9	1.9	307.1	15.1	2.7	320.2	17.0	2.1	283.6	16.2	2.2	303.6	18.0	1.4	131.0		
11097	915	17.2	2.1	310.3	15.5	2.8	321.8	17.3	2.5	311.2	16.8	2.5	308.0	18.2	1.7	103.2		
11097	930	17.8	2.1	305.8	16.0	3.2	323.0	17.6	2.8	284.0	17.2	2.9	328.1	18.5	1.6	80.9		
11097	945	18.4	1.8	311.7	16.6	2.7	321.5	18.1	2.6	300.7	17.7	2.6	317.5	19.1	1.5	152.0		
11097	1000	19.0	2.2	332.0	17.3	3.1	341.8	18.6	2.4	303.7	18.1	3.0	311.8	19.5	1.8	71.0	0.0	0
11097	1015	19.3	2.5	327.2	17.5	3.8	348.2	19.2	3.3	291.9	18.5	3.2	35.8	20.6	1.2	81.8		
11097	1030	19.9	2.5	320.9	18.1	3.7	347.0	19.5	3.5	46.3	19.1	3.5	341.9	20.7	1.8	68.7		
11097	1045	20.6	2.4	311.2	18.9	3.4	332.3	20.0	3.4	27.5	19.4	4.0	312.7	21.2	1.3	91.6		
11097	1100	20.7	2.9	358.4	18.8	4.5	357.4	20.5	3.4	20.9	19.6	3.5	334.5	21.5	1.9	84.4		
11097	1115	21.4	1.9	353.8	19.6	2.9	346.8	20.5	3.5	14.7	20.4	3.2	23.0	21.7	1.8	72.4		
11097	1130	21.8	2.2	0.3	19.9	3.3	359.8	21.0	2.5	19.2	20.4	3.6	36.7	21.6	2.2	65.7		
11097	1145	21.9	2.2	327.6	20.2	3.3	359.0	21.5	3.0	23.4	20.5	3.6	44.7	22.3	1.8	62.4		
11097	1200	22.1	2.1	328.9	20.3	3.2	336.4	21.6	3.6	27.4	21.0	3.6	359.4	22.7	1.8	62.6	0.0	0

Table 16

Rec.	Location	Latitude	Longitude	Start	Pump	Tube	Flow	Flow	Tube	Volume	Chromatogram area		Air Concentration		Atmos. Dil.
Index		E UTM m	N UTM m	Time			Before	After	Correction	per 30 min	PMCH	PDCH	(ppt)	(pg/m3)	Factor
17	OH Pylon #217, behind 4 Range Pl., Engadine	315212	6229516	0800	9	21	42.69	42.89	0.917	1929	6.5540	2.0330	8.060	125,930	1.01E-05
17	OH Pylon #217, behind 4 Range Pl., Engadine	315212	6229516	0800	9	HaV	42.48	42.69	0.845	1786	19.9130	5.5900	26.450	413,275	3.32E-05
18	Bottom, Kelton Pl.,Nth Engadine	316828	6231187	0800	11	HalV	45.49	46.18	0.893	1753	3.3000	1.5470	4.463	69,732	5.61E-06
21	Cnr. Hahn/Lawrence ST., ANSTO	313849	6230122	0800	16	Hal	42.57	42.66	0.854	1804	1.2219	3.3930	1.606	25,087	2.02E-06
22	Cnr. Einstein/Hahn Sts., ANSTO	313849	6230010	0800	15	25	45.63	45.63	0.952	1878	53.2240	0.9164	77.224	1,206,617	9.70E-05
24	Cnr. Rutherford/Hahn Ave., ANSTO	313826	6230264	0800	18	A1	43.95	43.86	1.021	2093	0.1520	1.1030	0.171	2,671	2.15E-07
28	End of Fairview Ave, Engadine	315298	6228276	0800	10	34	32.41	32.50	0.985	2731	1.9960	3.4650	1.732	27,069	2.18E-06
31	Fermi/Einstein Aves, S. of HIFAR	313525	6229949	0800	13	35	36.99	36.61	0.803	1964	3.7930	0.8400	4.580	71,566	5.75E-06
32	Ferntree Reserve, Engadine	315350	6229034	0800	8	26	42.47	42.64	0.909	1922	18.4600	1.1960	22.777	355,893	2.86E-05
34	Holmlea Pl, North Engadine	315892	6230274	0800	12	11	42.39	43.41	0.965	2024	1.6040	1.3250	1.878	29,346	2.36E-06
42	Int. Sierra/Ridge rds., Engadine	315228	6230299	0800	7	43	40.66	40.82	0.930	2054	4.5400	2.0530	5.241	81,886	6.58E-06
46	Liverpool/Heath. Rd, park bay bot. str.sect. N.Ill Rd	313620	6229708	0800	19	S1	42.64	42.83	1.072	2258	0.7460	2.8900	0.783	12,228	9.83E-07
47	Liverpool/Heath. Rd, park bay bot. W. side Wor. Riv	314970	6229043	0800	17	HalII	44.23	44.36	1.093	2221	0.0980	4.4190	0.103	1,616	1.30E-07
51	Meteorological Tower, ANSTO	313683	6230063	0800	14	9	44.41	44.49	0.987	1998	246.1120	0.6060	336.262	5,254,092	4.22E-04
58	OH Pylon #216, behind 9 Alpine, Pl, Engadine	315179	6229971	0800	6	20	43.95	43.75	0.973	1997	10.3330	2.4540	12.273	191,762	1.54E-05
62	On fence opp. Building 64 carpark, ANSTO	314327	6230157	0800	20	S2	44.98	44.88	1.147	2298	1.5390	0.5280	1.588	24,809	1.99E-06
80	Water board road, further SW of Sarbugal track	315099	6230399	0800	23	10	47.86	47.91	0.871	1637	0.1910	2.7900	0.275	4,298	3.46E-07
18	Bottom, Kelton Pl.,Nth Engadine	316828	6231187	0930	11	32	46.18	46.86	0.904	1749	20.9050	7.4950	28.353	443,022	4.03E-05
21	Cnr. Hahn/Lawrence ST., ANSTO	313849	6230122	0930	16	Hall	42.66	42.74	0.983	2072	0.1760	2.3260	0.200	3,128	2.84E-07
22	Cnr. Einstein/Hahn Sts., ANSTO	313849	6230010	0930	20	2	44.88	44.79	1.002	2011	3.5110	1.9730	4.139	64,679	5.88E-06
24	Cnr. Rutherford/Hahn Ave., ANSTO	313826	6230264	0930	18	15	43.86	43.76	0.919	1888	0.3370	1.0960	0.422	6,593	5.99E-07
28	End of Fairview Ave, Engadine	315298	6228276	0930	10	17	32.50	32.69	0.835	2306	8.7390	1.4020	8.990	140,474	1.28E-05
32	Ferntree Reserve, Engadine	315350	6229034	0930	8	28	42.64	42.81	0.973	2050	9.9330	5.9330	11.495	179,608	1.63E-05
34	Holmea Pl, North Engadine	315892	6230274	0930	12	33	43.41	44.43	0.867	1777	13.7340	4.9090	18.336	286,504	2.60E-05
38	Int Ferntree hill Rd and pipeline road	315169	6228521	0930	15	12	45.63	45.63	1.066	2103	2.9650	0.4080	3.344	52,248	4.75E-06
41	Int. Sarbugal Pass track/Water Board road	315525	6230562	0930	17	13	44.36	44.48	0.986	1998	3.0460	0.5410	3.616	56,493	5.13E-06
42	Int. Sierra/Ridge rds., Engadine	315228	6230299	0930	7	14	40.82	40.97	0.998	2196	1.4930	0.9460	1.611	25,176	2.29E-06
54	Needles, river level, east side of river	315849	6230689	0930	19	27	42.83	43.01	0.926	1942	2.6260	0.5860	3.207	50,105	4.55E-06
58	OH Pylon #216, behind 9 Alpine, Pl, Engadine	315179	6229971	0930	6	22	43.75	43.55	0.914	1885	3.3460	0.9430	4.210	65,787	5.98E-06
70	Water Board road, NE of Ferntree, near pump A33	315048	6229514	0930	13	19	36.64	36.28	1.090	2691	4.6290	2.2350	4.080	63,752	5.79E-06
80	Water board road, further SW of Sarbugal track	315099	6230399	0930	23	S5	47.91	47.96	1.249	2345	0.2540	1.2990	0.256	3,996	3.63E-07
85	Pipeline Rd, 1/2 way SW Sarbugal gate to pump A33	315031	6229524	0930	14	36	44.49	44.56	0.99	2001	0.5140	0.2880	0.608	9,499	8.63E-07

PMCH Release 8, 01/10/97, Lucas Heights

Table 17

14:45 14/10/99

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ANSTO Perfluorocarbon Tracer Field Studies

Date	Release Times EST	Sampling Times EST	Source Location	Release Rate g hr^{-1}	Sampling Type	Lucas Heights 10m			Lucas Heights 49m			Atmospheric Dilution Speed (ms^{-1})	Comments
						Wind speed ms^{-1}	Wind direction °	Pasquill Stabilities USEPA	Wind speed ms^{-1}	Wind direction °	Pasquill Stabilities USEPA		
14/08/96	0610 to 0900	0720 to 1010	B. 34 (7.6m)	120	N/F	1.9 to 3.6	304 to 324	F to A	5.4 to 8.4	318 to 337	D	4.2	
16/08/96	0720 to 0940	0800 to 1130	B.34	94	N/F	1.8 to 3.5	194 to 258	D	4.0 to 5.6	201 to 255	D to E	3.3	
11/06/97	0715 to 0950	0800 to 0845	HIFAR (23m)	103	N/F	1.4 to 1.6	259 to 280	E to D	2.9 to 3.7	239 to 245	E to D	2.2	
		0900 to 0930				1.9 to 2.0	258 to 262	D	3.5 to 4.3	245 to 251	D	2.5	
		0930 to 1030				1.6 to 2.5	260 to 280	D to C	2.8 to 4.0	255 to 281	D	2.5	
23/06/97	0930 to 1118	1015 to 1045	HIFAR	103	F	1.9 to 2.0	261 to 274	D to C	2.7 to 2.8	256 to 263	D to C	2.0	Found release stopped
		1030 to 1100			N	2	261 to 272	C to D	2.6 to 2.8	256 to 268	D	2.0	at 1145 EST
		1130 to 1200			N/F	1.9 to 2.1	277 to 287	C	2.7 to 3.0	279 to 288	D	2.1	
9/07/97	1020 to 1315	1100 to 1130	HIFAR	103	N	3.0 to 3.3	260 to 263	D	4.8 to 5.1	268 to 272	D	4.0	Release stopped
		1230 to 1300			N/F	3.1 to 3.3	260 to 266	D	5.3 to 5.4	271 to 276	C	4.4	between 1215 & 1315 EST
13/08/97	1122 to 1206	1130 to 1200	HIFAR	103	N	4.3 to 4.6	250 to 265	D	6.7 to 7.5	259 to 271	D	5.8	
28/08/97	0705 to 1015	0800 to 0830	HIFAR	103	N/F	1.6 to 2.0	243 to 267	C to D	1.6 to 2.5	267 to 278	D	2.1	
		0945 to 1015			N/F	2.4 to 2.5	305 to 310	D to B	2.8 to 2.9	295 to 307	D	2.6	
1/10/97	0710 to 1000	0800 to 0830	HIFAR	103	N/F	2.1	284 to 297	D to C	2.6 to 2.9	289 to 296	D	2.3	
		0930 to 1000			N/F	1.8 to 2.2	312 to 332	A	2.7 to 3.1	322 to 342	C	2.6	

N = Near field
F = Far field

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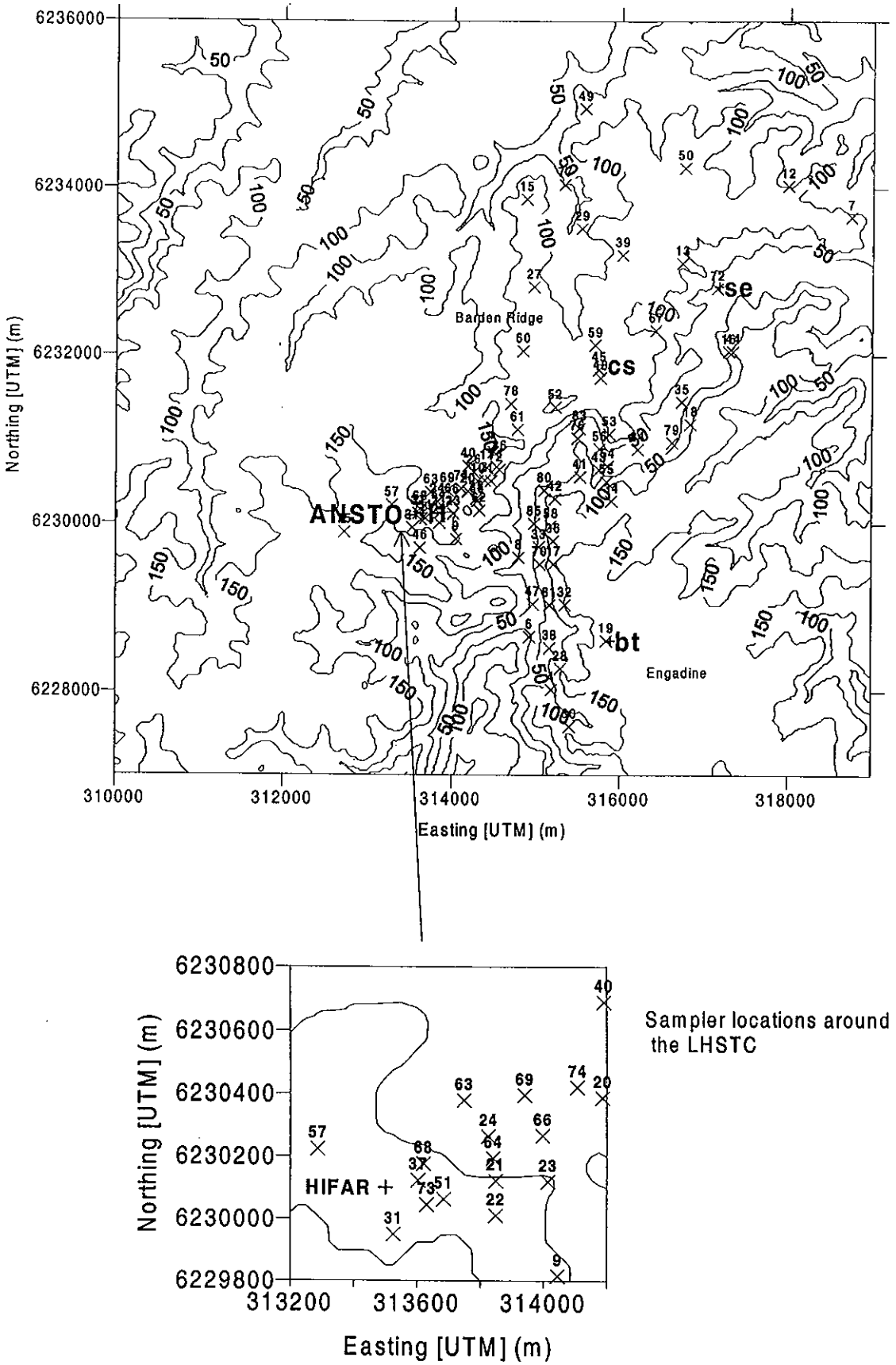
Table 18

HIFAR **Source location:** Eastings 313500 UTM (m)
Northings : 6230100 UTM (m)

Date	Time	Receptor	Wind Speeds (m/s) U10m	U49m	Udil	Pasquill Stability	Release Height (m)	Concentrations (g/m**3) U10m	U49m	Udil	Tracer
110697	0800-0830	Meteorological Tower, ANSTO	1.5	3.3	2.2	D	0	4.143E-05	1.883E-05	2.825E-05	9.300E-07
		E 313683 N 6230063 UTM (m)					23	2.790E-06	1.268E-06	1.902E-06	
						E	0	1.031E-04	4.688E-05	7.032E-05	
							23	8.515E-09	3.870E-09	5.806E-09	
230697	1030-1100	Meteorological Tower, ANSTO	1.9	2.7	2.0	C	0	1.606E-05	1.130E-05	1.526E-05	2.200E-06
		E 313683 N 6230063 UTM (m)					23	4.695E-06	3.304E-06	4.461E-06	
						D	0	3.271E-05	2.302E-05	3.108E-05	
							23	2.203E-06	1.550E-06	2.093E-06	
230697	1030-1100	Int. Sierra/Ridge Rds, Engadine	1.9	2.7	2.0	C	0	2.264E-07	1.594E-07	2.151E-07	1.500E-07
		E 315228 N 6230299 UTM (m)					23	2.223E-07	1.564E-07	2.112E-07	
						D	0	6.793E-07	4.781E-07	6.454E-07	
							23	6.223E-07	4.379E-07	5.912E-07	
090797	1100-1130	Cnr Lawrence/Hahn Ave, ANSTO	3.1	4.9	4.0	D	0	6.287E-06	3.977E-06	4.872E-06	3.300E-07
		E 313849 N 6230122 UTM (m)					23	2.515E-06	1.591E-06	1.949E-06	
090797	1100-1130	E. end of Thomson Ave, ANSTO	3.1	4.9	4.0	D	0	1.433E-06	9.066E-07	1.111E-06	3.700E-07
		E 314289 N 6230298 UTM (m)					23	1.120E-06	7.086E-07	8.680E-07	
130897	1130-1200	Meteorological Tower, ANSTO	4.4	7.1	5.8	D	0	1.413E-05	8.754E-06	1.072E-05	3.600E-07
		E 313683 N 6230063 UTM (m)					23	9.512E-07	5.895E-07	7.216E-07	
280897	0800-0830	Meteorological Tower, ANSTO	1.8	2.0	2.1	C	0	1.695E-05	1.526E-05	1.453E-05	1.600E-06
		E 313683 N 6230063 UTM (m)					23	4.956E-06	4.461E-06	4.248E-06	
						D	0	3.453E-05	3.108E-05	2.960E-05	
							23	2.325E-06	2.093E-06	1.993E-06	
280897	0800-0830	Menai Town Centre	1.8	2.0	2.1	C	0	3.668E-08	3.301E-08	3.144E-08	1.900E-08
		E 316755 N 6234243 UTM (m)					23	3.656E-08	3.291E-08	3.134E-08	
						D	0	1.400E-07	1.260E-07	1.200E-07	
							23	1.367E-07	1.231E-07	1.172E-07	
011097	0800-0830	Cnr. Einstein/Hahn St, ANSTO	2.1	2.7	2.3	C	0	3.998E-06	3.110E-06	3.650E-06	1.200E-06
		E 313849 N 6230010 UTM (m)					23	2.843E-06	2.211E-06	2.595E-06	
						D	0	8.787E-06	6.834E-06	8.023E-06	
							23	3.676E-06	2.859E-06	3.357E-06	
011097	0800-0830	Behind 4 Range Pl., under pylon, Engadine	2.1	2.7	2.3	C	0	1.910E-07	1.485E-07	1.744E-07	2.700E-07
		E 315212 N 6229516 UTM (m)					23	1.877E-07	1.460E-07	1.714E-07	
						D	0	5.782E-07	4.497E-07	5.279E-07	
							23	5.319E-07	4.137E-07	4.857E-07	
011097	0930-1000	Ferntree Reserve, Engadine	2.0	2.9	2.6	A	0	2.501E-08	1.725E-08	1.924E-08	1.800E-07
		E 315350 6229034 UTM (m)					23	2.497E-08	1.722E-08	1.921E-08	
						C	0	1.494E-07	1.030E-07	1.149E-07	
							23	1.474E-07	1.017E-07	1.134E-07	

Table 19



Sampler locations around the LHSTC

Regional topography - locations of meteorological stations and samplers

Figure 1

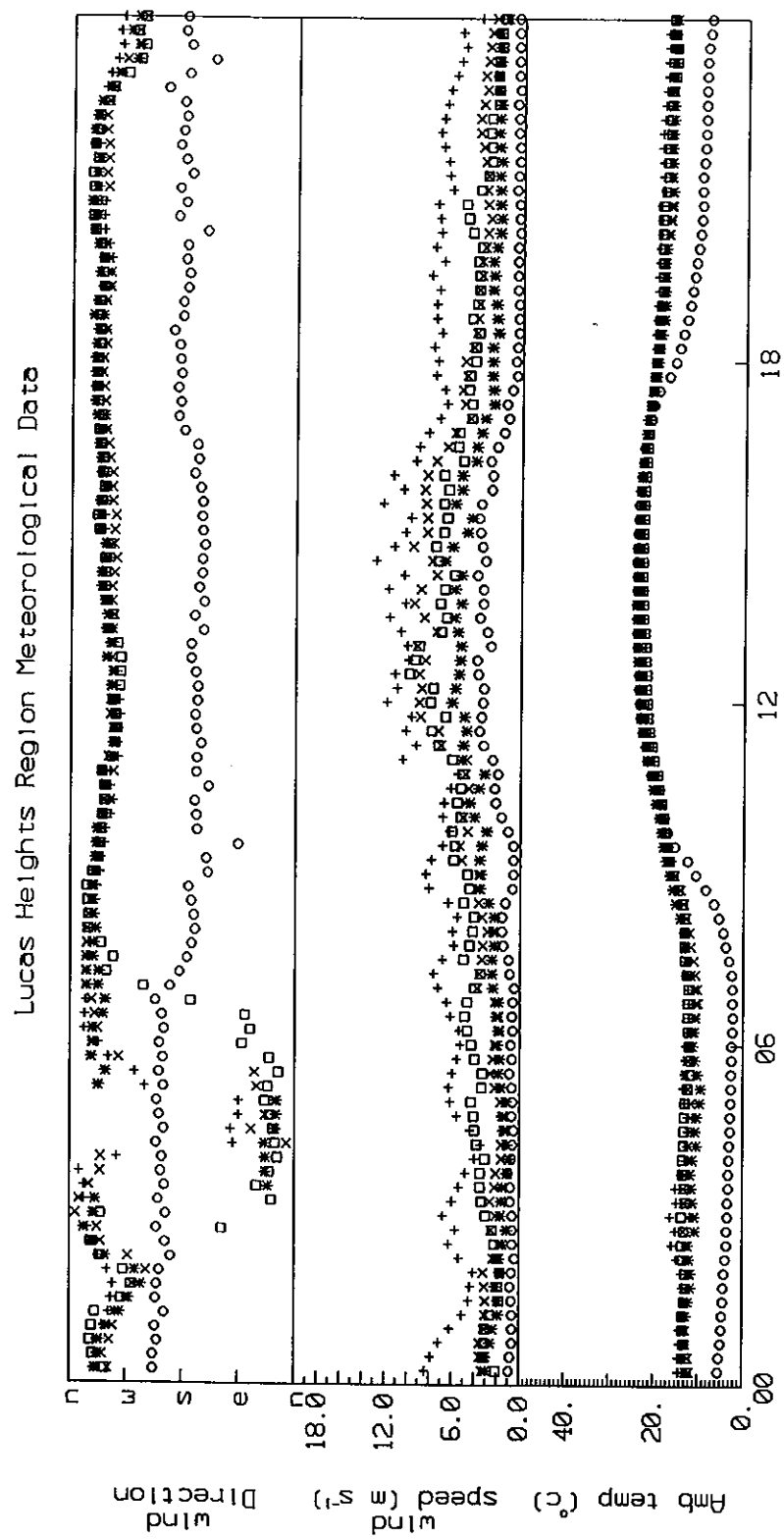

Lucas Heights Region Meteorological Data
Amb temp (°C)
Wind speed (m s⁻¹)
Wind Direction
0.00
20.
40.
0.0
6.0
12.0
18.0
N
E
S
W
N
06
12
18
140896
Times (EST)
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate

Figure 2

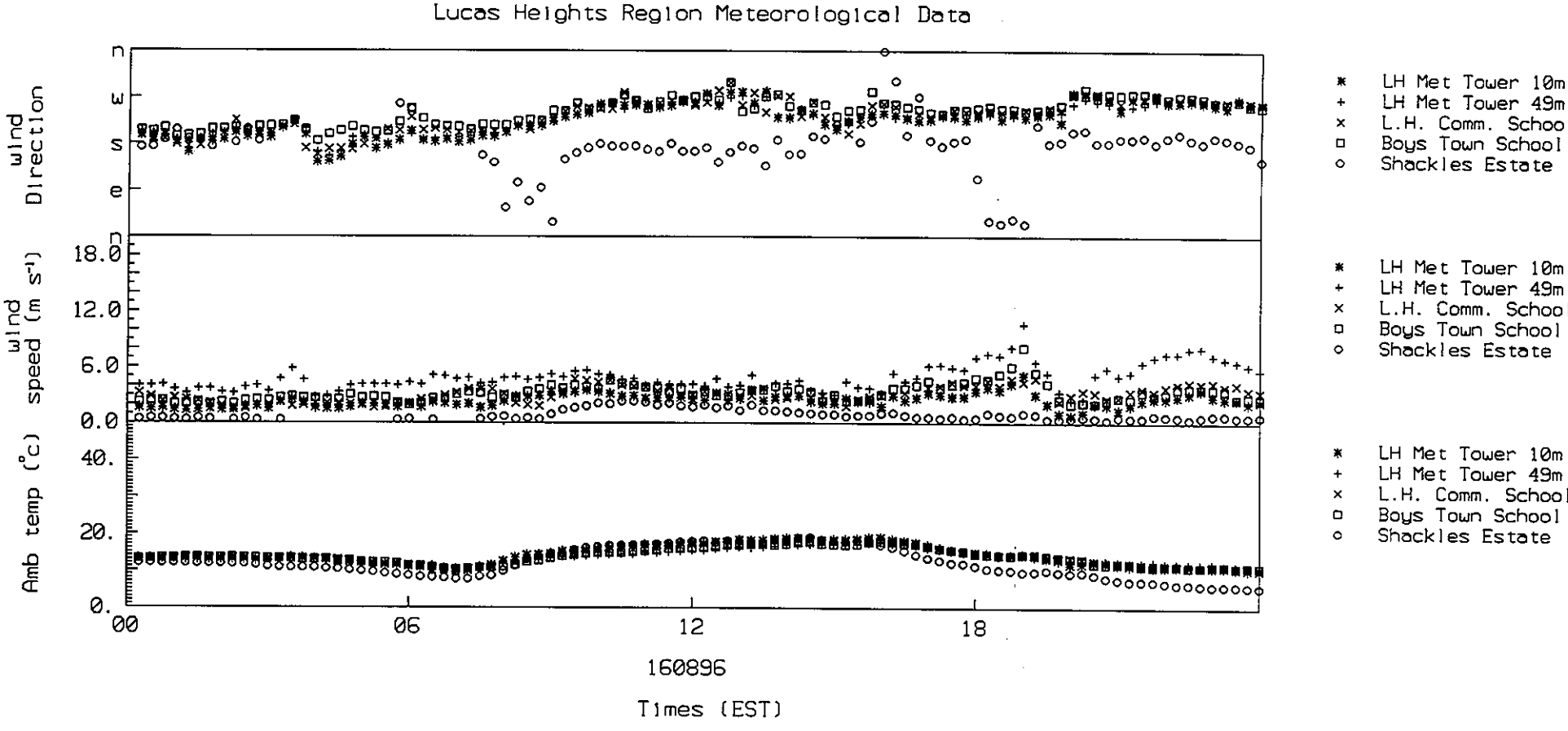
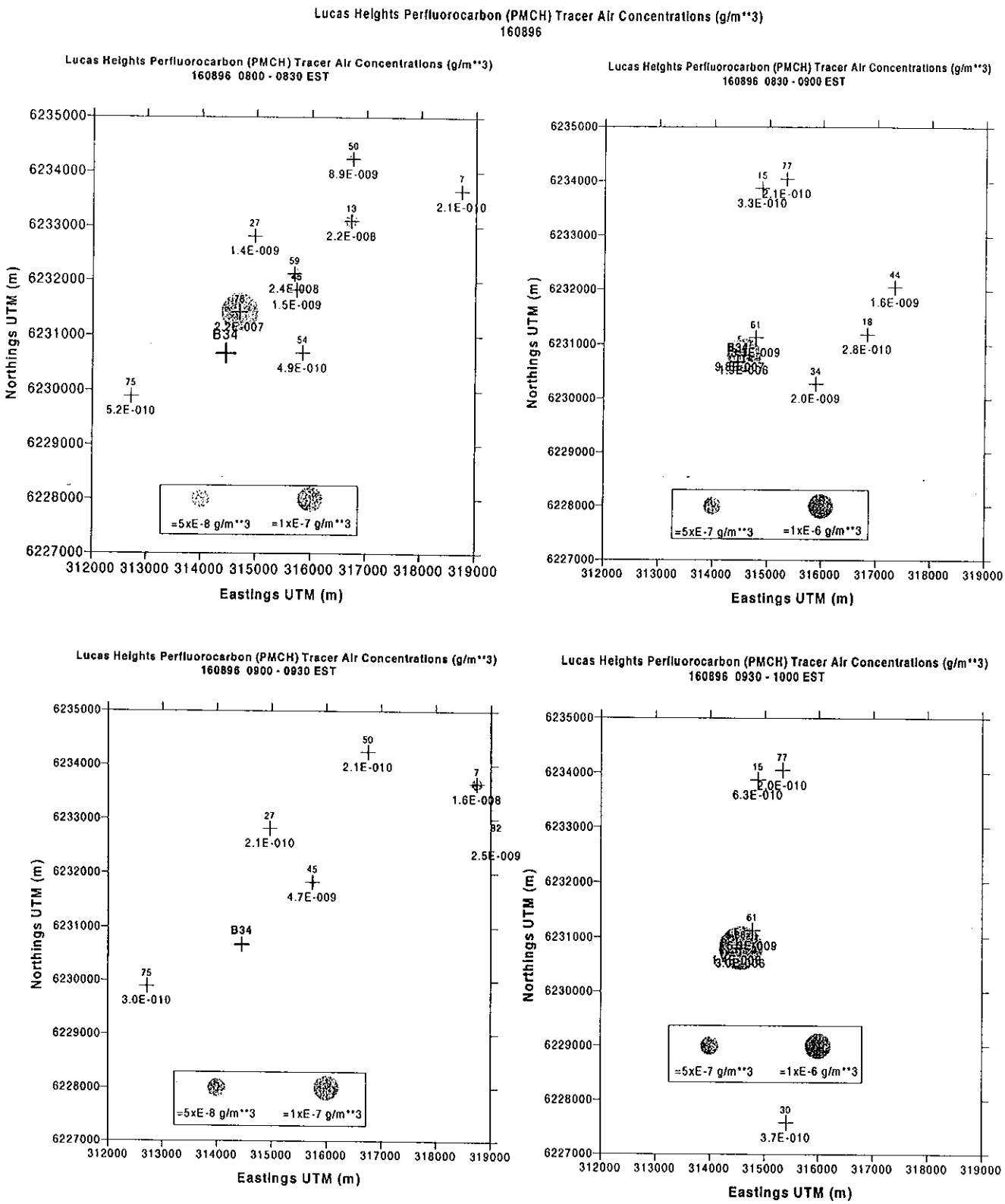

Lucas Heights Region Meteorological Data
wind Direction
n
w
s
e
wind speed (m s-1)
18.0
12.0
6.0
0.0
Amb temp (°c)
40.
20.
0.
00
06
12
18
160896
Times (EST)
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate

Figure 3



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.

Figure 4

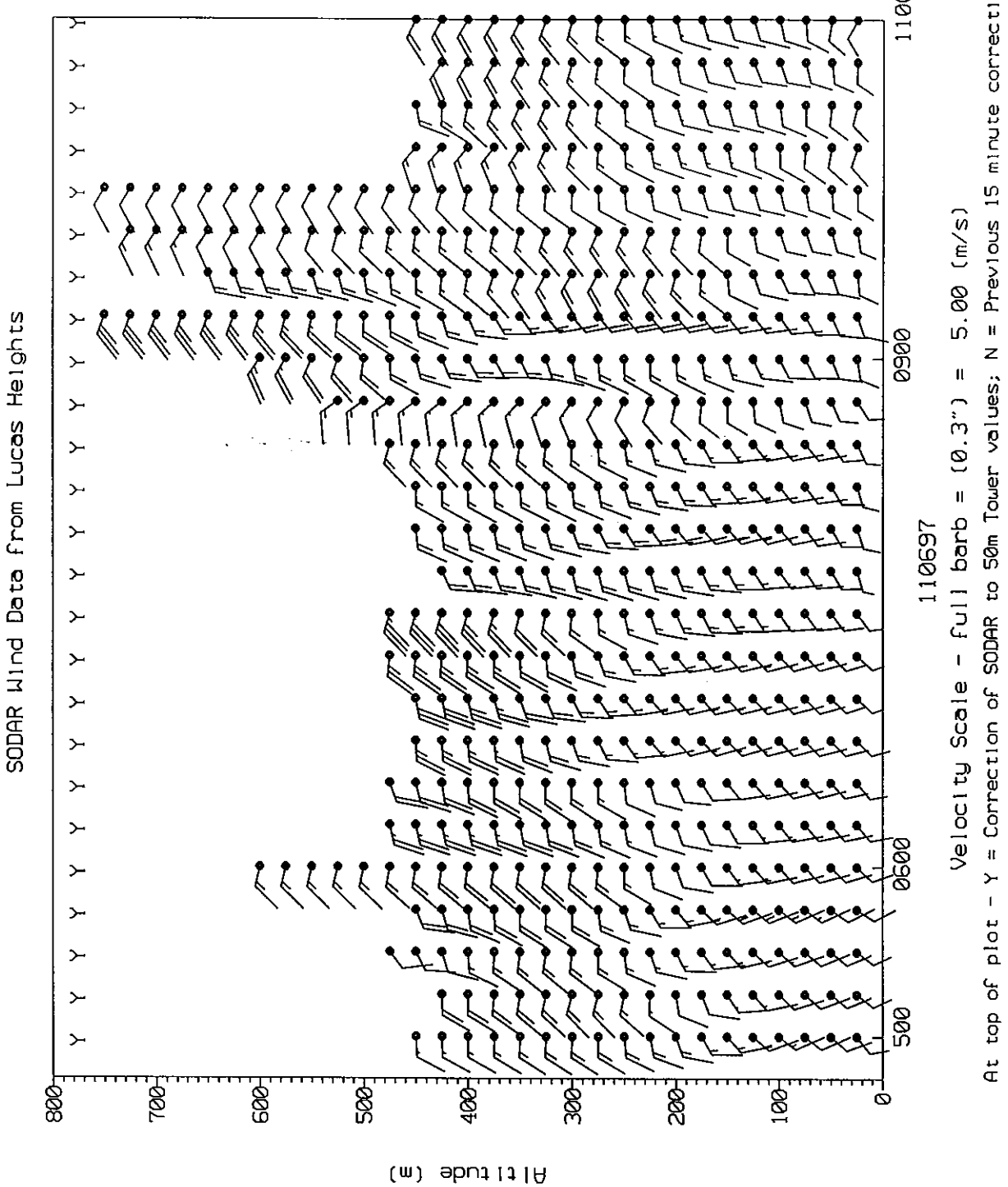

SODAR Wind Data from Lucas Heights
Altitude (m)
800
700
600
500
400
300
200
100
0
500
0600
0900
1100
110697
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 5

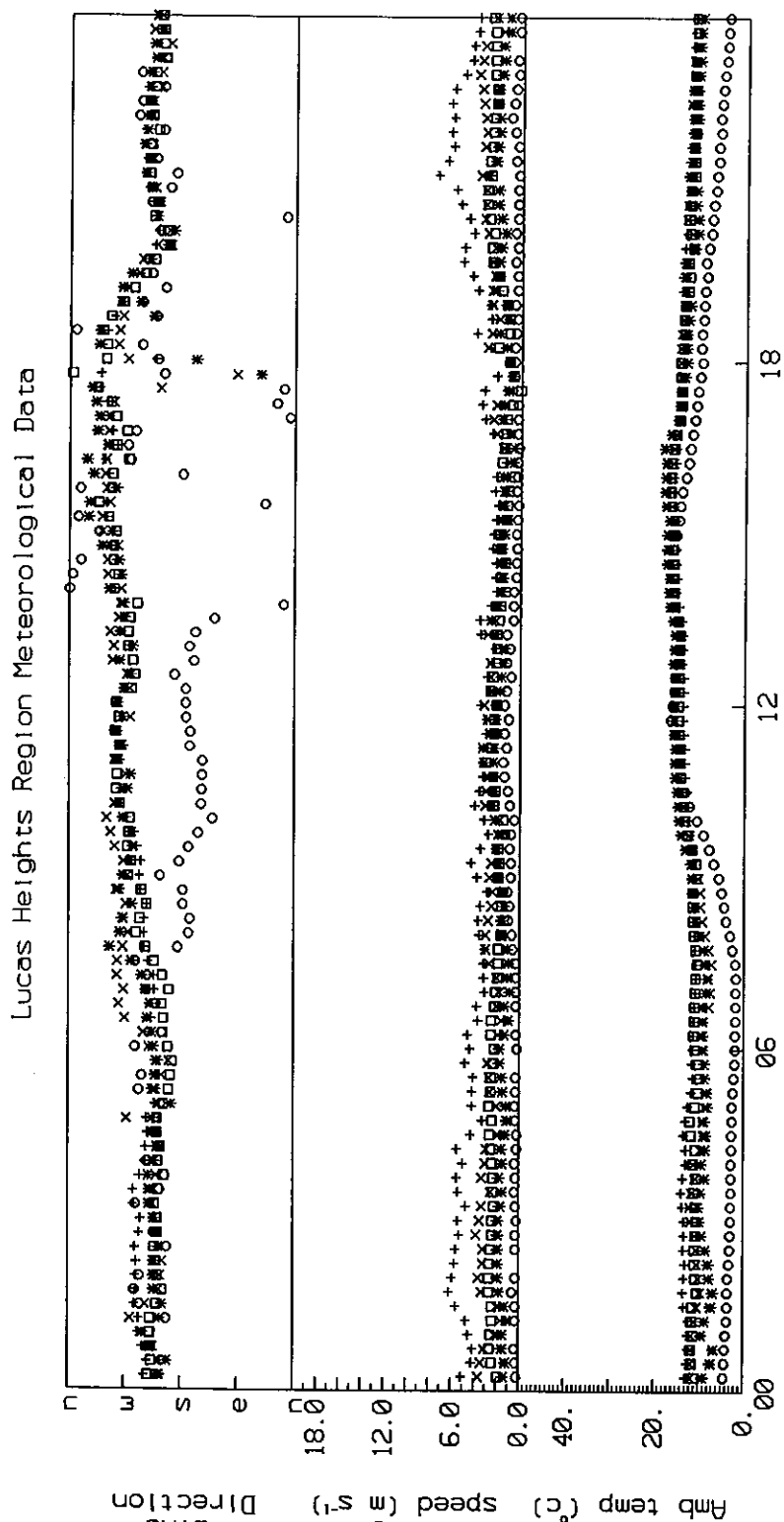

Lucas Heights Region Meteorological Data
Amb temp (°C)
wind speed (m s-1)
wind Direction
N
E
S
W
0.00
20.
40.
0.0
6.0
12.0
18.0
06
12
18
110697
Times (EST)
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
◇ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
◇ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
◇ Shackles Estate

Figure 6

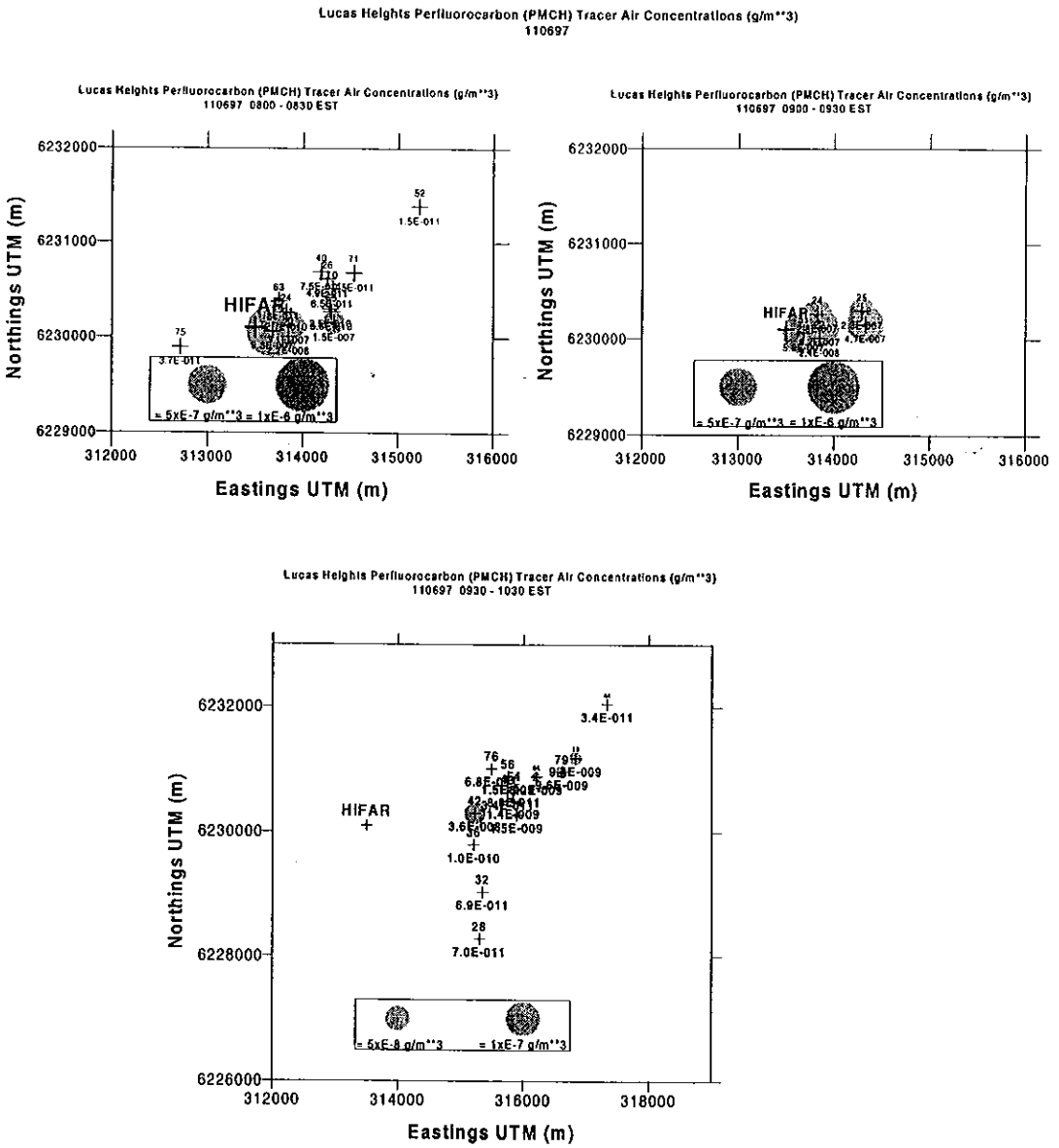

Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
110697
Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
110697 0800 - 0830 EST
Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
110697 0900 - 0930 EST
Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
110697 0930 - 1030 EST
HIFAR
Northings UTM (m)
Eastings UTM (m)
6232000
6231000
6230000
6229000
6228000
6226000
312000
313000
314000
315000
316000
318000
= 5xE-7 g/m**3 = 1xE-6 g/m**3
= 5xE-8 g/m**3
= 1xE-7 g/m**3
1.5E-011
3.7E-011
1.5E-007
3.4E-011
1.0E-010
6.9E-011
7.0E-011

Figure 7

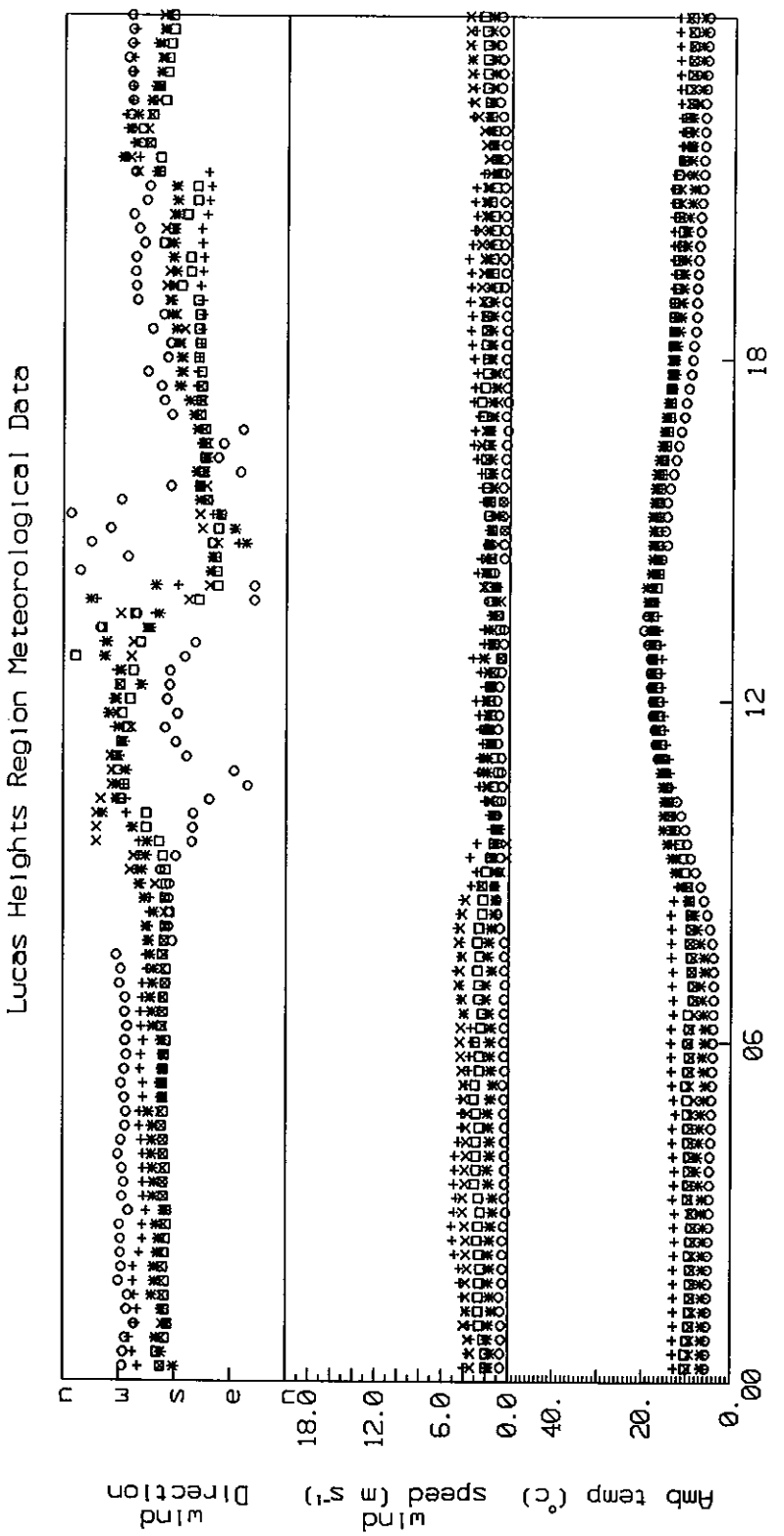
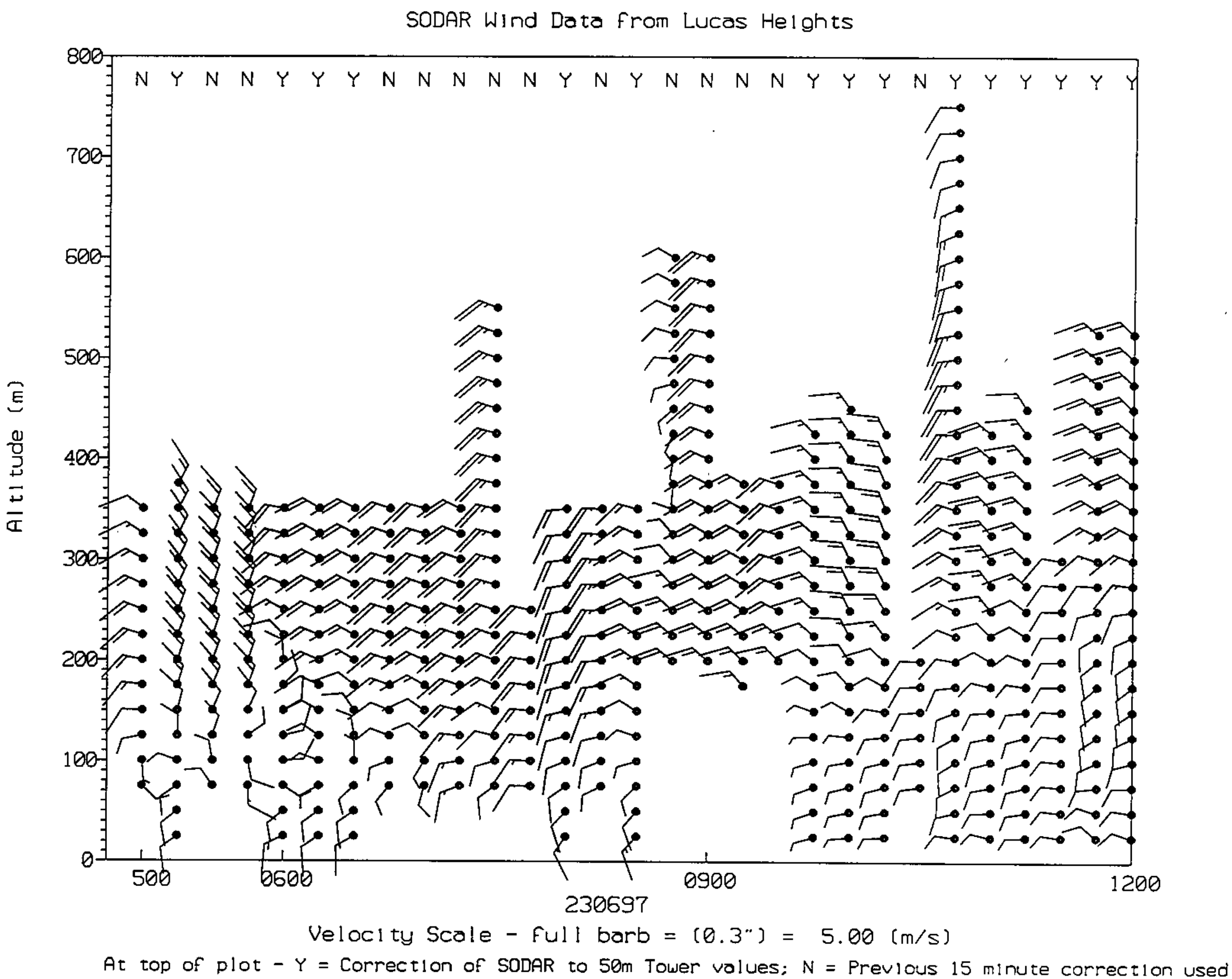

Lucas Heights Region Meteorological Data
Wind Direction
Wind speed (m s-1)
Amb temp (°C)
N
E
S
W
18.0
12.0
6.0
0.0
40.
20.
0.00
06
12
18
230697
Times (EST)
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate

Figure 8



SODAR Wind Data from Lucas Heights
N Y N N Y Y Y N N N N N Y N Y N N N N Y Y Y N Y Y Y Y Y Y
Altitude (m)
800
700
600
500
400
300
200
100
0
500
0600
0900
1200
230697
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 9

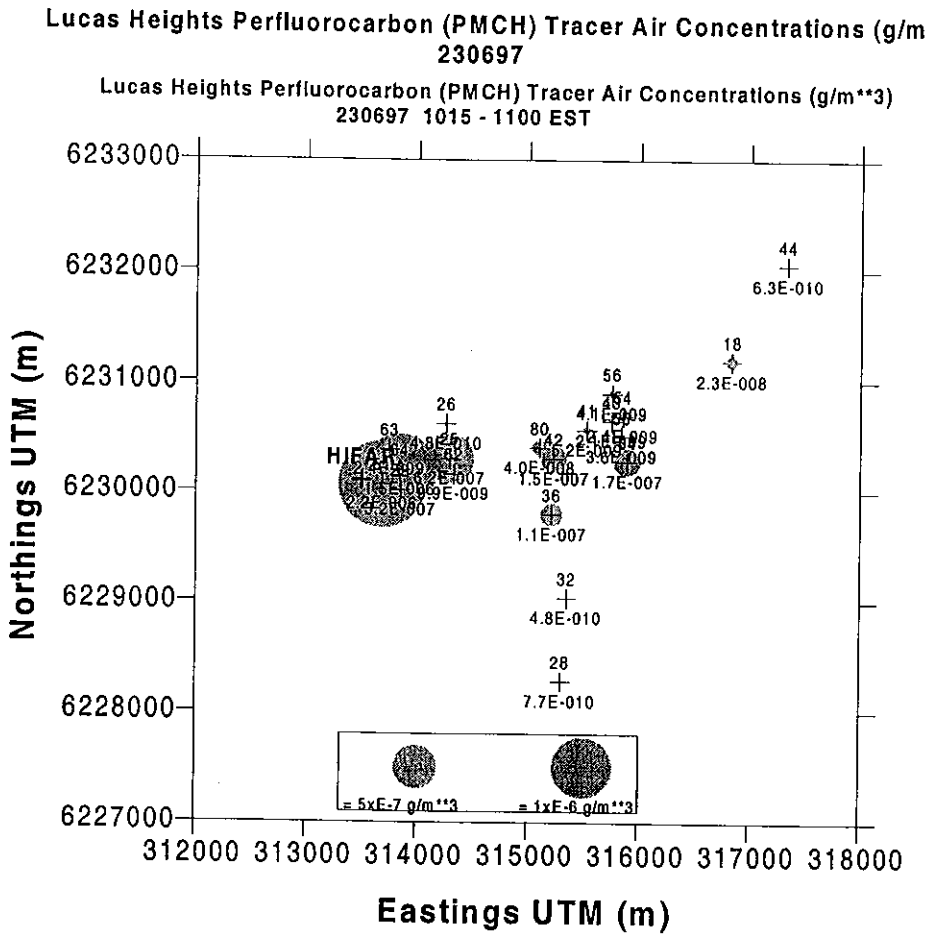

Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
230697
Lucas Heights Perfluorocarbon (PMCH) Tracer Air Concentrations (g/m**3)
230697 1015 - 1100 EST
Northings UTM (m)
6233000
6232000
6231000
6230000
6229000
6228000
6227000
312000 313000 314000 315000 316000 317000 318000
Eastings UTM (m)
HIFAR
44
6.3E-010
18
2.3E-008
56
26
63
80
4.0E-008
1.5E-007
1.7E-007
36
1.1E-007
32
4.8E-010
28
7.7E-010
= 5xE-7 g/m**3
= 1xE-6 g/m**3

Figure 10

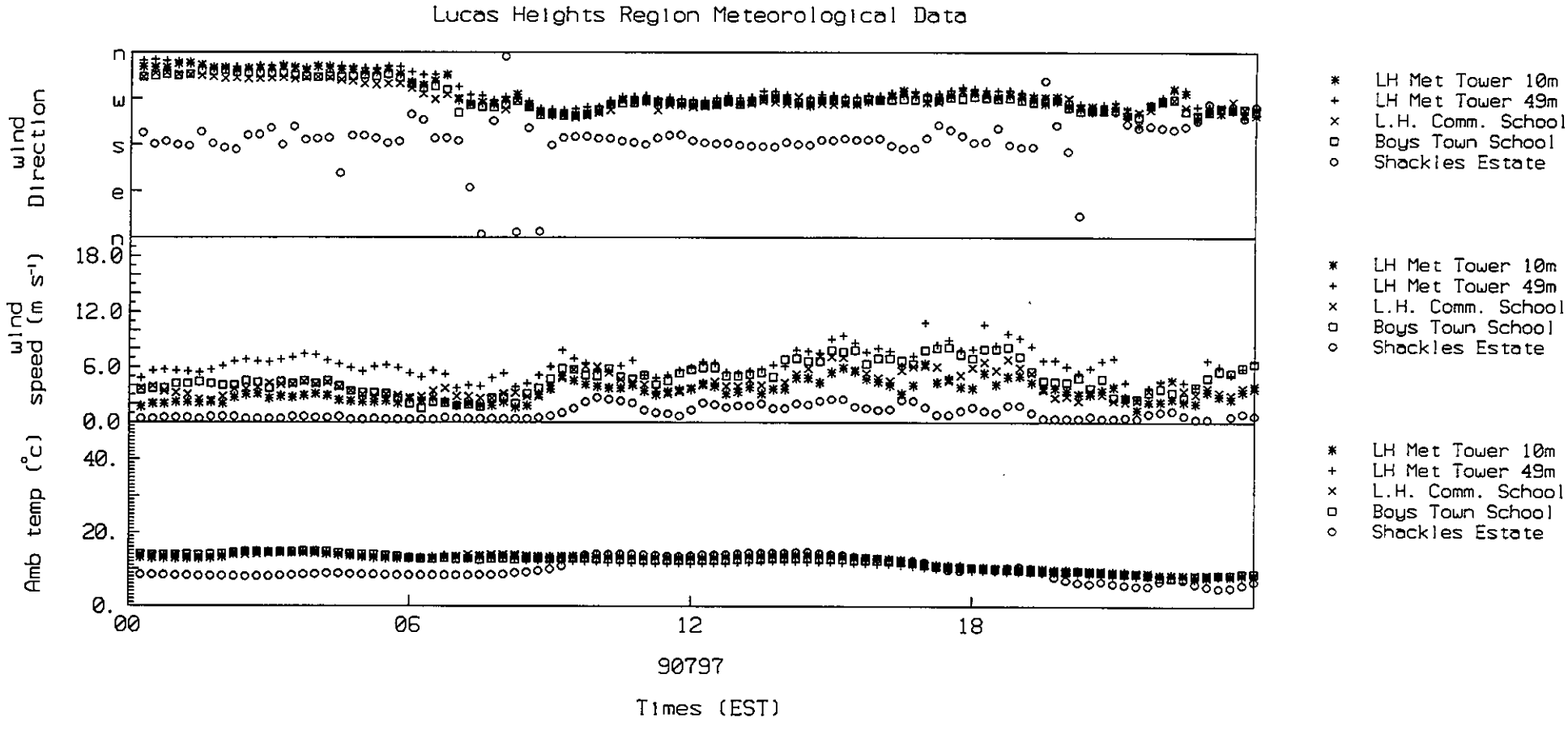

Lucas Heights Region Meteorological Data
Wind Direction
n
e
s
e
n
Wind speed (m s-1)
18.0
12.0
6.0
0.0
Amb temp (°c)
40.
20.
0.
00
06
12
18
90797
Times (EST)
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate

Figure 11

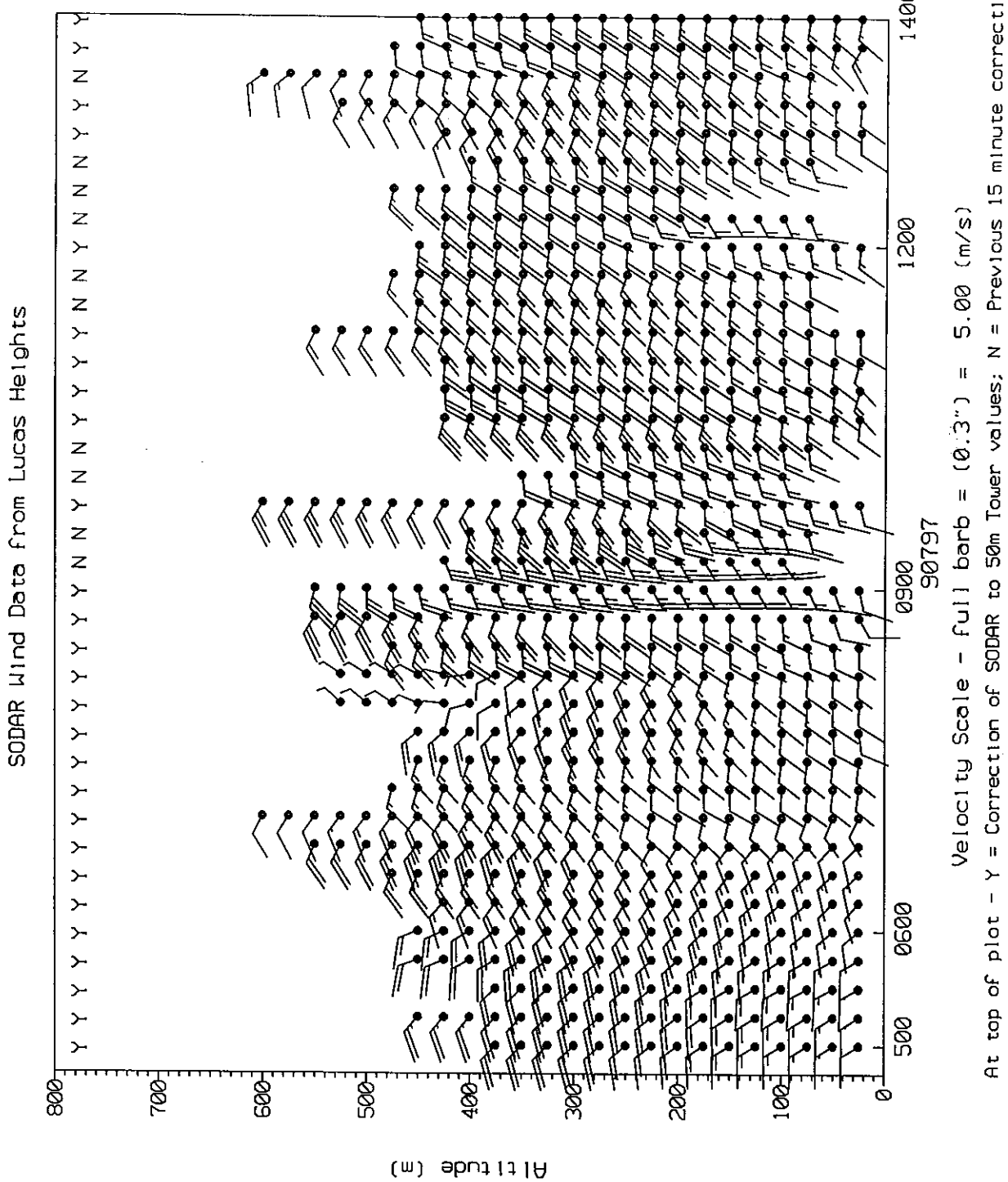
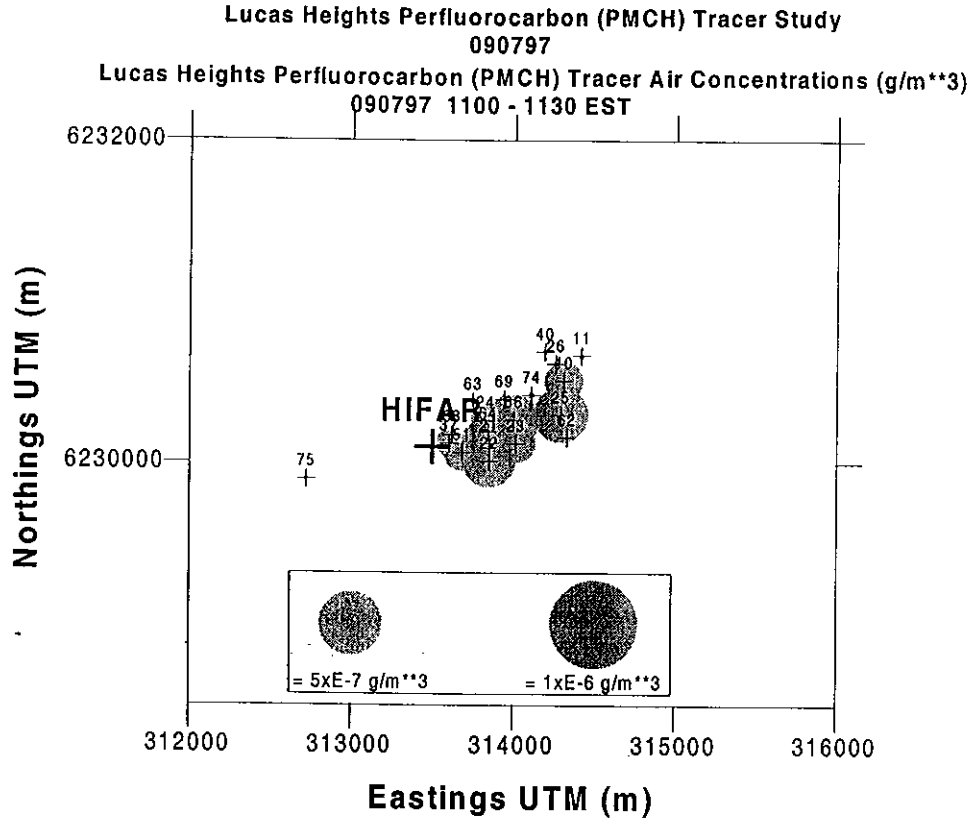
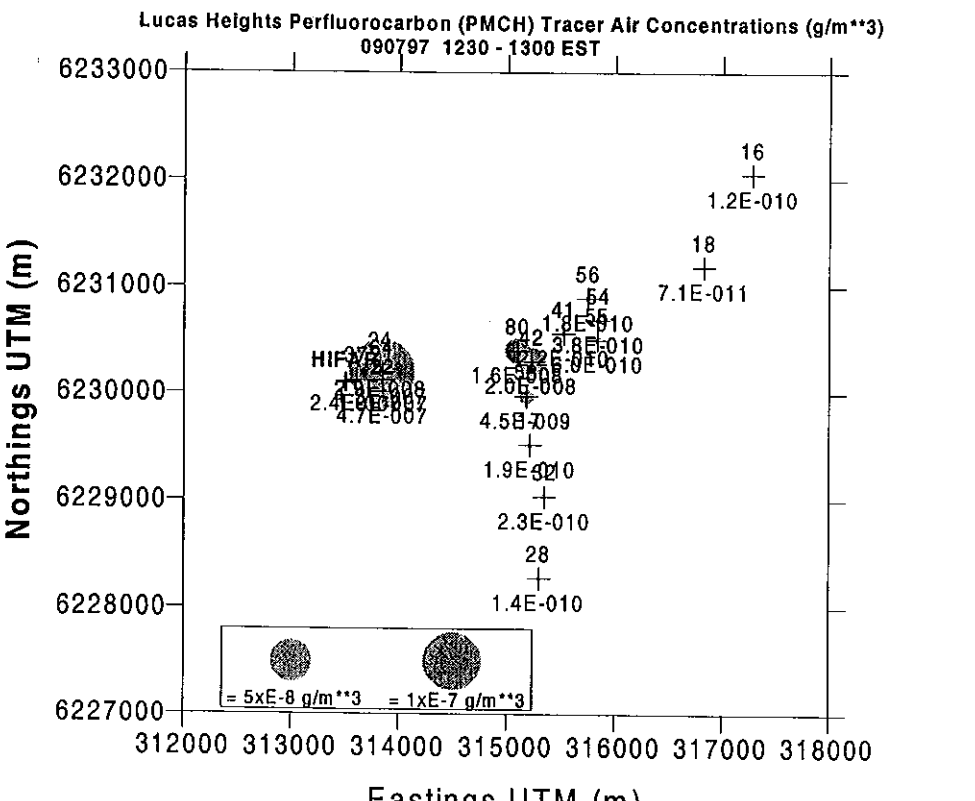

SODAR Wind Data from Lucas Heights
Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y N N Y N N Y Y Y Y N N Y N N N Y Y N Y Y
800
700
600
500
400
300
200
100
0
Altitude (m)
500
0600
0900
90797
1200
1400
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 12





The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.
N.B. Air concentrations at Receptors 22 & 37 have not been plotted as solid circles due to the large values at these locations.

Figure 13

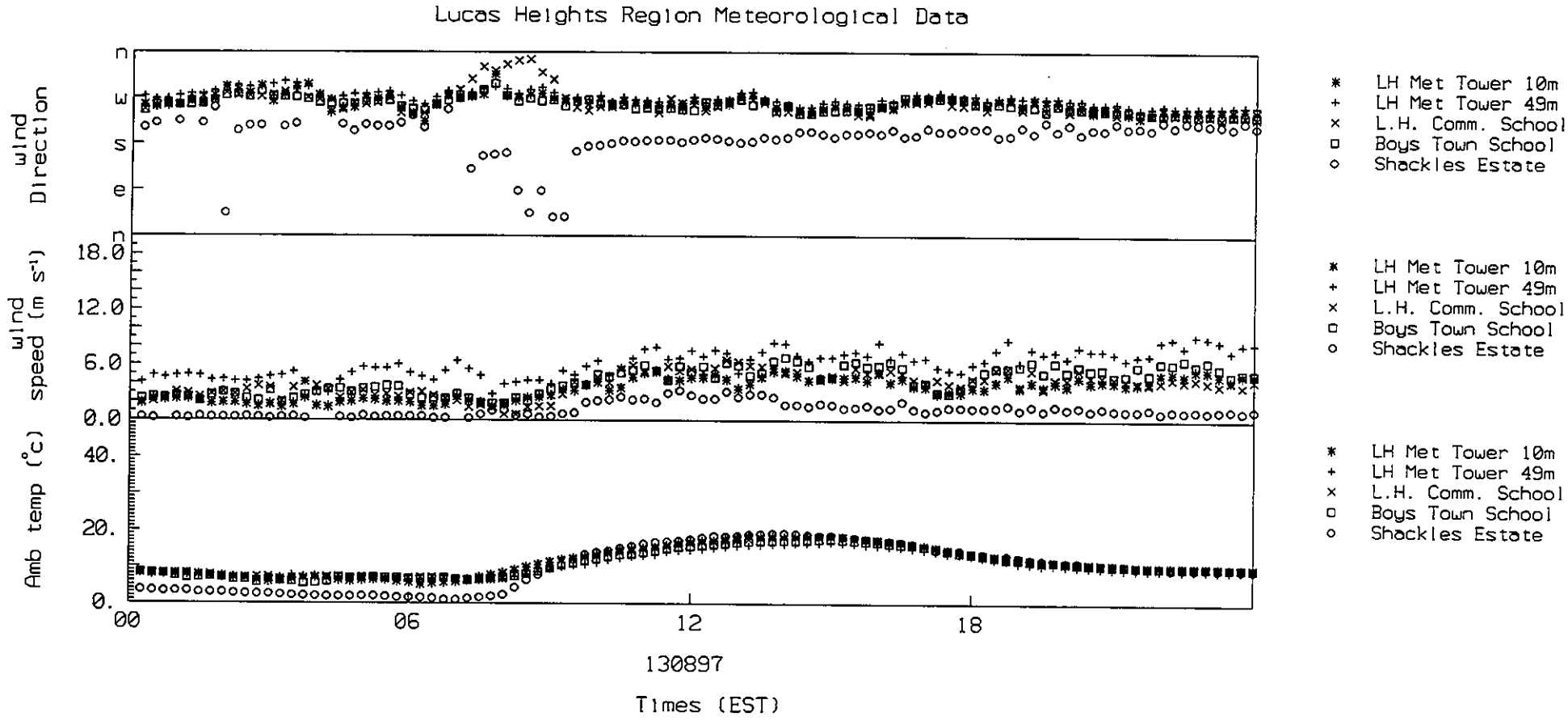

Lucas Heights Region Meteorological Data
wind Direction
N
E
S
E
N
wind speed (m s-1)
18.0
12.0
6.0
0.0
Amb temp (°C)
40.
20.
0.
00
06
12
18
130897
Times (EST)
LH Met Tower 10m
LH Met Tower 49m
L.H. Comm. School
Boys Town School
Shackles Estate

Figure 14

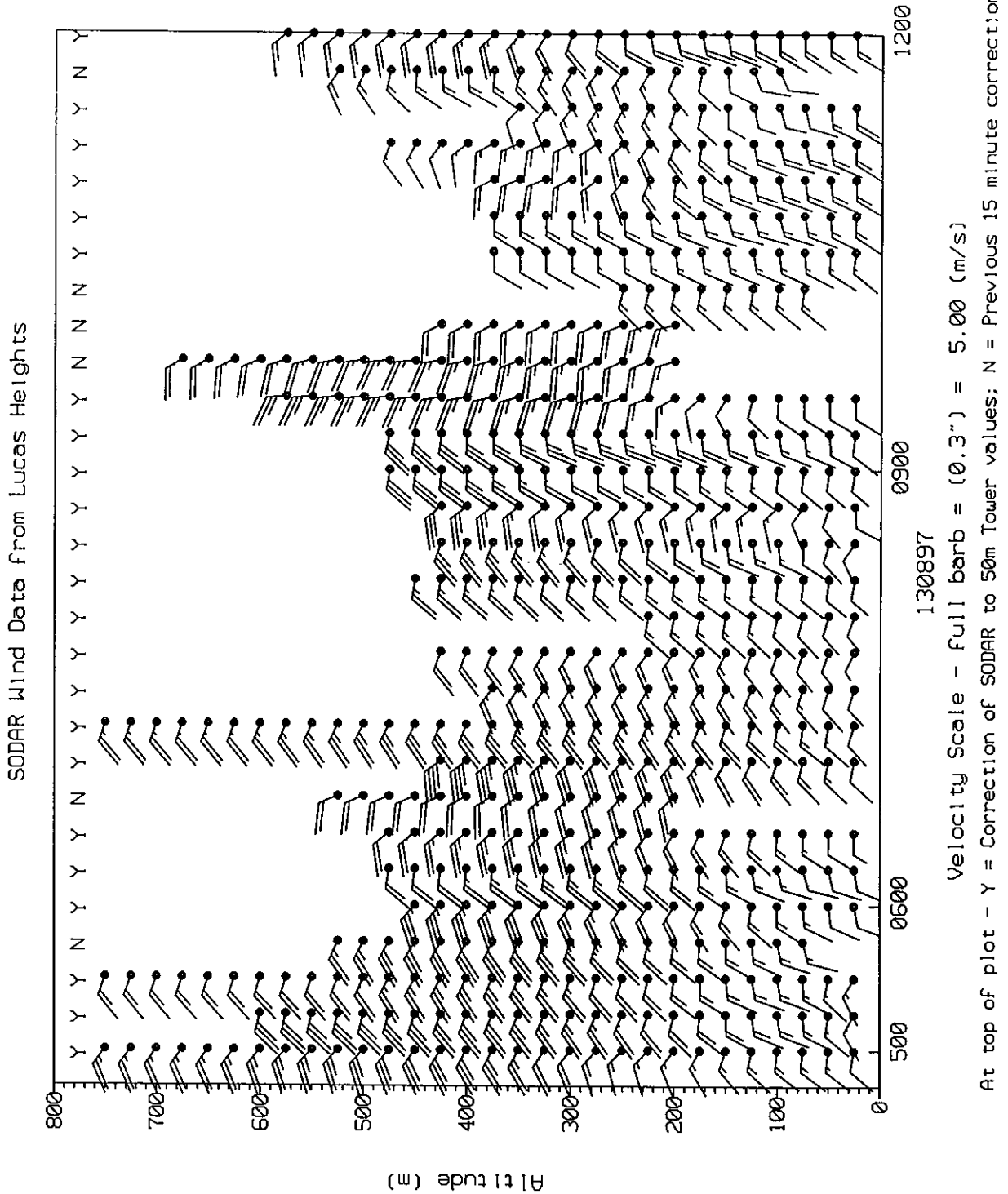
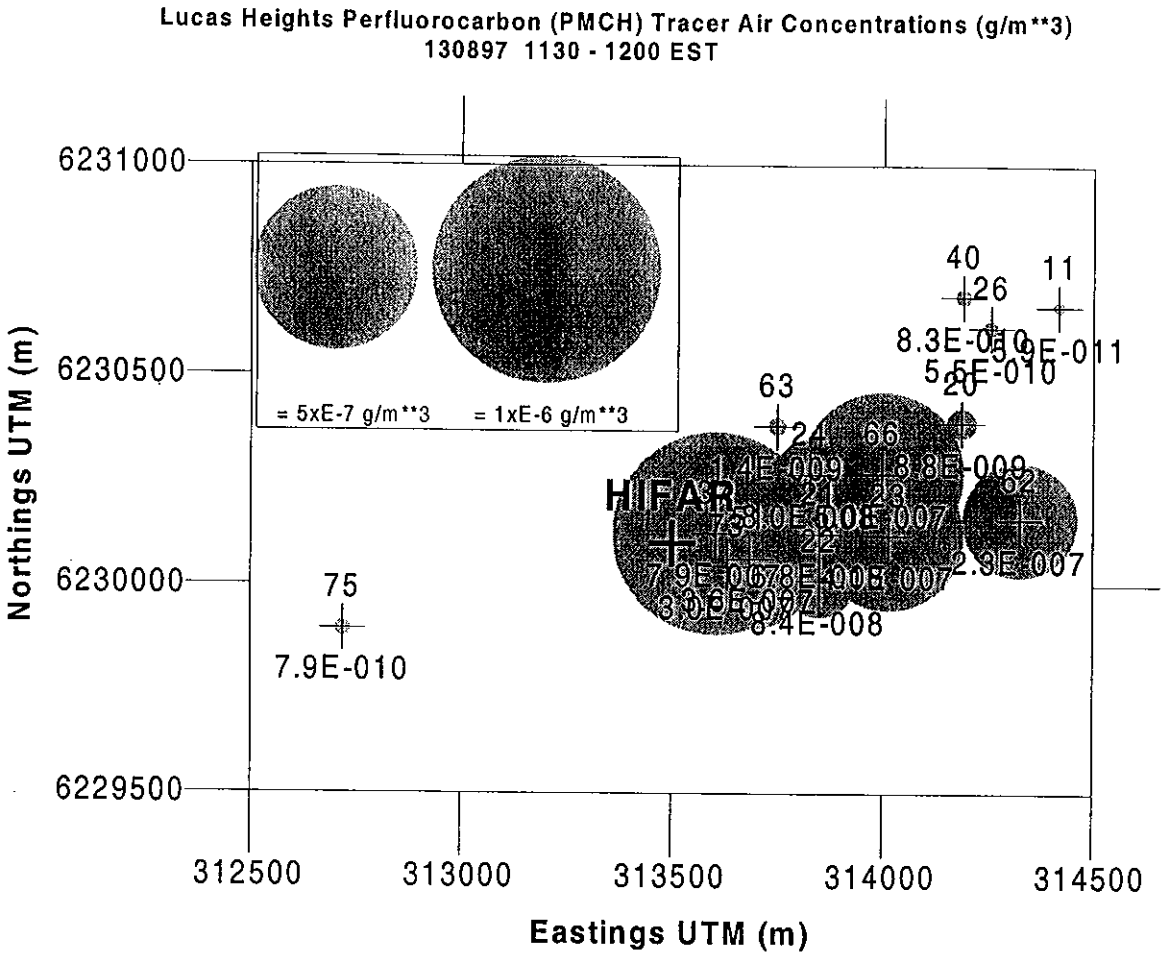

SODAR Wind Data from Lucas Heights
Y Y Y Y N Y Y Y Y N Y Y Y Y Y Y Y Y Y Y N N N Y Y Y Y Y Y N Y
800
700
600
500
400
300
200
100
0
Altitude (m)
500
0600
0900
1200
130897
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 15



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the upper section of the plot.

Figure 16

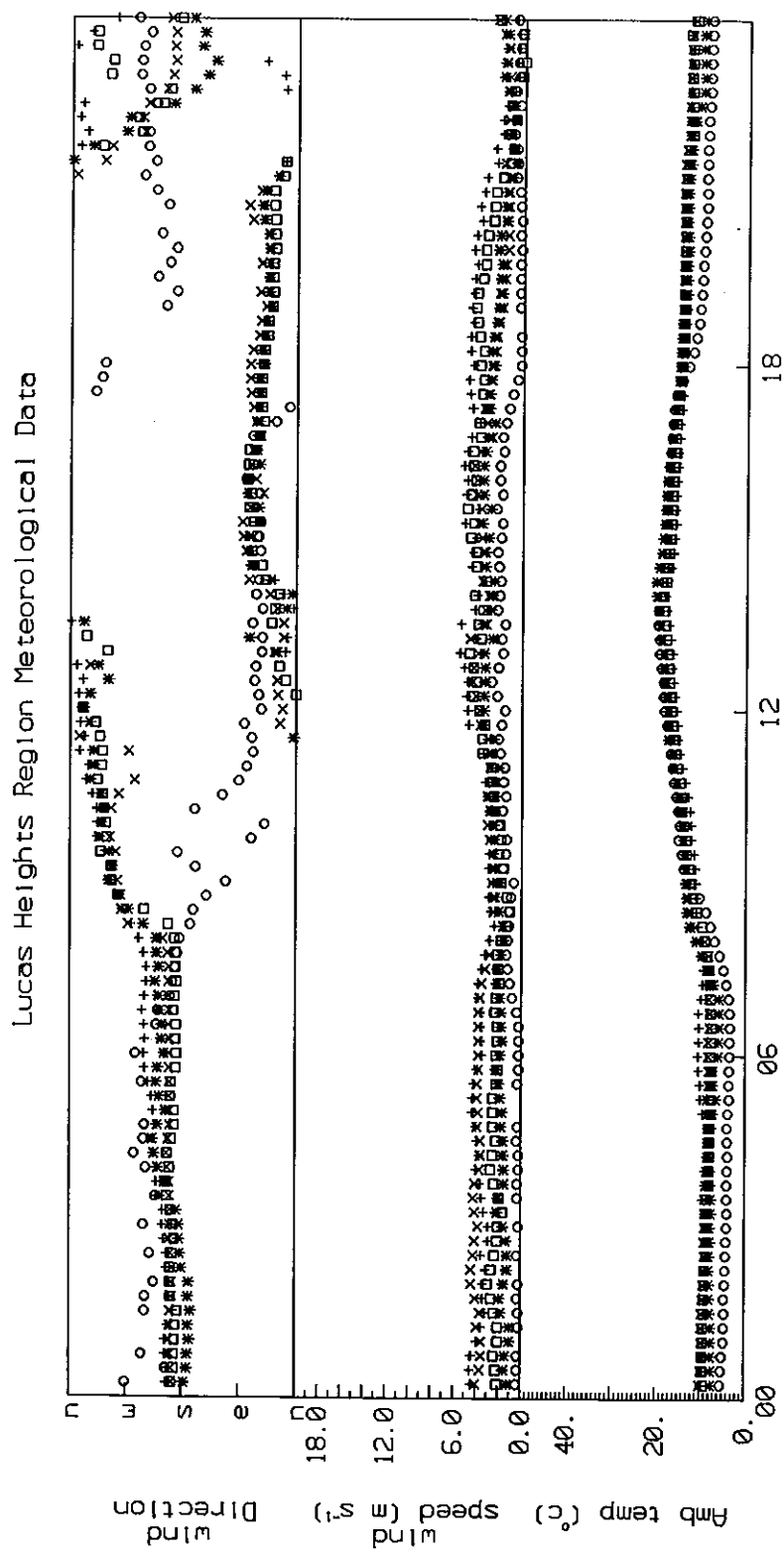

Lucas Heights Region Meteorological Data
Amb temp (°C)
Wind speed (m s⁻¹)
Wind Direction
0.00
20.
40.
0.0
6.0
12.0
18.0
N
E
S
W
N
06
12
18
280897
Times (EST)
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate

Figure 17

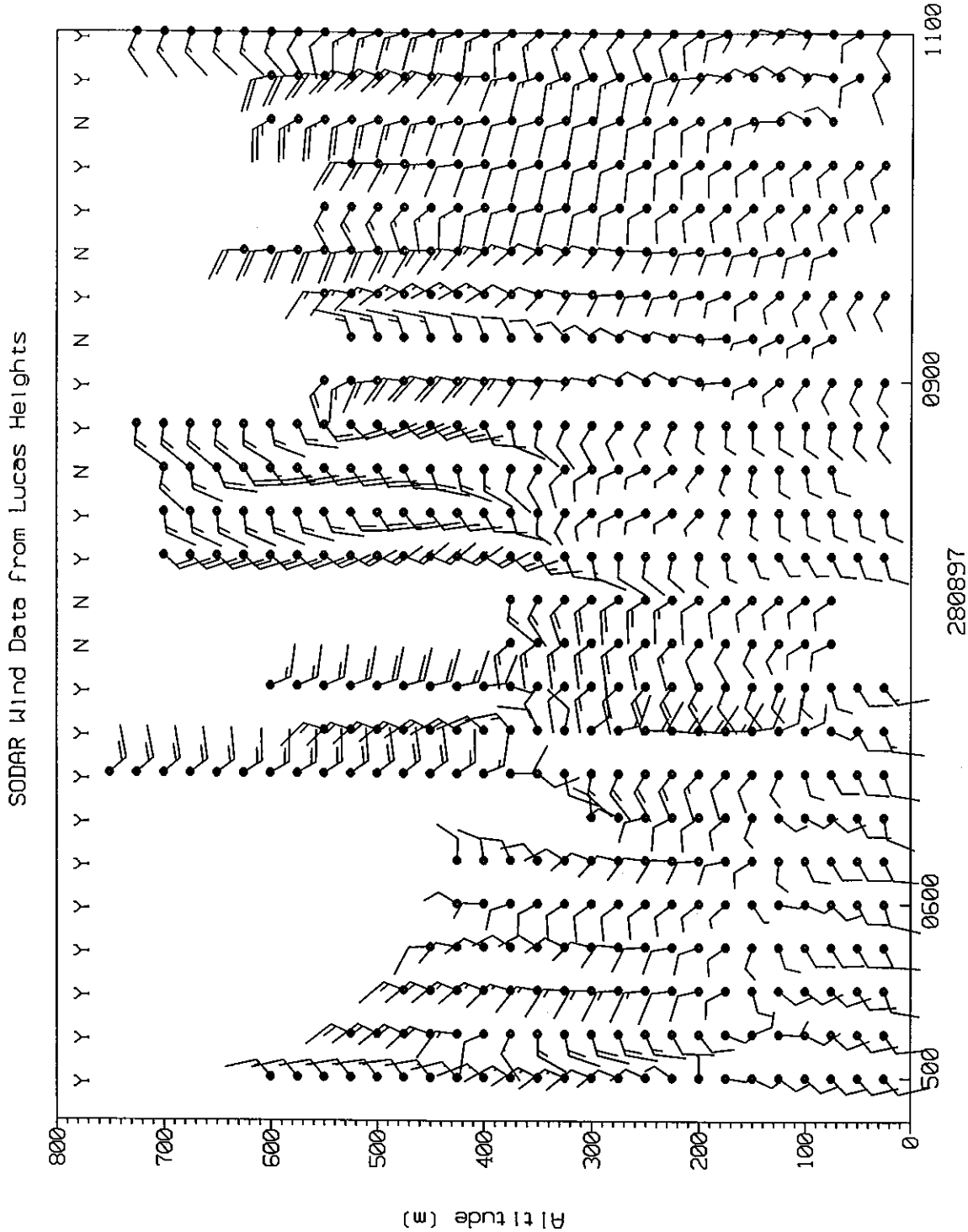
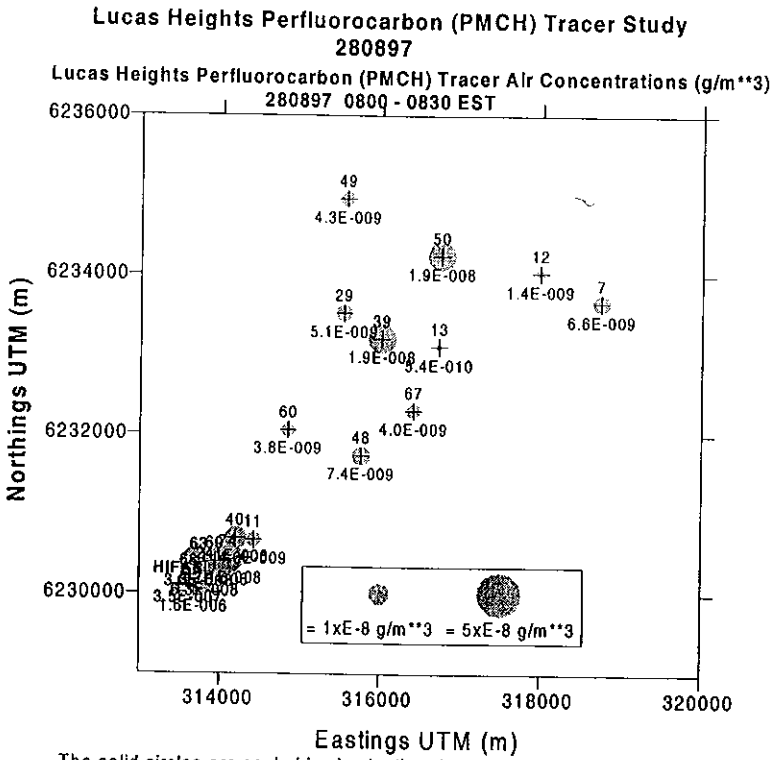
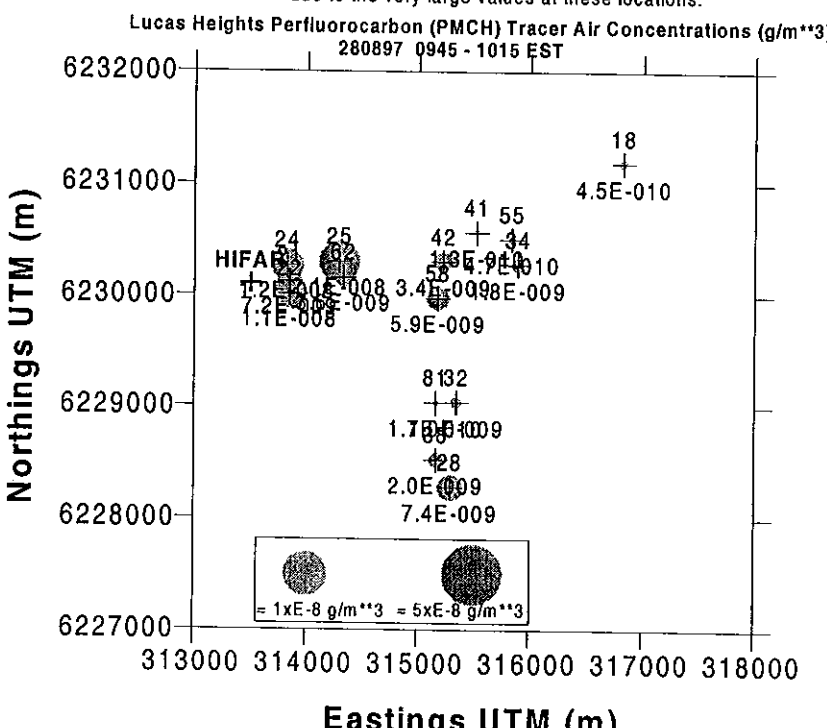

SODAR Wind Data from Lucas Heights
Y Y Y Y Y Y Y Y Y Y N N N Y Y Y N Y Y N Y Y N Y Y
800
700
600
500
400
300
200
100
0
Altitude (m)
500
0600
280897
0900
1100
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 18



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.
N.B. The air concentrations at Receptors 51 and 68 are not plotted as solid circles due to the very large values at these locations.



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.

Figure 19

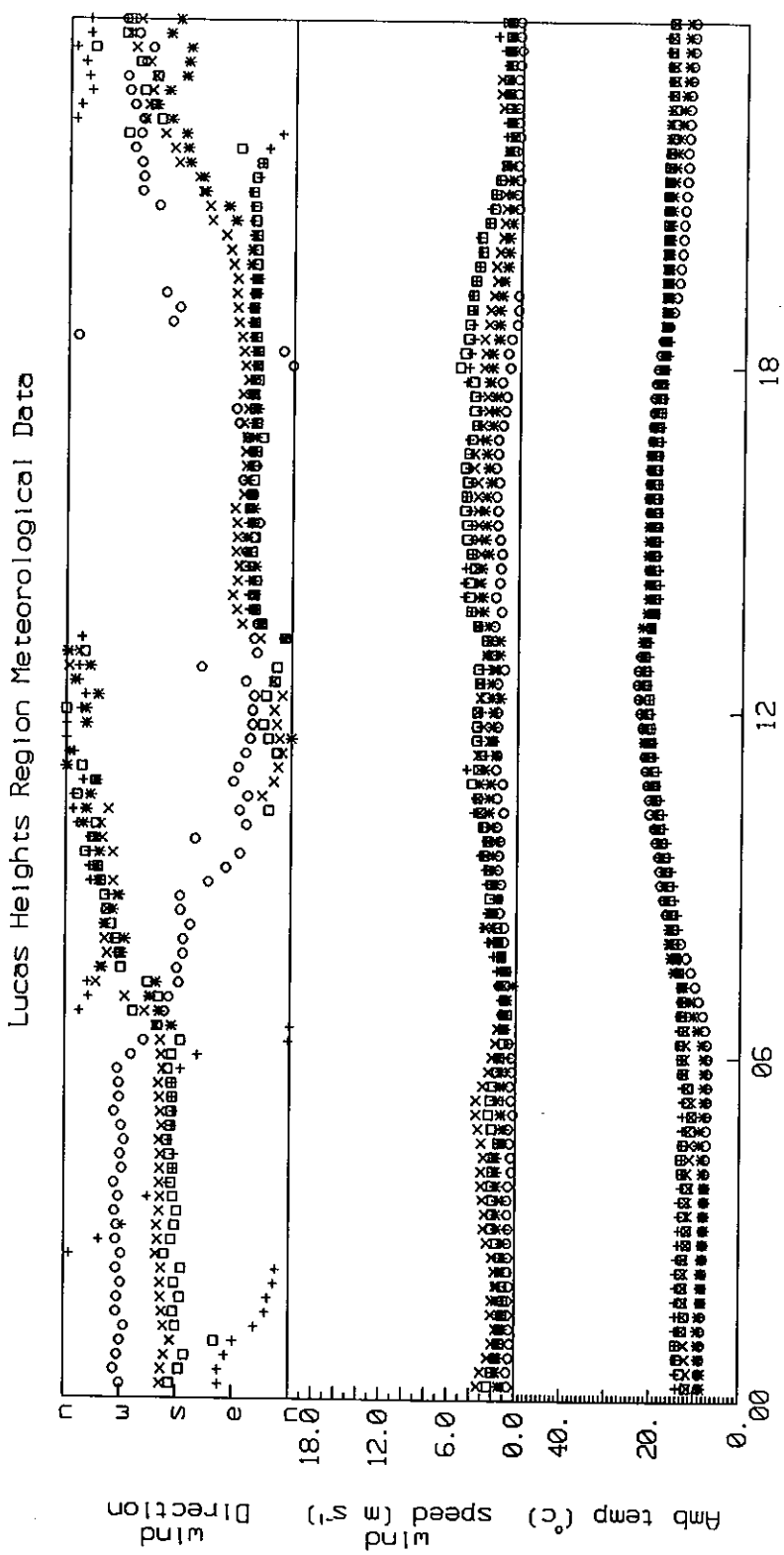

Lucas Heights Region Meteorological Data
Amb temp (°C)
wind speed (m s⁻¹)
wind Direction
18.0
12.0
6.0
0.0
40.
20.
0.00
06
12
18
11097
Times (EST)
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate
* LH Met Tower 10m
+ LH Met Tower 49m
× L.H. Comm. School
□ Boys Town School
○ Shackles Estate

Figure 20

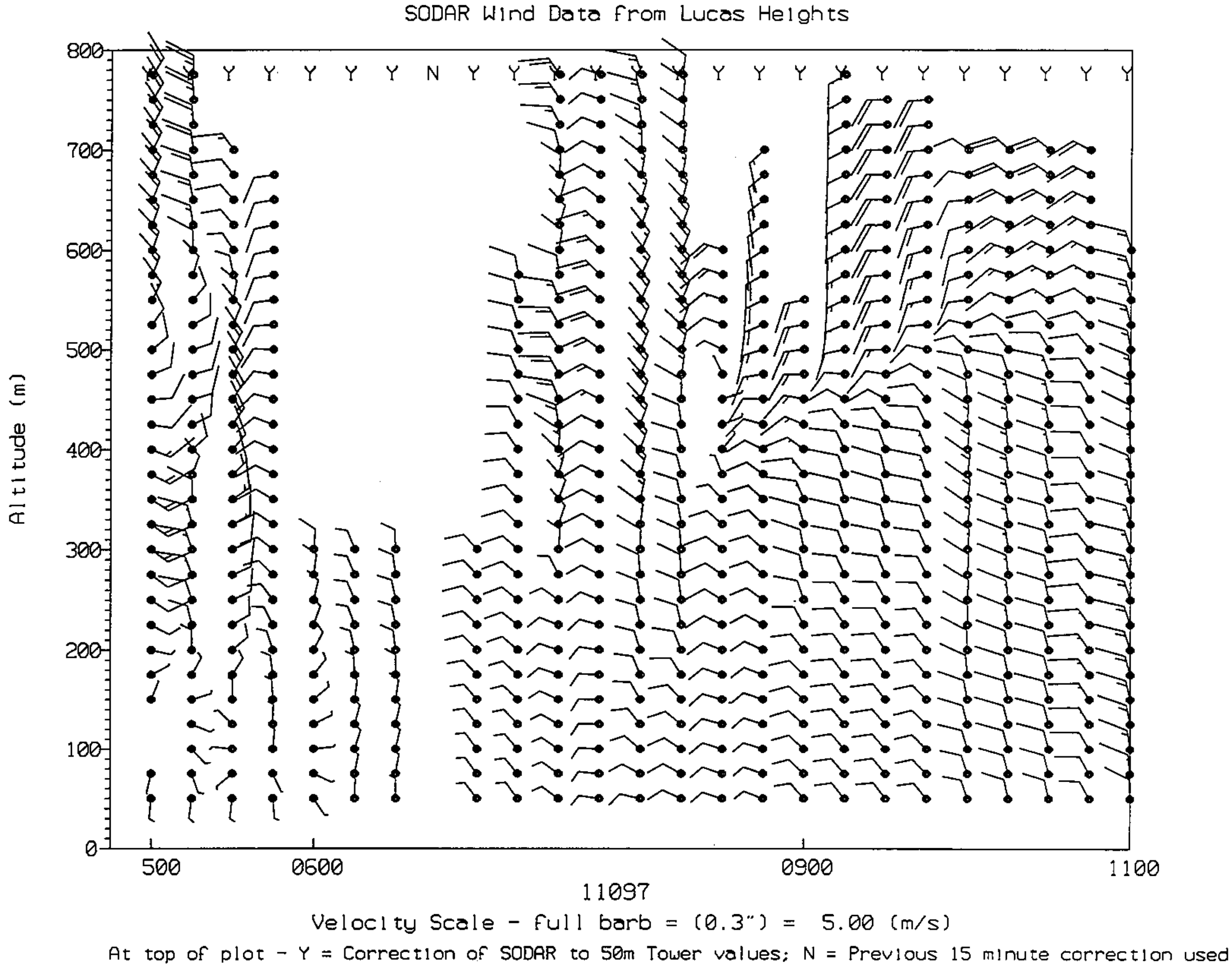
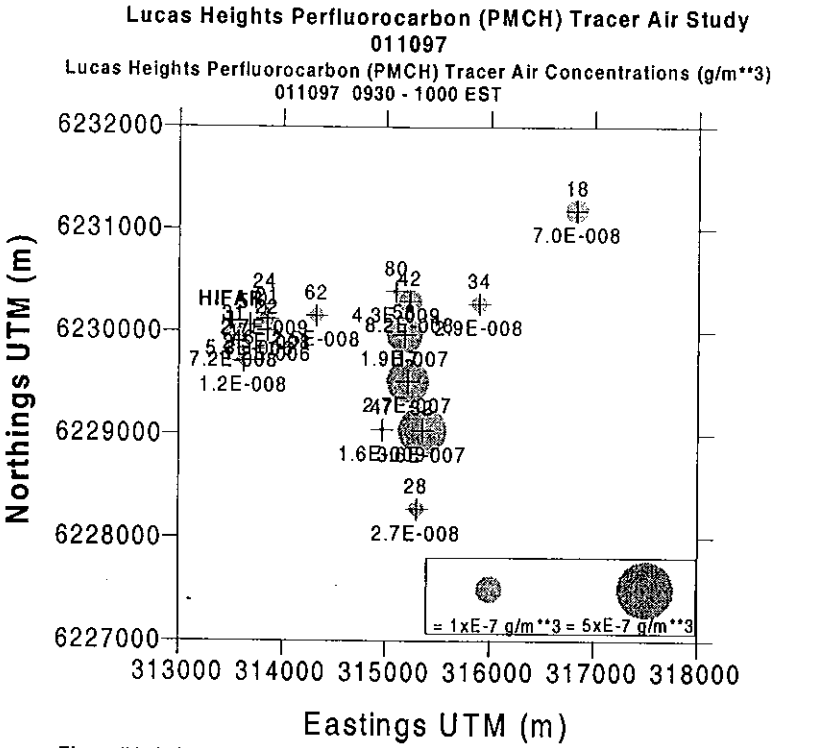
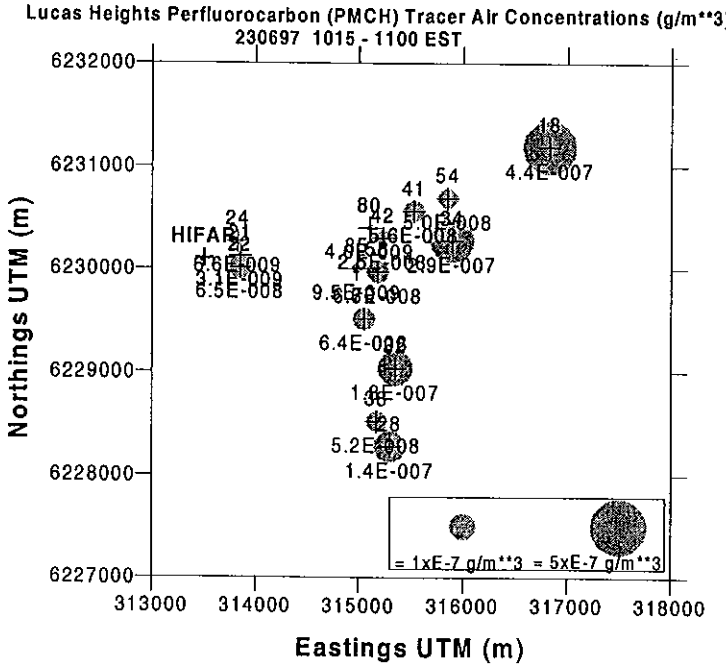

SODAR Wind Data from Lucas Heights
Altitude (m)
800
700
600
500
400
300
200
100
0
Y Y Y Y Y Y N Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y
500
0600
0900
1100
11097
Velocity Scale - full barb = (0.3") = 5.00 (m/s)
At top of plot - Y = Correction of SODAR to 50m Tower values; N = Previous 15 minute correction used

Figure 21



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.
N.B. The air concentrations at Receptors 51 and 22 are not plotted as solid circles due to the very large values at these locations.



The solid circles are scaled in size by the air concentrations at each sampler location.
The scales are shown in the box in the lower section of the plot.

Figure 22