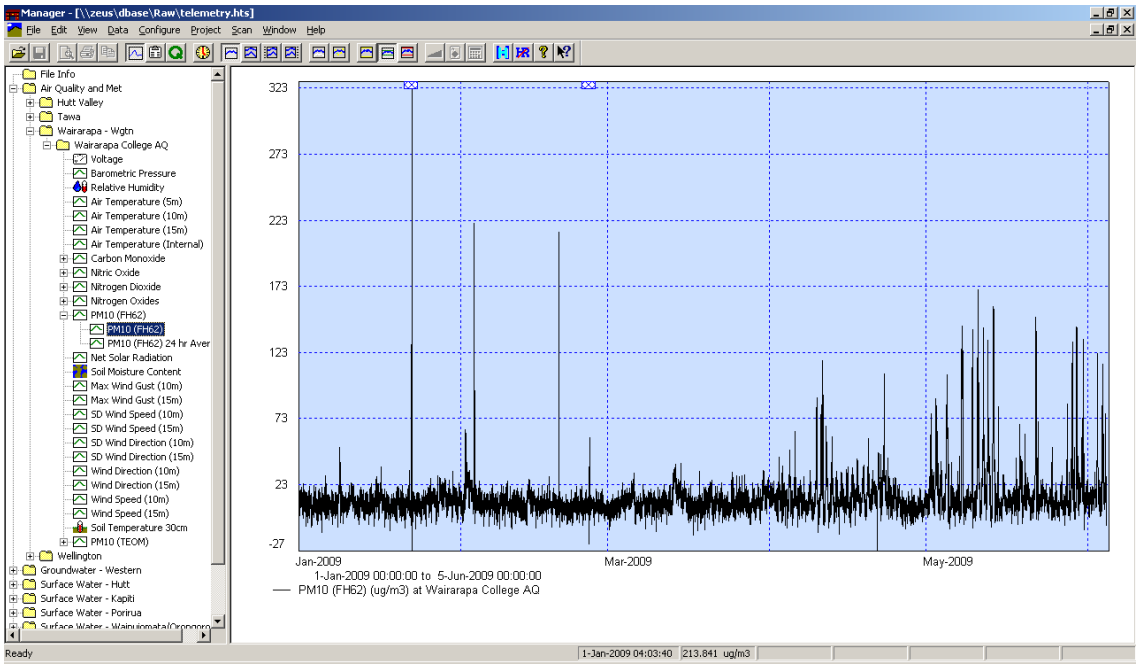
Air quality data processing and archiving



Contents

1. Purpose and scope

The purpose of this procedure is to ensure that air quality data obtained from the GW monitoring network represents, as far as possible, actual ambient contaminant concentrations at the monitoring site. This procedure supports the air quality monitoring objective to ensure that air quality data used for state of the environment and NES-AQ reporting are robust and scientifically defensible.

This procedure documents the data handling, validation and ratification processes necessary to produce a 'quality-assured' dataset that is ready for further analysis and reporting.

This procedure describes:

- Data storage procedures, including archiving
- Data adjustment and editing procedures, including corrections for calibrations
- Documentation of data adjustments and excluded or missing record
- Data quality acceptance criteria

2. Responsibilities

The Environmental Monitoring Officers - air quality (EMOs) and Environmental Scientist - air quality (AQ scientist) are responsible for data processing and validation. The AQ scientist is responsible for data ratification and the Senior Analyst, Science, Strategy and Information is responsible for data archiving.

3. Frequency

Air quality data are validated or processed within three weeks of a final calibration. Processed data are ratified annually with data for the previous calendar year being ratified by 30 June.

4. References

Good practice guide for air quality monitoring and data management. Ministry for the Environment, 2009. [http://www.mfe.govt.nz/publications/air/good-practice-guide-air-quality-2009/index.html]

5. Resources and definitions

5.1 Equipment required

- A computer connected to Hilltop database
- Site logs containing written records of all station visits and actions taken
- Record of daily data site checks
- E-logs (excel spreadsheets) containing the results of audit and final calibrations and a record of instrument maintenance carried out

5.2 Definitions and work flow

5.2.1 Definitions

Data processing is the series of steps and accompanying documentation necessary to convert raw data to the final data set.

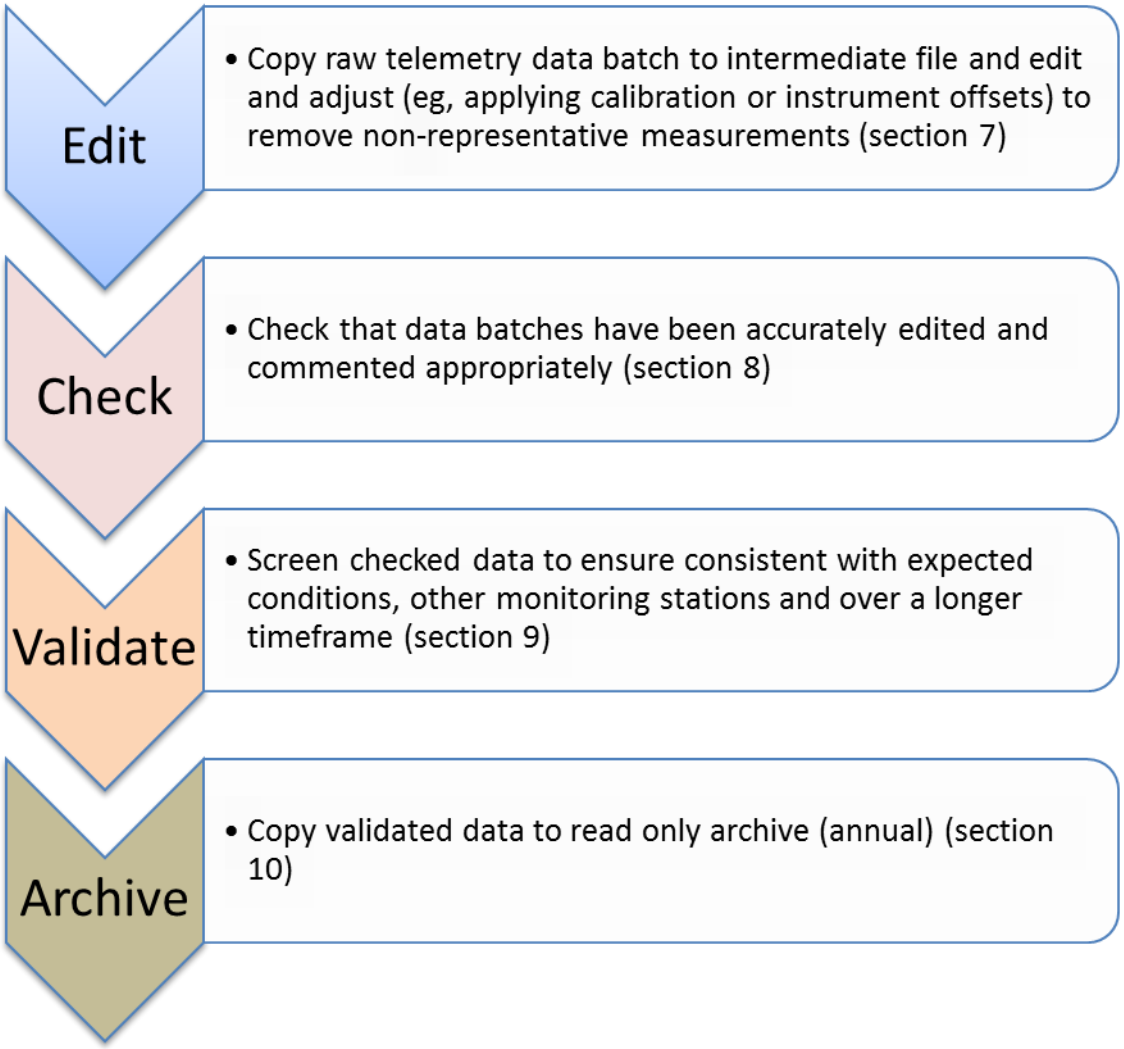
Data editing is the process of examining data for spurious measurements that do not represent actual ambient concentrations and applying calibration curves to adjust the data to compensate for instrument drift over time.

Data checking involves QA of edited data and is carried out by someone other than the data editor

Data validation is the process of screening checked data to ensure that it is consistent over the monitoring network and over a longer time frame.

Data archiving is the process of uploading validated data to permanent read-only electronic storage.

5.2.2 Work flow:



6. Data transfer, storage, handling and archiving

6.1 Data transfer

Station air quality analysers are connected by digital interface via multiplexors to dataloggers (IQuest DS-4483) that store air quality data collected at 10 second intervals as 10 minute or 5 minute averages at NZST. Information from the datalogger is called in by the HydroTel application every hour between 6 am and 6 pm by GPRS (General Packet Radio Service) using the Vodafone mobile network.

The service HydroHill runs on two GW telemetry servers 'Zeus' (Wellington) and 'Thor' (Wairarapa). Every five minutes HydroHill interrogates the HydroTel SQL database and checks for new data which is then copied into the relevant telemetry.hts file on the GW servers.

6.2 Data storage and archiving

The two GW telemetry servers are each divided into three data storage areas:

- 'raw' area is the repository for permanent storage of raw data. Data from the western area of the region is stored on H:\Raw\telemetry.hts.
- 'check' area is the shared area for data that has been edited and is ready for ratification. The common file used is H:\Check\AQ Update.
- 'archive' area contains the final permanent dataset which has read only access. H:\archive\telemetry.hts

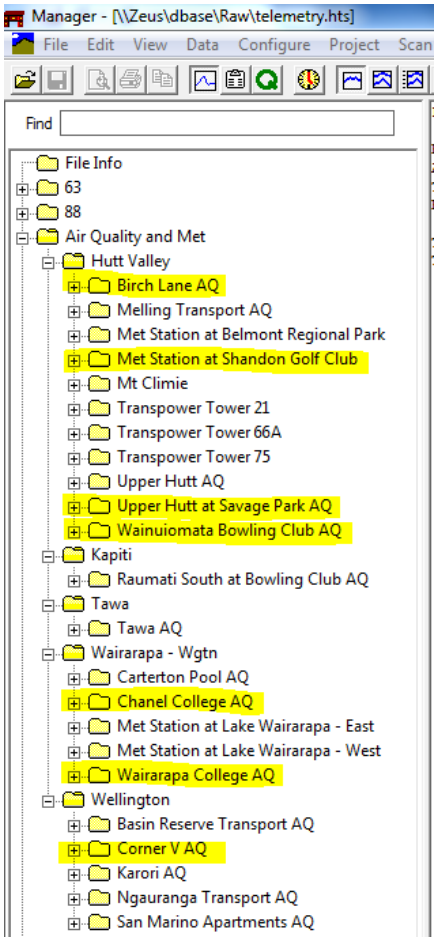


Figure 6.1: Example of site tree showing current air quality stations in yellow

Daily backups of all files are made by ITSS, which in turn are backed up every seven days

The 'data source' refers to the actual measurements recorded by the instrument's datalogger for a particular contaminant, eg Carbon Monoxide. Calibrated data refers to a data source that has been transformed using calibration ratings entered into Hilltop Ratings programme, eg, Calibrated Carbon Monoxide. Data sources are converted into different units (eg, ppm to ug/m^3) or averaging periods (eg, 10 minute averages to 24-hour averages) and the resulting outputs are stored as a 'virtual measurement', eg, CO 8 Hr Moving Mean (ppm). Calibrated data and virtual measurements are not a time series as such and are calculated on the fly every time the user wishes to view at the data. Data comments are only associated with the data source, and will not appear alongside the calibrated data or any virtual measurements.

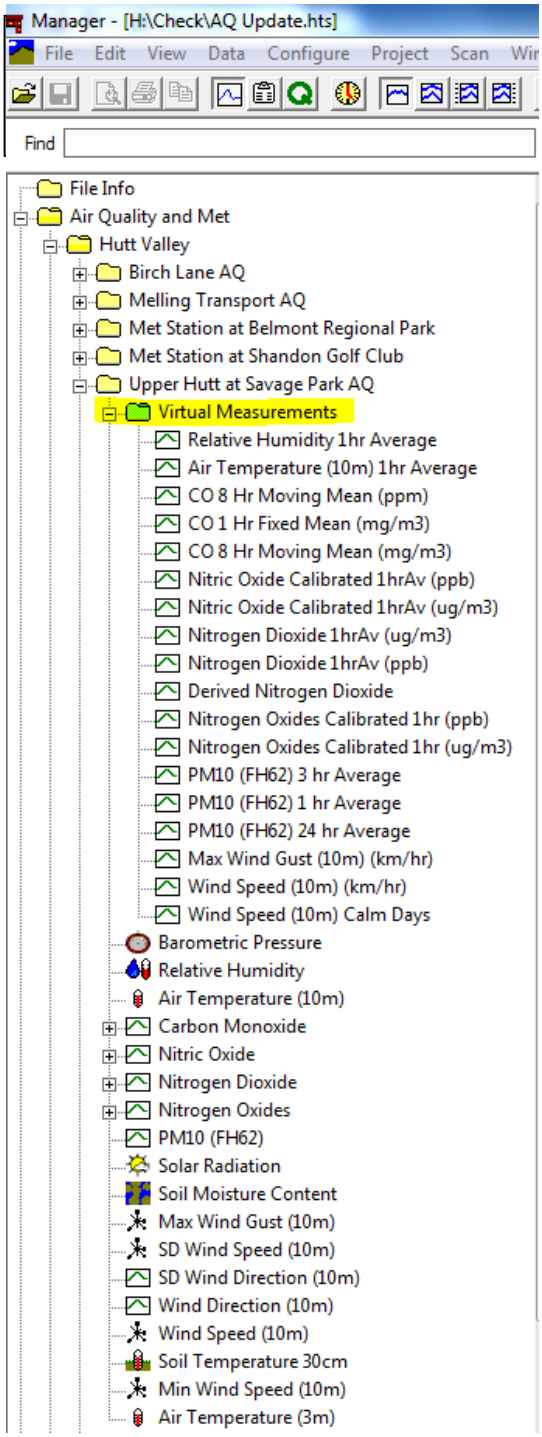


Figure 6.2: Example of site tree showing data source and virtual measurements

When the sites were first set up, the data loggers could only log a maximum number of 32767, 3276.7, 327.67, 32.767 or 3.2767 depending on the maximum value expected and the resolution required. Carbon monoxide is logged to 2 decimal places as the maximum sample is not expected to exceed 327.67. NOx is logged to 1 decimal place as the as the maximum sample is not expected to exceed 3276.7 but will exceed 327.67. At most sites the data logger programme has now been updated to allow a 'floating, decimal point.

6.3 Data handling

Raw data may be examined and manipulated using specific Hilltop software applications. Hilltop Manager is used to view, edit and copy data to other areas. Hilltop Hydro provides specialised tables and graphing facilities needed to analyse air quality data.

6.4 Site metadata

Site metadata are stored on the processing database and in an excel spreadsheet WGN_DOCS-#1294147-GWRC AQ Site Metadata

7. Procedures – data editing

7.1 Select a period of data to edit

Air quality and meteorological data are processed or validated in batches. For carbon monoxide and nitrogen oxides a batch is the period starting and ending with a final calibration. This period may range from weeks to months, depending on an instrument's performance. PM_{10} data is processed between monthly maintenance or for the same time period as the data from a co-located gas analyser. Meteorological data is processed for the period between annual instrument replacements or services at any other time.

Details of who processed the data, checked it, the date the data were processed or checked, whether the data were processed within target time frames and the archive date are recorded in Data Processing Database (a SQL application).

To select a batch of data to process - open the Processing Database and use the drop down menu to select the site and parameter and click Data Processing to open the batch records for that site and data source as shown in Figure 7.1.

DATE ON and DATE OFF are the start and end dates for the period of data being processed.

Figure 7.1: First screen of the data processing register

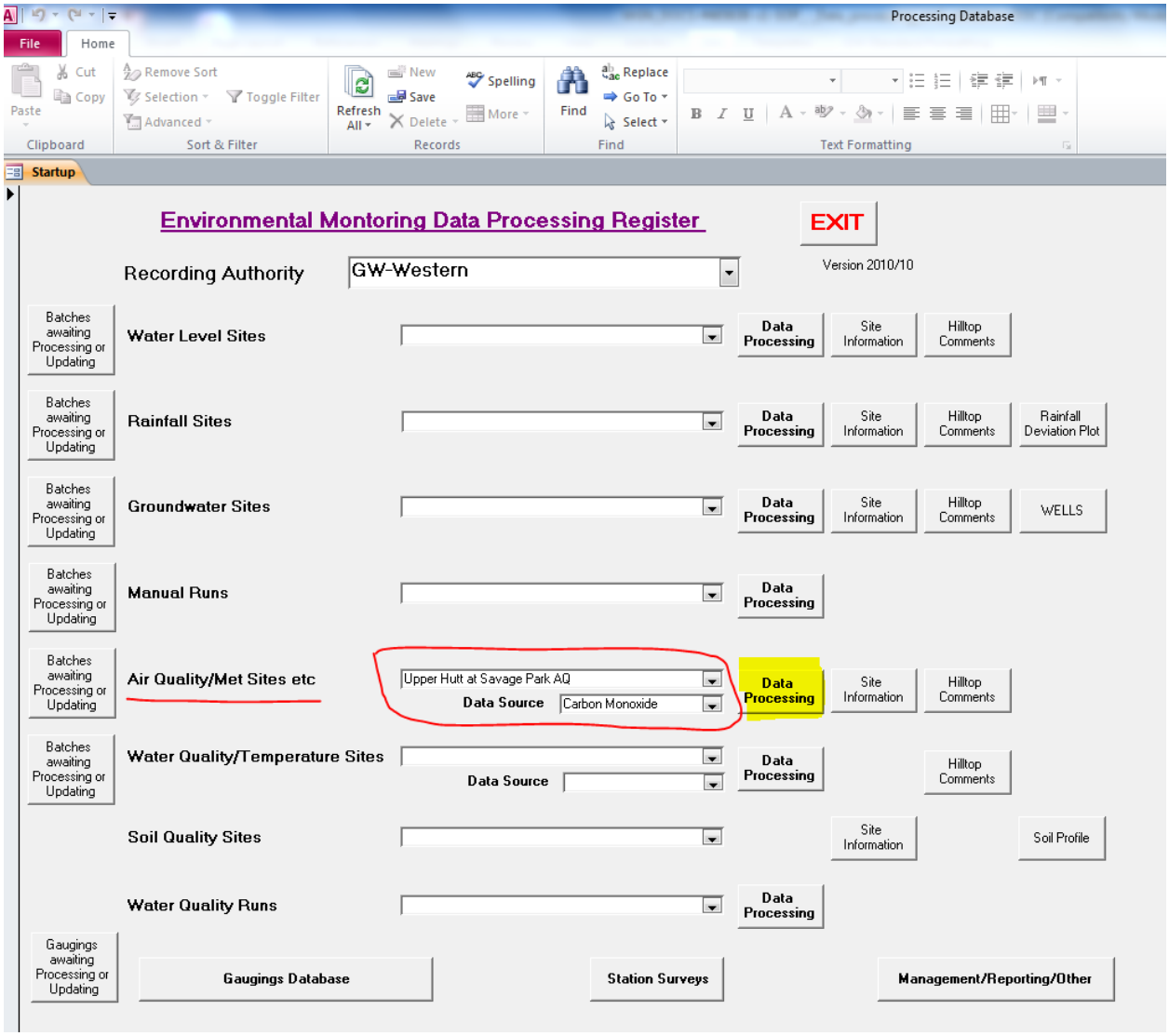
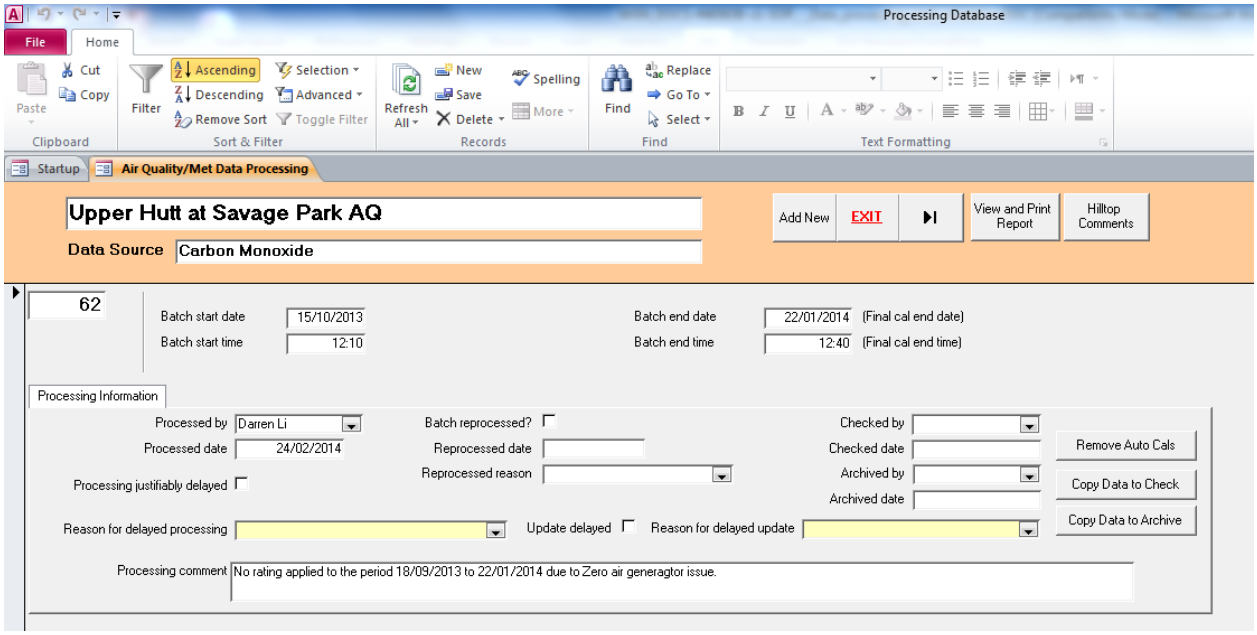


Figure 7.2: Example of the batch processing record accessed by clicking the Data Processing tab highlighted in yellow in Figure 7.1



7.2 Copy raw data to editing file

Data in the raw telemetry file remains un-calibrated and unedited and is retained as a permanent record. Data must be copied from the raw telemetry file (source) to a data editing file (destination) before editing and in order for calibration ratings to be applied to gas data. To copy data, right click on the data source and enter the destination file name in the Copy Data Source dialogue box.

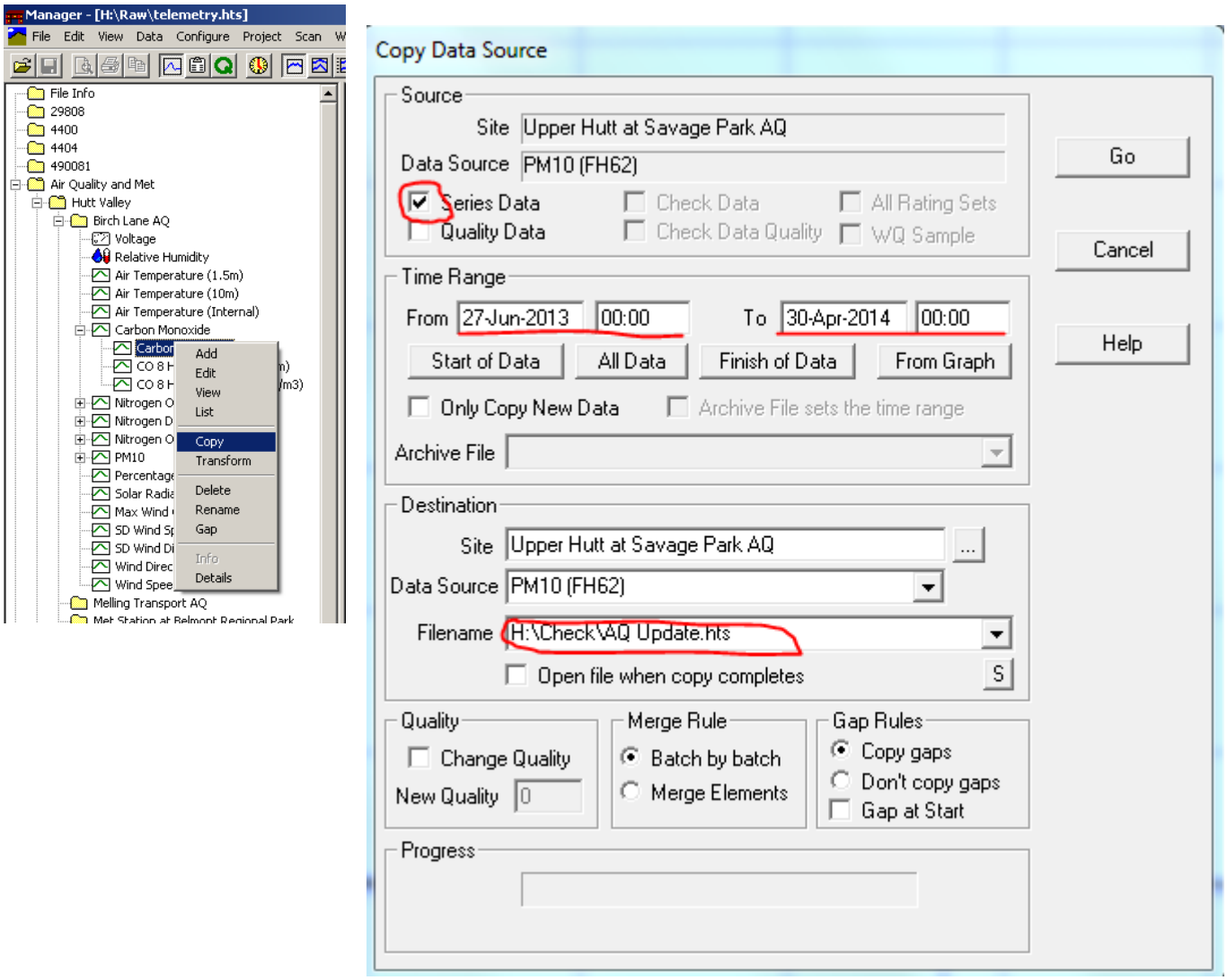


Figure 7.3: Copy data dialogue box

After copying you may need to refresh by clicking on F5.

7.3 Identifying invalid data

Spurious or invalid data is data that does not reflect actual ambient concentrations. Invalid data can result from instrument malfunction, maintenance, calibrations, power outages etc. Invalid data is best identified by viewing the graphed data and looking for anomalies, such as positive or negative spikes, periods of flatline data or baseline drift and so on. All such periods should be cross-checked against the site log and instrument maintenance records to ascertain if there is a probable cause for the unusual data. Keep in mind that unusual data can also be 'real' due to the presence of a local emissions source, eg a vehicle idling outside the monitoring station or nearby construction works – painting etc.

Check for the following periods of invalid data:

Carbon monoxide and nitrogen oxides

- Spikes during audit and final calibrations
- Six daily automatic zero checks between midnight and 1 am (NOx)
- Daily zero checks/adjustments between midnight and 1 am (CO)
- Periods during maintenance
- Periods where logger has been reprogrammed or replaced
- Periods of power failure
- Data points where NO is greater than NOx (overplot NO and NOx). Bear in mind that when background levels are low the measurement errors associated with NO and NOx values may overlap resulting in negative values or NO being higher than NOx.

PM_{10}

- Periods during maintenance (annual calibration, PM_{10} head cleaning)
- Periods where logger has been reprogrammed or replaced
- Periods of power failure
- Following automatic filter change at midnight
- Extreme or unusual negative or positive spikes

Meteorological data

- Periods during maintenance or instrument replacement
- Periods where logger has been reprogrammed or replaced
- Periods of power failure
- Extended periods of high wind speed or unchanging wind direction

7.4 Data editing

Data editing involves deleting invalid data and inserting or removing gaps in the data.

7.4.1 Deleting and inserting or closing gaps using Hilltop Manager

To delete data in Hilltop Manager, select a period of data and use the data/edit command to bring up the editing screen as shown in Figure 7.5.

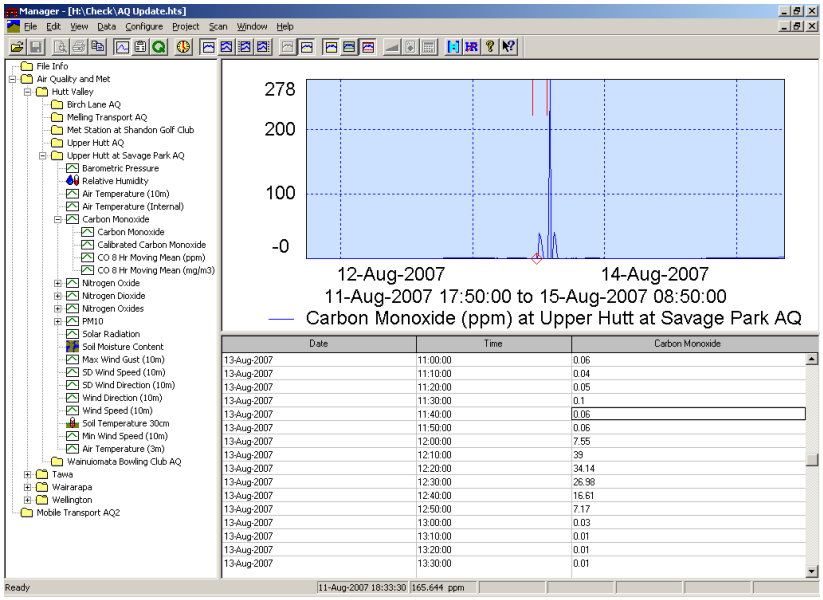


Figure 7.5: Data edit screen in Hilltop Manager

To delete a data point (eg, a 10 minute average as shown above) hold down the Ctrl and Delete keys together.

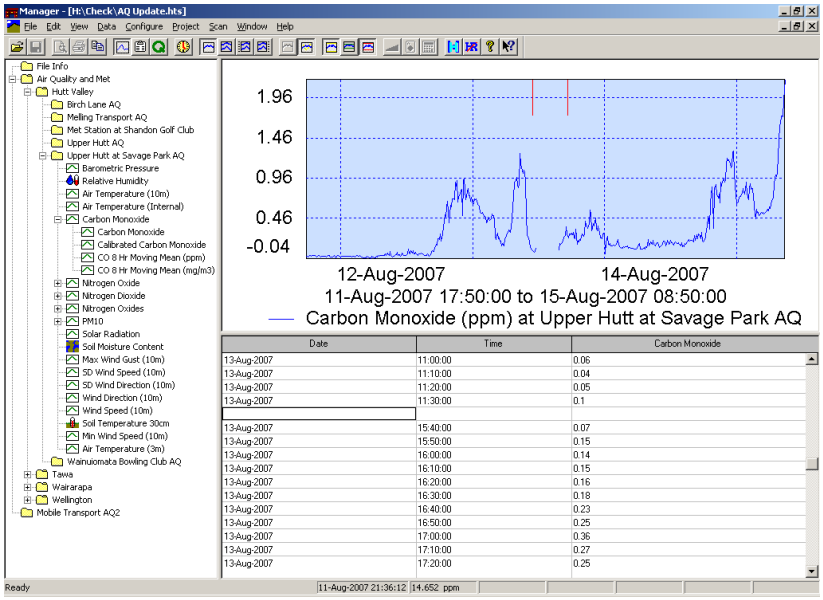


Figure 7.6: Deleting a data point in Hilltop Manager edit mode

Once the required period of data is deleted, insert a gap by holding down the Ctrl and Insert keys at the same time. As a general rule a gap must be inserted when more than 15 minutes worth of data is removed and a comment inserted. This is to ensure that when the data is averaged we know where there are periods of less than 75% hourly data capture. However, the gaps are closed for the daily carbon monoxide zero checks.

7.4.2 Automatic Excel scripts to remove data from Hilltop

An Excel macro is available for deleting regularly occurring events, such as the six daily NOx auto calibrations and the daily CO audit calibrations. Such operations should

be carried out in the personal edit areas first – as this command cannot be undone. The Excel macros are contained in the following spreadsheets:

J:\AIR QUALITY\AQ Calibration Templates\Data Deletion Script for NOx.xls

J:\AIR QUALITY\AQ Calibration Templates\Data Deletion Script for CO (New).xls

Check these with Darren

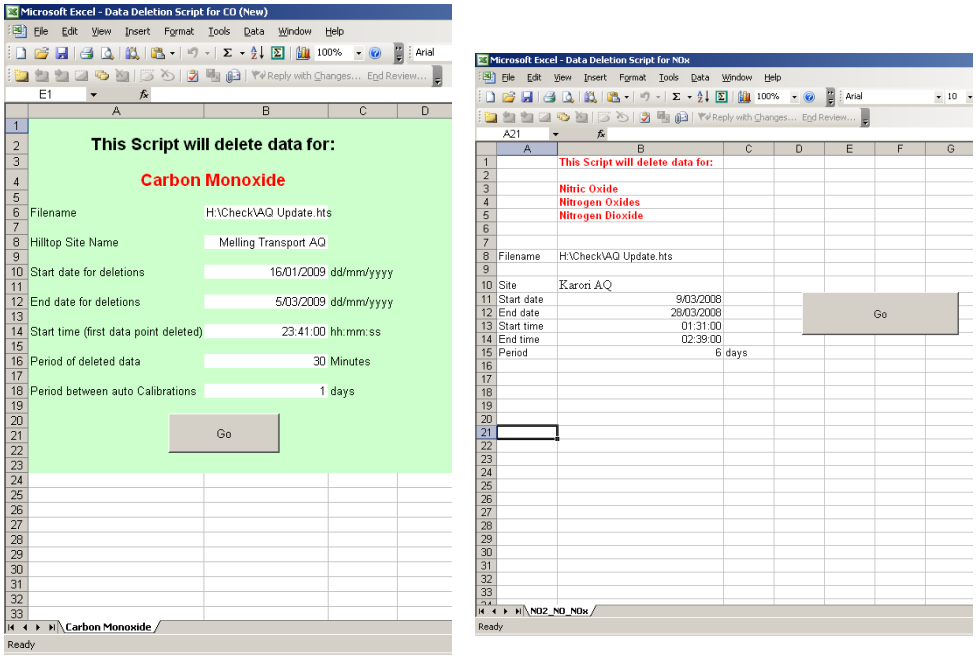


Figure 7.7: Excel spreadsheets used to delete recurring specified data points from Hilltop

7.4.3 Removing spikes using Hilltop Manager

Spikes can be removed using the Transform command in Hilltop. Ticking the 'Remove Spikes' feature removes all values outside a lower and upper limit (or keeps all the values between the lower and upper limit). For example, a lower limit of -70 and an upper limit of 100 means all values below -70 and above 100 are deleted. A gap will be inserted if the 'Gap at Spike' check box is ticked. See Figure 7.8.

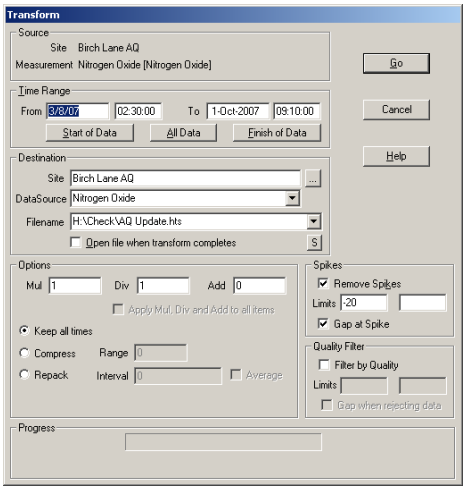


Figure 7.8: Data transform to remove spikes using Hilltop Manager

7.4.4 Closing gaps using Hilltop Manager

If you wish to remove all gaps of a specified duration between two dates, this can be achieved using the 'Gap' function in Hilltop Manager as shown in Figure 7.9. Type the gap length (eg 10 minutes) in the 'Select gaps less than or equal to' box. This will then check all the gaps of this length. Scroll through the list to check and if OK click the 'Remove gaps' tab to close or remove these gaps.

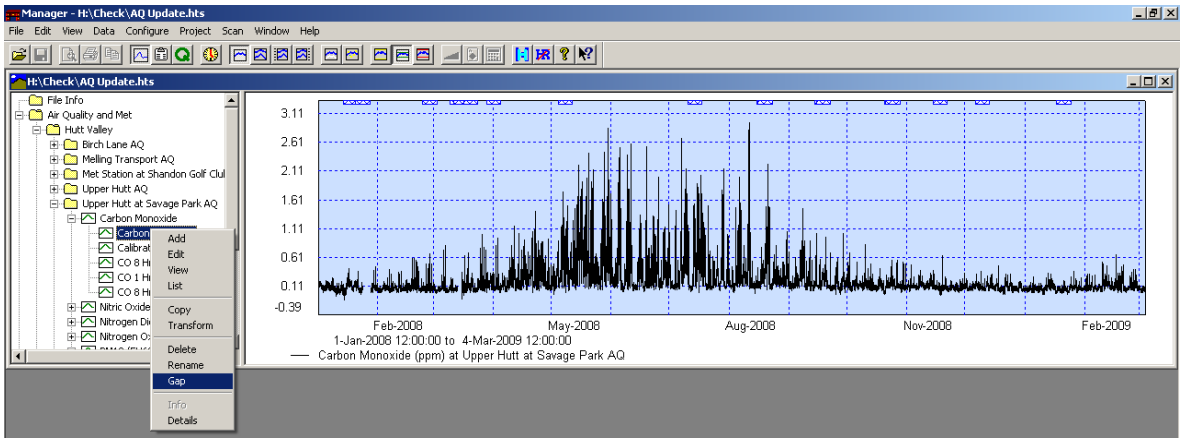


Figure 7.9: Gap function that can be used for a data source using Hilltop Manager

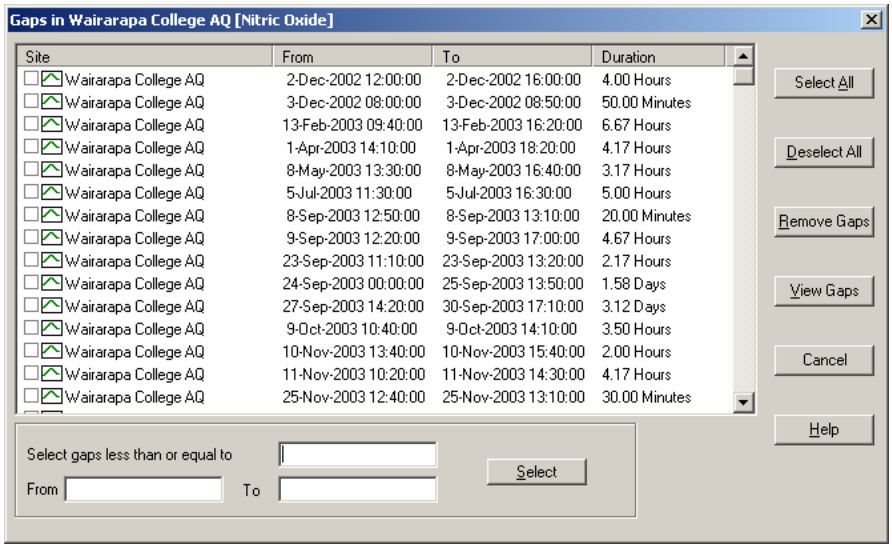


Figure 7.10: Gap dialogue box in Hilltop Manager

To select a particular gap to be closed, place cursor on icon to the right of check box and left click with mouse.

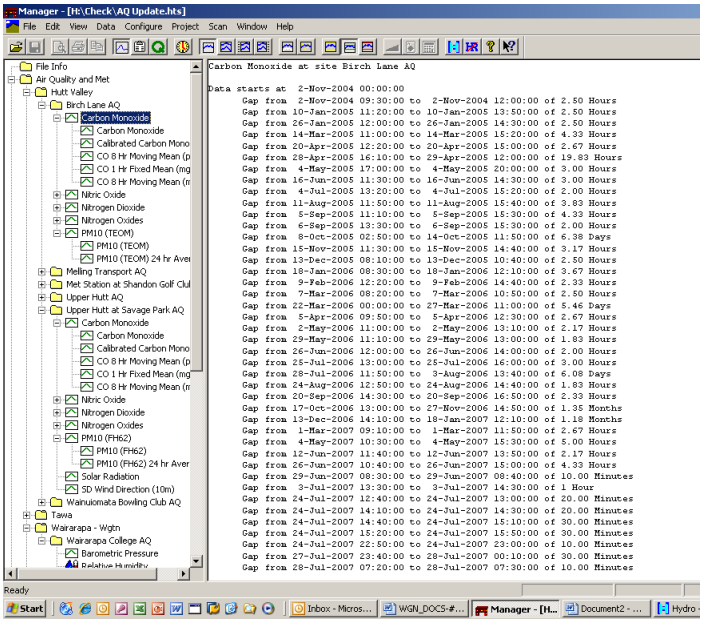


Figure 7.13: List of gaps for the data source displayed by Hilltop Manager

7.5 Data annotation (comments)

All periods of missing record or deleted data must be accompanied by a data comment specifying the date/time of the missing record and the reason, if known. Data should also be commented to reflect any factors which may influence the data, for instance the switch to a new instrument or a change in instrument setting, such as sample inlet temperature for the PM_{10} analysers.

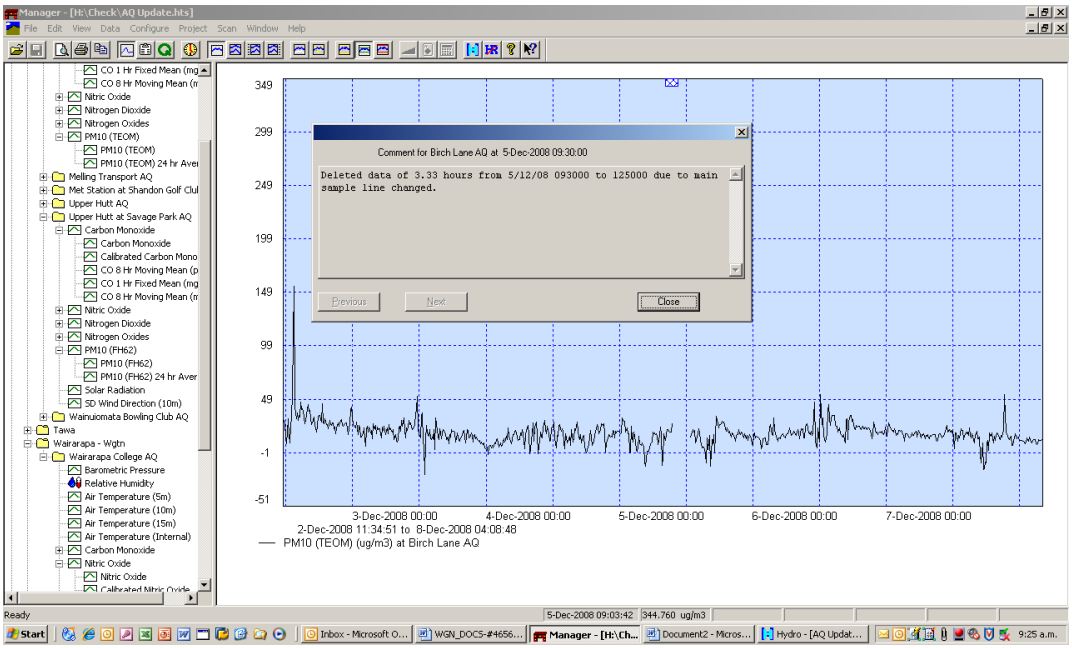
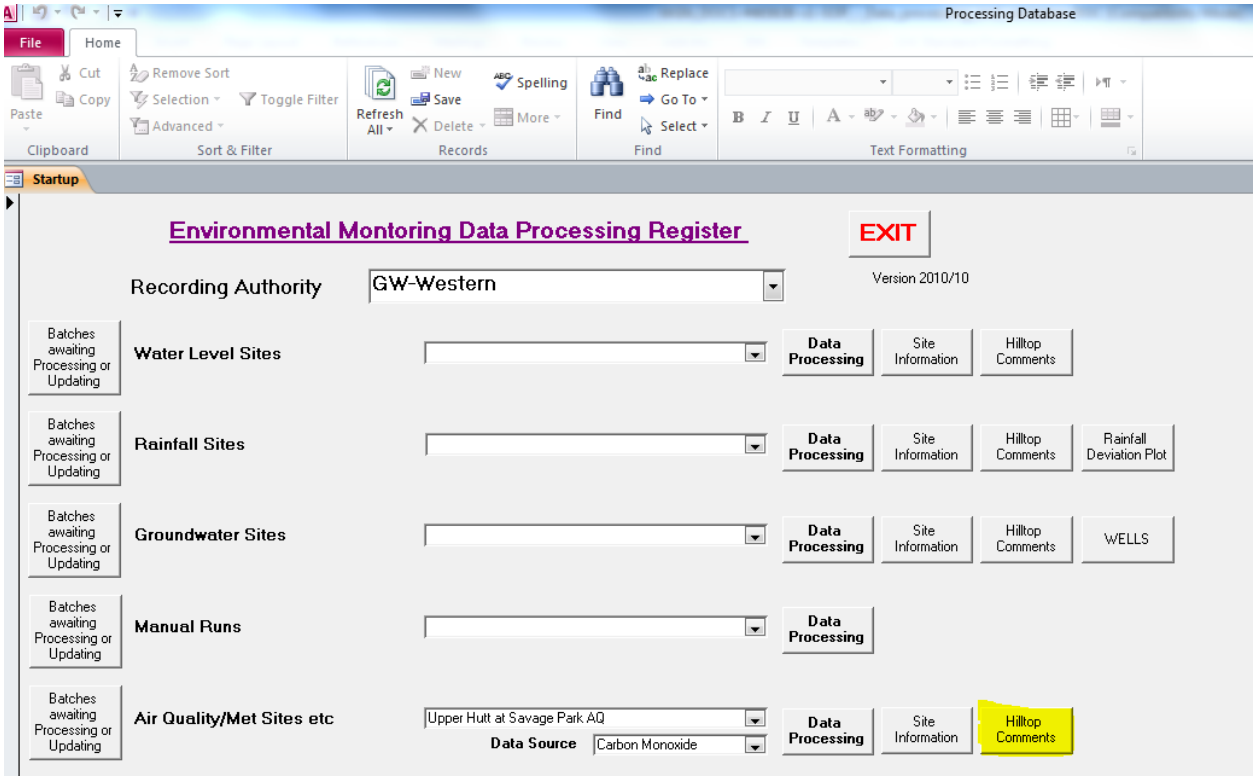
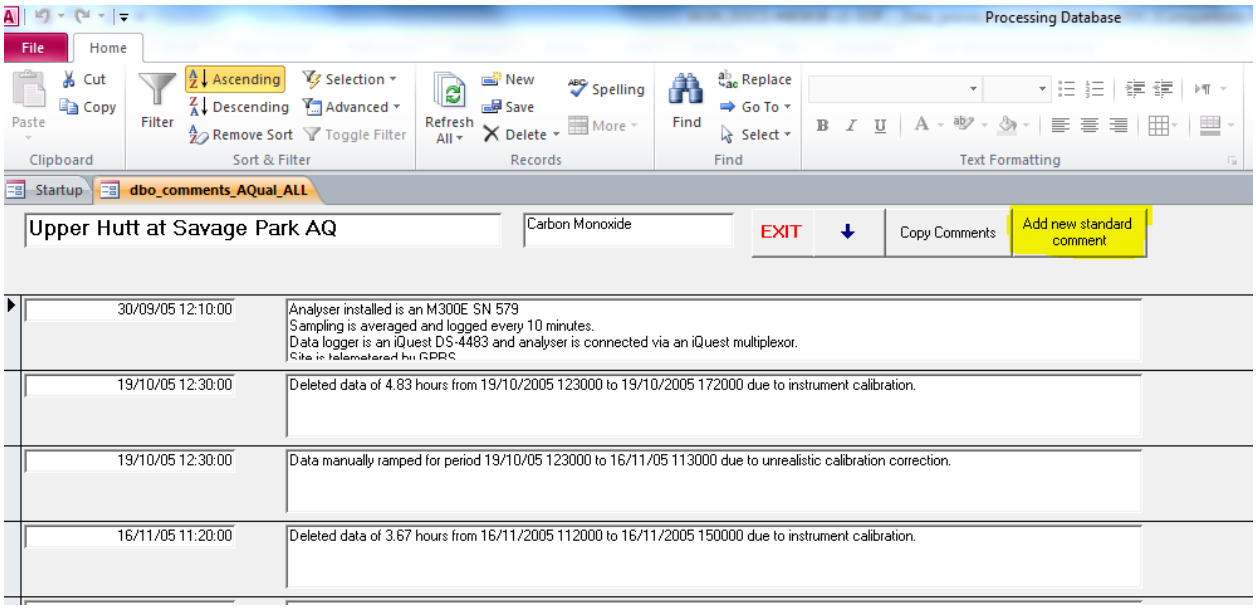


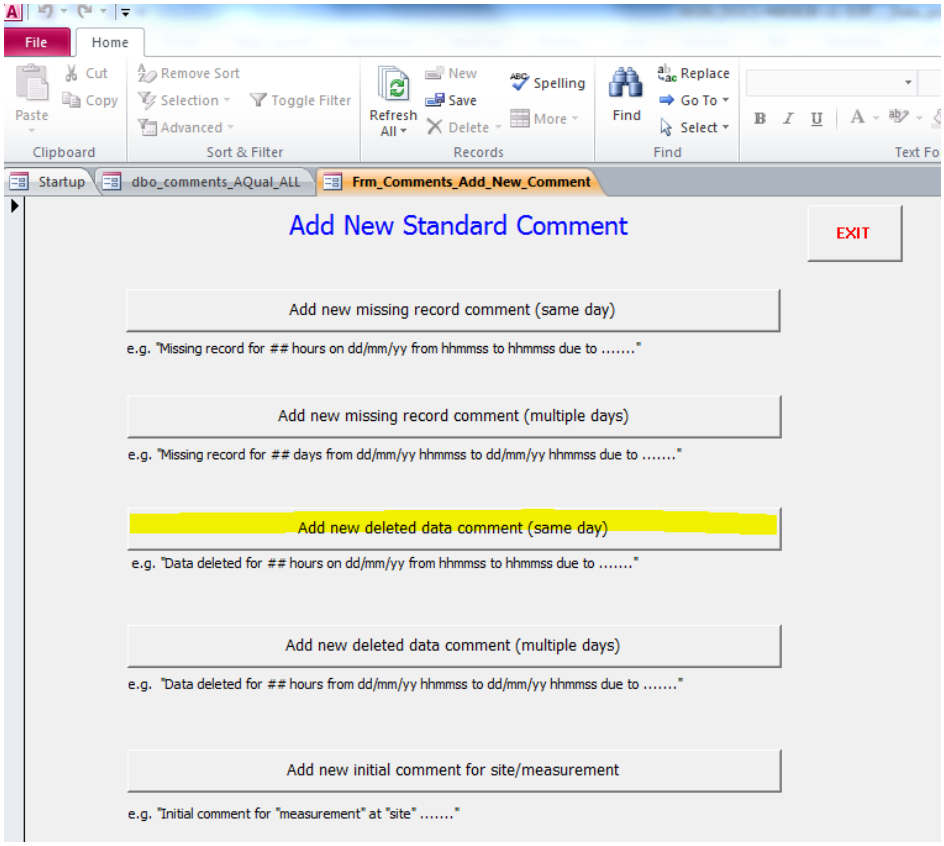
Figure 7.11 Read-only data comments associated with the data source can be viewed directly from Hilltop

Data comments are stored in a SQL database that can be viewed/edited and entered using the Data Processing Database. Open the database and use the drop down menu to select the desired site and parameter and click Hilltop Comments.

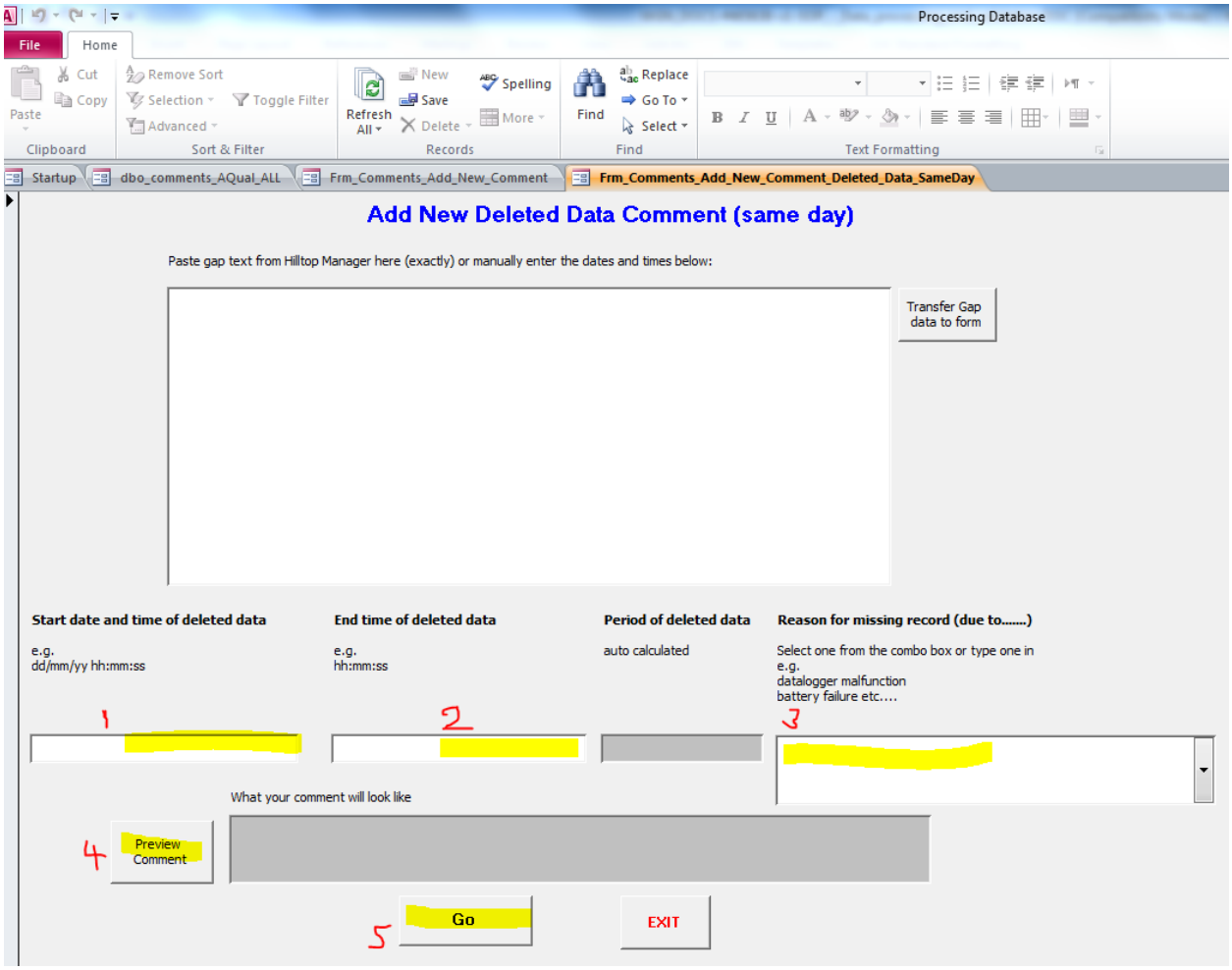




To add a comment select from the following menu, depending on whether the missing or deleted data are restricted to the same day or multiple days.

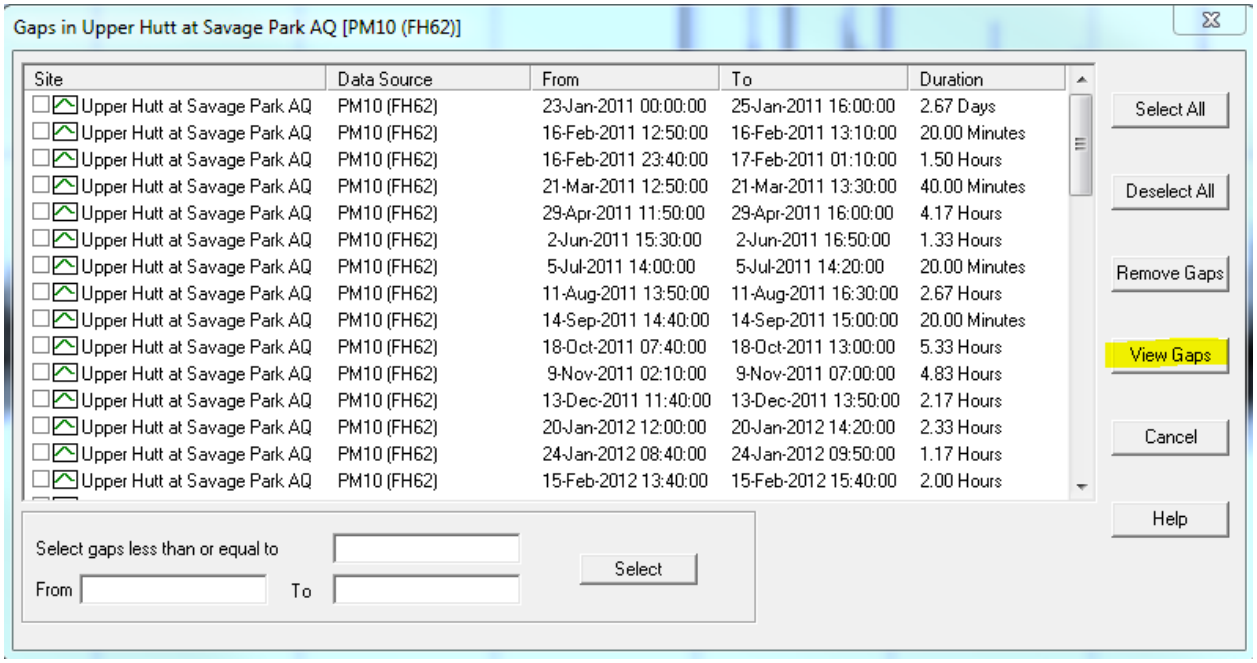


Enter the period of missing or deleted data as shown below.

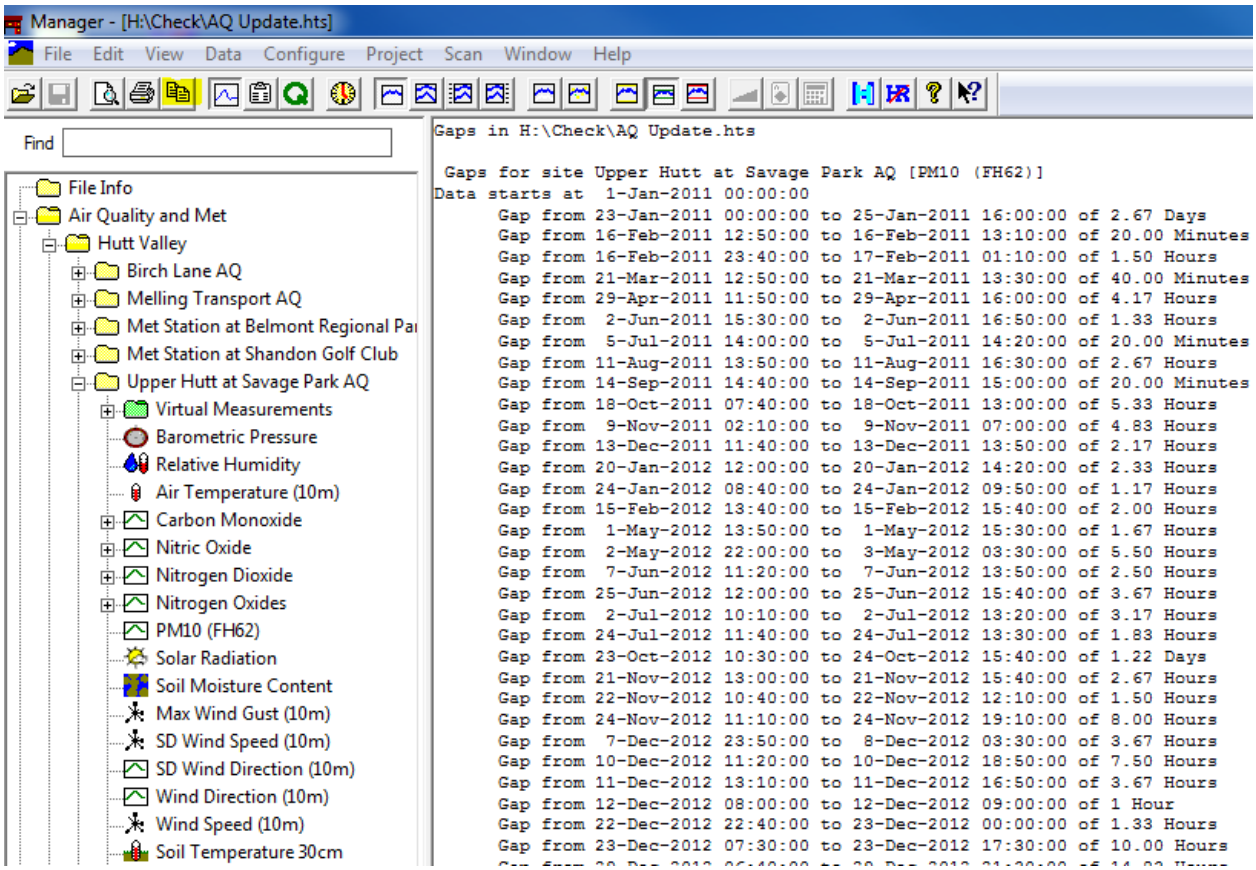


Alternatatively you can copy across gaps from Hilltop Manager.

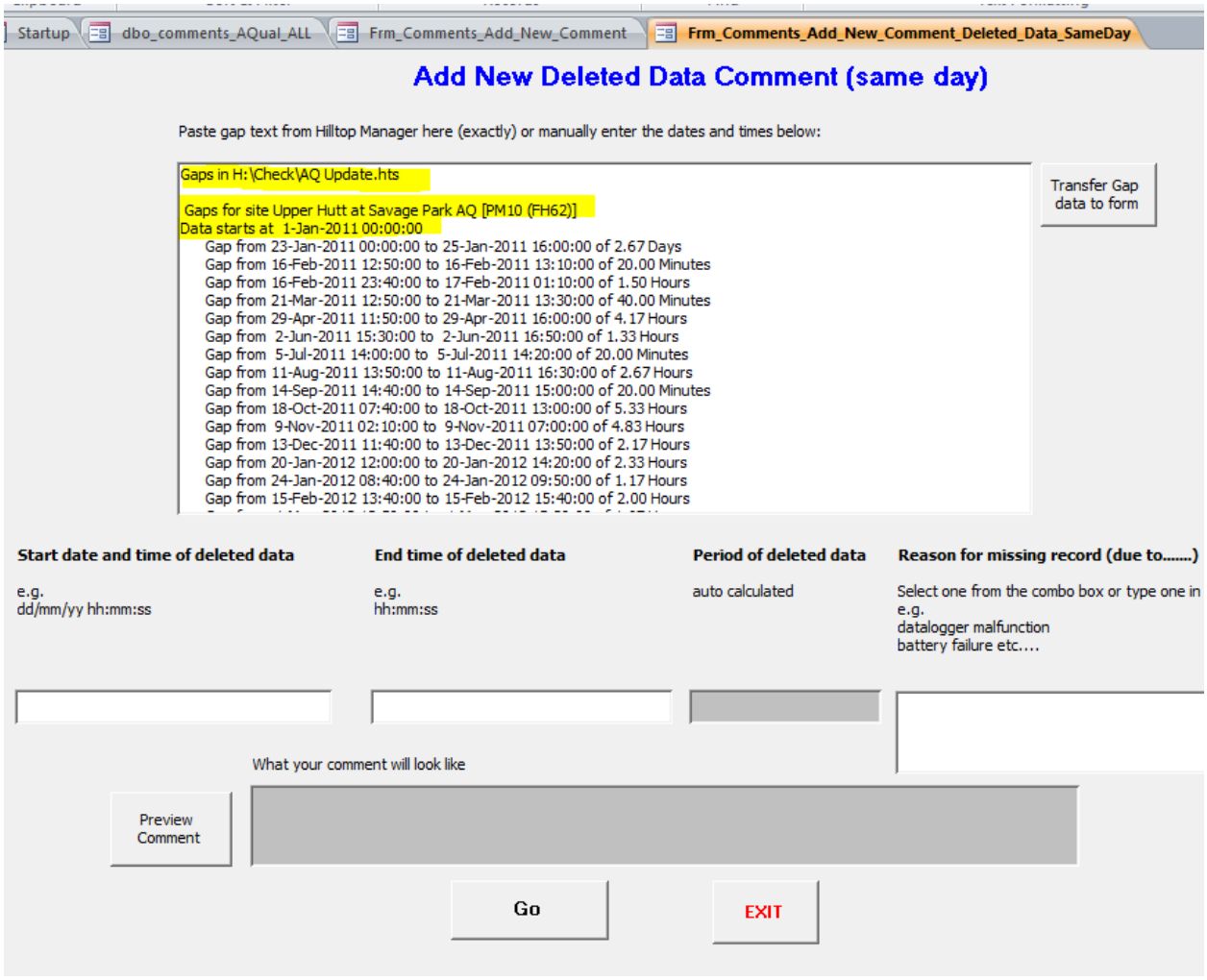
Right click on parameter and click on gap.

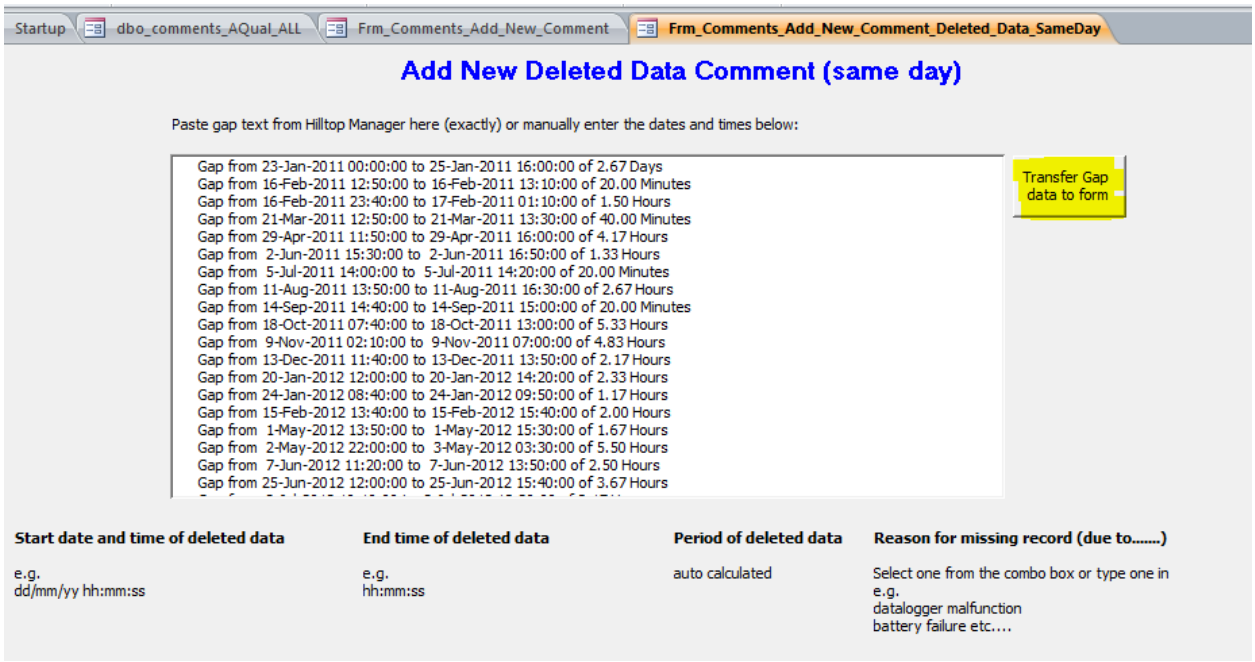


Click on part of screen that shows Hilltop gaps and then click on the copy button



Paste into the comments data base and remove first three lines of text as shown in yellow below.


Startup
dbo_comments_AQual_ALL
Frm_Comments_Add_New_Comment
Frm_Comments_Add_New_Comment_Deleted_Data_SameDay
Add New Deleted Data Comment (same day)
Paste gap text from Hilltop Manager here (exactly) or manually enter the dates and times below:
Gaps in H:\Check\AQ Update.hts
Gaps for site Upper Hutt at Savage Park AQ [PM10 (FH62)]
Data starts at 1-Jan-2011 00:00:00
Gap from 23-Jan-2011 00:00:00 to 25-Jan-2011 16:00:00 of 2.67 Days
Gap from 16-Feb-2011 12:50:00 to 16-Feb-2011 13:10:00 of 20.00 Minutes
Gap from 16-Feb-2011 23:40:00 to 17-Feb-2011 01:10:00 of 1.50 Hours
Gap from 21-Mar-2011 12:50:00 to 21-Mar-2011 13:30:00 of 40.00 Minutes
Gap from 29-Apr-2011 11:50:00 to 29-Apr-2011 16:00:00 of 4.17 Hours
Gap from 2-Jun-2011 15:30:00 to 2-Jun-2011 16:50:00 of 1.33 Hours
Gap from 5-Jul-2011 14:00:00 to 5-Jul-2011 14:20:00 of 20.00 Minutes
Gap from 11-Aug-2011 13:50:00 to 11-Aug-2011 16:30:00 of 2.67 Hours
Gap from 14-Sep-2011 14:40:00 to 14-Sep-2011 15:00:00 of 20.00 Minutes
Gap from 18-Oct-2011 07:40:00 to 18-Oct-2011 13:00:00 of 5.33 Hours
Gap from 9-Nov-2011 02:10:00 to 9-Nov-2011 07:00:00 of 4.83 Hours
Gap from 13-Dec-2011 11:40:00 to 13-Dec-2011 13:50:00 of 2.17 Hours
Gap from 20-Jan-2012 12:00:00 to 20-Jan-2012 14:20:00 of 2.33 Hours
Gap from 24-Jan-2012 08:40:00 to 24-Jan-2012 09:50:00 of 1.17 Hours
Gap from 15-Feb-2012 13:40:00 to 15-Feb-2012 15:40:00 of 2.00 Hours
Transfer Gap data to form
Start date and time of deleted data
e.g.
dd/mm/yy hh:mm:ss
End time of deleted data
e.g.
hh:mm:ss
Period of deleted data
auto calculated
Reason for missing record (due to.....)
Select one from the combo box or type one in
e.g.
datalogger malfunction
battery failure etc....
What your comment will look like
Preview Comment
Go
EXIT


Startup
dbo_comments_AQual_ALL
Frm_Comments_Add_New_Comment
Frm_Comments_Add_New_Comment_Deleted_Data_SameDay
Add New Deleted Data Comment (same day)
Paste gap text from Hilltop Manager here (exactly) or manually enter the dates and times below:
Gap from 23-Jan-2011 00:00:00 to 25-Jan-2011 16:00:00 of 2.67 Days
Gap from 16-Feb-2011 12:50:00 to 16-Feb-2011 13:10:00 of 20.00 Minutes
Gap from 16-Feb-2011 23:40:00 to 17-Feb-2011 01:10:00 of 1.50 Hours
Gap from 21-Mar-2011 12:50:00 to 21-Mar-2011 13:30:00 of 40.00 Minutes
Gap from 29-Apr-2011 11:50:00 to 29-Apr-2011 16:00:00 of 4.17 Hours
Gap from 2-Jun-2011 15:30:00 to 2-Jun-2011 16:50:00 of 1.33 Hours
Gap from 5-Jul-2011 14:00:00 to 5-Jul-2011 14:20:00 of 20.00 Minutes
Gap from 11-Aug-2011 13:50:00 to 11-Aug-2011 16:30:00 of 2.67 Hours
Gap from 14-Sep-2011 14:40:00 to 14-Sep-2011 15:00:00 of 20.00 Minutes
Gap from 18-Oct-2011 07:40:00 to 18-Oct-2011 13:00:00 of 5.33 Hours
Gap from 9-Nov-2011 02:10:00 to 9-Nov-2011 07:00:00 of 4.83 Hours
Gap from 13-Dec-2011 11:40:00 to 13-Dec-2011 13:50:00 of 2.17 Hours
Gap from 20-Jan-2012 12:00:00 to 20-Jan-2012 14:20:00 of 2.33 Hours
Gap from 24-Jan-2012 08:40:00 to 24-Jan-2012 09:50:00 of 1.17 Hours
Gap from 15-Feb-2012 13:40:00 to 15-Feb-2012 15:40:00 of 2.00 Hours
Gap from 1-May-2012 13:50:00 to 1-May-2012 15:30:00 of 1.67 Hours
Gap from 2-May-2012 22:00:00 to 3-May-2012 03:30:00 of 5.50 Hours
Gap from 7-Jun-2012 11:20:00 to 7-Jun-2012 13:50:00 of 2.50 Hours
Gap from 25-Jun-2012 12:00:00 to 25-Jun-2012 15:40:00 of 3.67 Hours
Transfer Gap data to form
Start date and time of deleted data
e.g.
dd/mm/yy hh:mm:ss
End time of deleted data
e.g.
hh:mm:ss
Period of deleted data
auto calculated
Reason for missing record (due to.....)
Select one from the combo box or type one in
e.g.
datalogger malfunction
battery failure etc....

7.6 Apply calibration ratings to gas data

7.6.1 Background

Gas analysers are calibrated on a regular basis to correct for instrument response drift over a known period of time. The audit calibration involves using a reference gas to determine analyser response at a range of concentrations (eg dual point or multipoint) for the purpose of establishing the degree of instrument drift. The final calibration involves adjusting the instrument response against a range of known reference gas concentrations. Typically audit calibrations are carried out monthly to determine the degree of instrument drift. Final calibrations are carried out three-monthly or sooner if an audit calibration shows that the instrument drift is outside acceptable limits or following maintenance procedures likely to affect the instrument response.

The results of these calibrations are recorded in an e-log and are subsequently imported into the H:\Check\AQ Update.hts file where they are applied to the source data to create a calibrated data source.

7.6.2 Importing calibration ratings to Hilltop using e-logs

E-logs are Excel spreadsheets copied from the field laptops and saved on the J Drive. The e-log contains the results of audit and final caliabrations and records instrument checks and maintenance procedures carried out. The e-logs are filed electronically by site, instrument and date. For example: J:\AIR QUALITY\AQ Sites\Karori\e Logs\2009\Karori AQ Feb CO 2009.xls

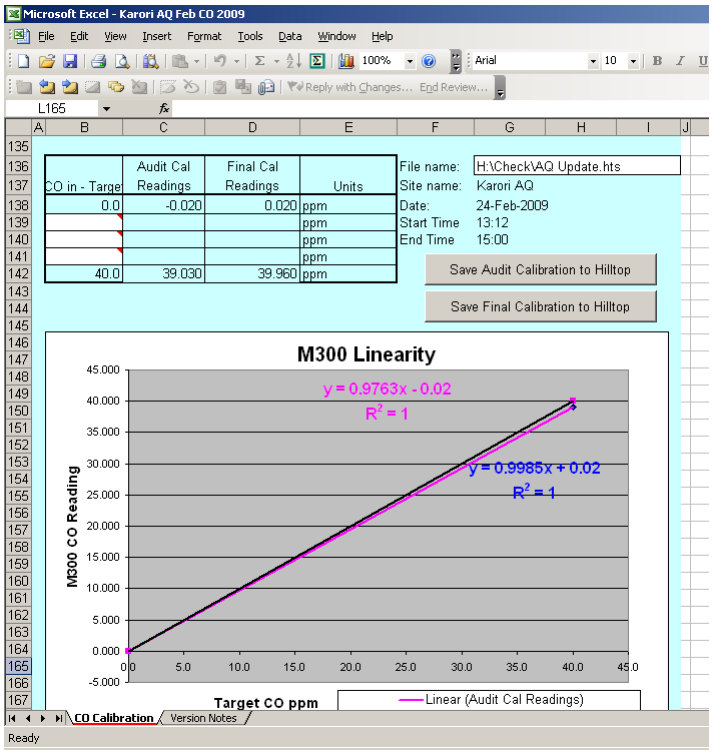


Figure 7.14: Example of a calibration record in an e-log

Calibration ‘ratings’ are imported to Hilltop ratings programme where they are used to ‘transform’ the data measurement source to a ‘rated’ virtual data source, ie the data is adjusted to compensate for instrument drift.

An analyser response ‘curve’ is constructed using the x,y pairs. x = UNRATED (instrument response) and y = RATED (known concentration of reference gas). Two curves are constructed (quadratic spline for multipoint and linear interpolation for dual point) – an audit curve and a final curve.

The air quality data are adjusted using the difference between the two curves (final and audit). Typically instrument drift increases with time so the data is adjusted gradually between the final and audit calibrations, ie the final calibration curve is not fully applied until one minute before the final calibration was carried out. When an audit calibration is carried out for the purposes of checking the instrument response and no adjustment to the instrument is made – the audit calibration is not imported to Hilltop.

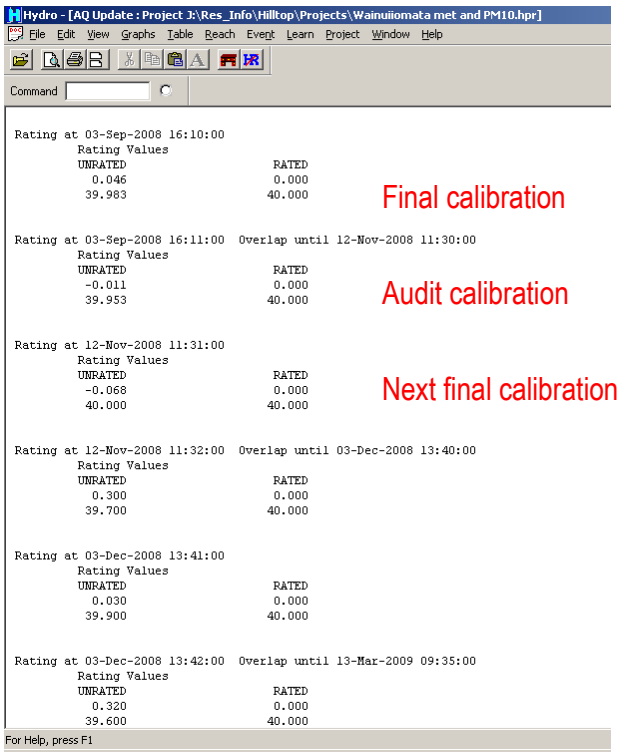


Figure 7.15: Example of a list of ratings listed in Hilltop Hydro using Rating table function

To import a calibration rating, open the relevant e-log and check the Hilltop destination File name is correct, eg H:\Check\AQ Update.hts. To import the audit and/or final rating to Hilltop, click the ‘Save’ button. The calibration results will be automatically inserted into the specified file name in the correct order and time. Where a dual point calibration has been completed, results for the zero and span cells should be filled in – the other cells should be left blank.

7.6.3 Check that ratings have been imported to Hilltop correctly

Print out and check the rating pairs in Hilltop Hydro.

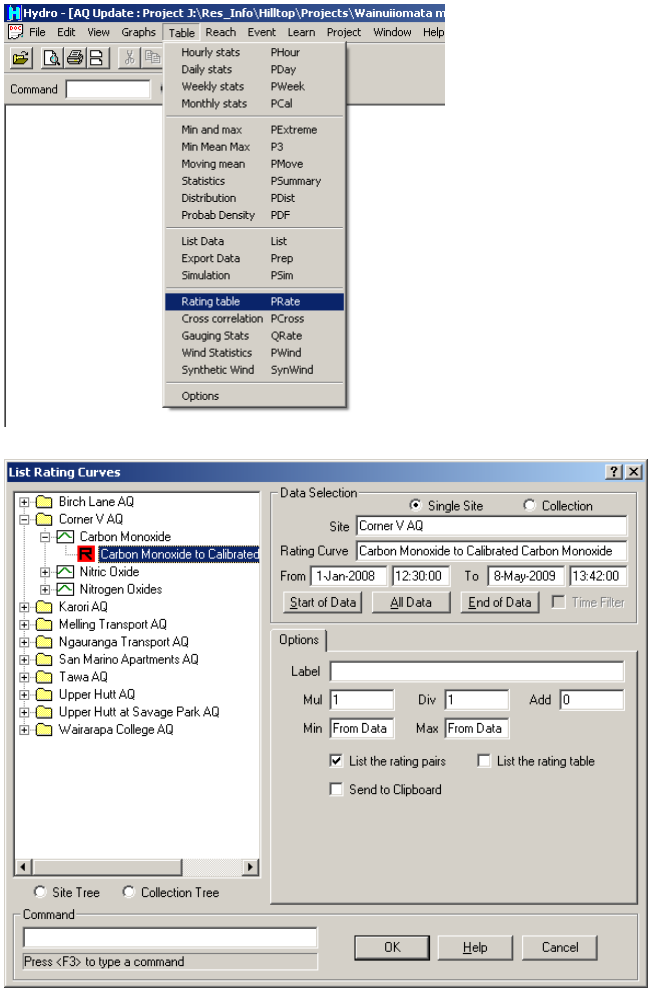
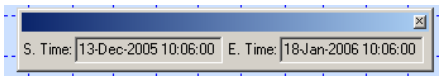
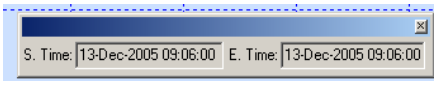


Figure 7.16: Dialogue box for viewing calibration ratings that have been imported into Hilltop

The audit calibration rating start time (S. Time) should be one minute after the start time of the previous final calibration. The audit calibration rating effective time (E. Time) should be one minute before the start time of the final calibration.





The ratings for the final calibration have the same start and effective time which is the time the final calibration process starts. This has the effect of gradually smoothing the ratings from the previous final calibration to the latest audit calibration.

7.6.4 Nitrogen oxides data

NOx analysers sample air to determine the concentrations of NO and NOx separately. Only the NO and NOx channels are calibrated with a reference gas. An example of the audit calibration results recorded in an E-log is shown below. NO_2 is calculated by the analyser by subtracting sampled NO from sampled NOx. The NO_2 data source is not calibrated. The NO, NOx and NO_2 data sources are edited and commented. Comments and editing for each of these data sources should match exactly.

Audit Calibration Rating Table

NO input by Calibrator	NO output by M200a	NOx input by Calibrator	NOx output by M200a	NO^2 Input	NO^2 Output Audit Cal
400	405.5	407.4	408.9	7.38	3.4
300	303.1	305.5	305.9	5.53	2.7
200	201.0	203.7	202.0	3.69	1.1
100	97.9	101.8	98.5	1.84	0.7
0	-1.5	0.0	-1.8	0.00	-0.3

Final Calibration Rating Table

NO input by Calibrator	NO output by M200a	NOx input by Calibrator	NOx output by M200a	NO^2 Input	NO^2 Output Final Cal
400	400.000	407.4	407.500	7.38	7.400
300	300.800	305.5	306.300	5.53	5.500
200	198.900	203.7	203.000	3.69	4.000
100	98.800	101.8	100.100	1.84	1.300
0	0.000	0.0	-0.100	0.00	-0.100

File name: h:\Check\AQ Update.hts
Site name: Corner V AQ
Date: 27-Jul-2007
Start Time of Final Cal: 16:03

Save to Hilltop

Figure 7.17: Example of NOx calibration results in e-log

7.6.5 Graph calibrated and un-calibrated data

To determine whether the calibration ratings have improved the data's baseline, overplot the uncalibrated data with the calibrated data in Hilltop Manager using the same or on a separate axis, if this is easier to view.

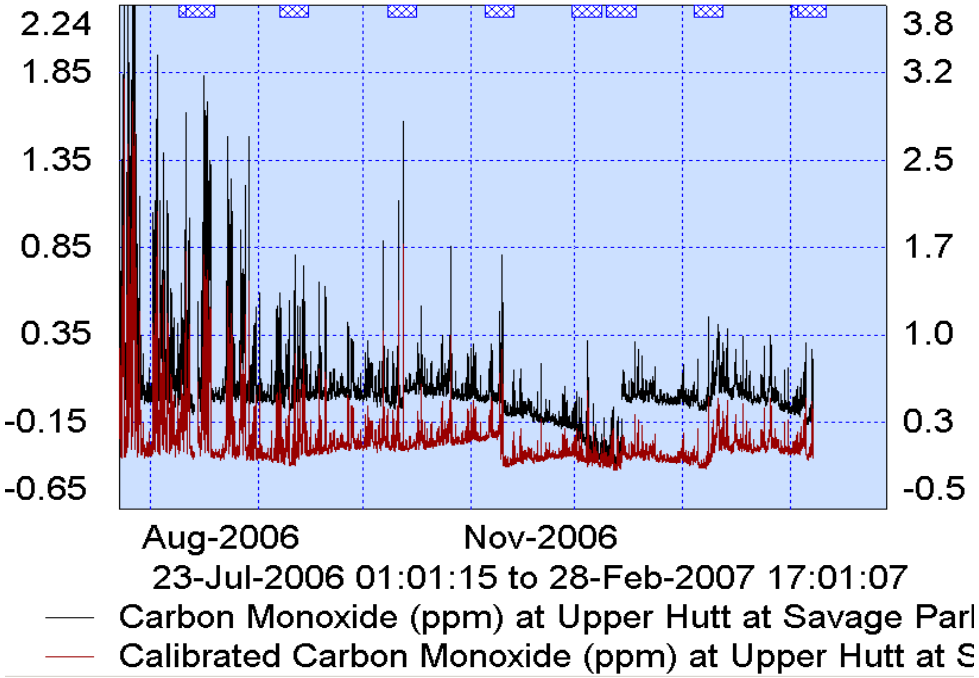


Figure 7.18: Overplot of calibrated and uncalibrated data using Hilltop Manager

Changes to the baseline that happen gradually are addressed by applying the calibration curves in Hilltop to adjust the data. However, where there is a sudden change in baseline (unrelated to a final calibration) applying the calibration ratings may result in data that is not representative of ambient conditions. Any periods of raw data between calibrations that show a sudden change in baseline should be brought to the attention of the air quality scientist, so this can be addressed during the data ratification process.

7.6.6 Editing ratings in Hilltop ratings programme

Ratings can be deleted or changed using the Hilltop ratings programme

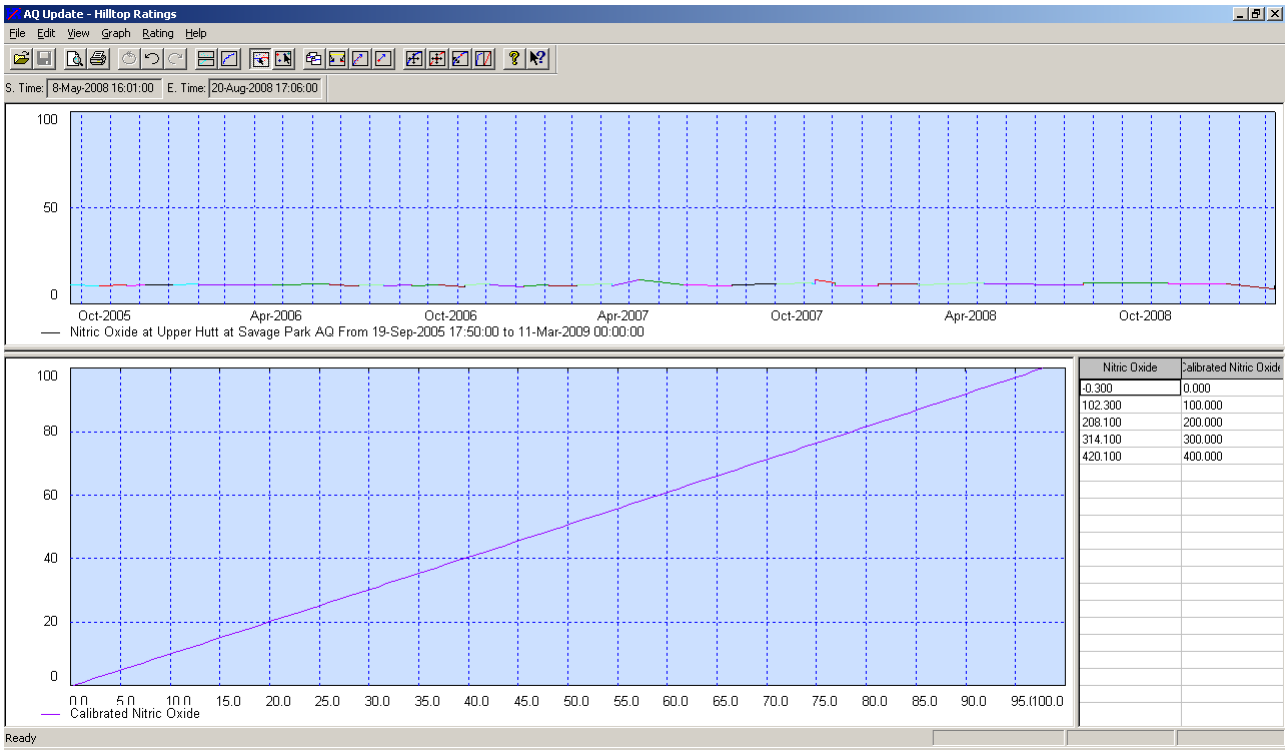


Figure 7.19: Hilltop Ratings screen

Sometimes applying a rating does not improve or appear to correct the instrument drift. This problem is often due to the instrument drift not being constant and/or differenes in the purity of the zero air and/or measurement error associated with the calibration process. During the data ratification process decisions may be made not to apply a calibration rating or to change the date the rating becomes effective, especially where there has been a sudden change in baseline. All adjustments to data made in this way must be documented with reasons in the processing database. Note due to the way the software operates it is not possible to have a period of data to which no calibration applies – the rating continues until a new rating is entered.

7.6.7 Identify invalid calibrations

Where an instrument has shown excessive zero or span drift, ie, outside of the tolerances in Table 7.1 below, the data should either be invalidated back to the last instrument adjustment or the previous calibration applied, in consultation with the AQ scientist.

Table 7.1: Tolerances for analyser span and zero drift for periods between final calibrations

Contaminant	**Zero drift** (absolute)	**Span drift %**
Carbon monoxide	+/- 1.5 ppm	+/- 15%
Nitric oxide (NO)	+/- 15 ppb	+/- 15%

Nitrogen oxides (NOx)	+/- 15 ppb	+/- 15%

Quality control charts for each analyser at each site are recorded on the instrument check sheet spreadsheet stored on J:\AIR QUALITY\AQ Sites. The QC charts monitor instrument drift at zero and span between audit and final calibrations.

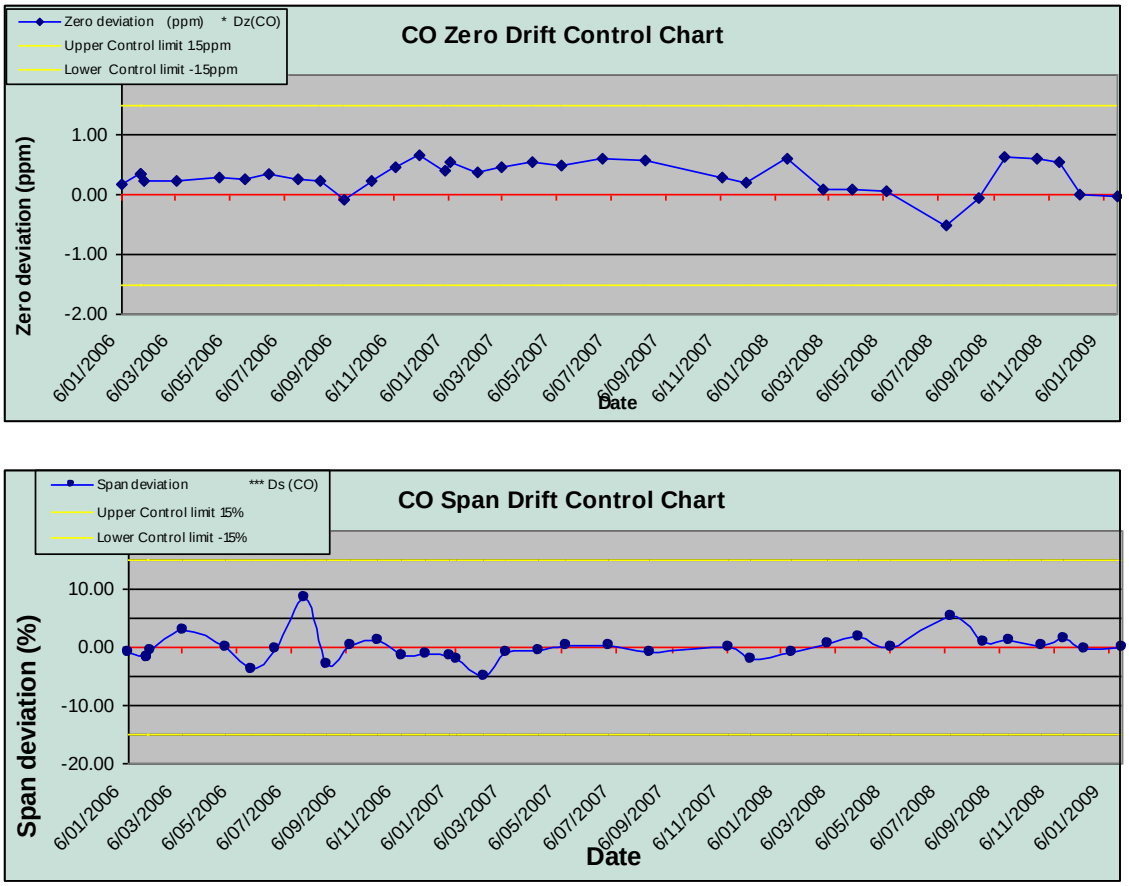


Figure 7.20: QC charts showing zero and span drift relative to acceptance limits

The results of all multipoint calibrations are plotted on a chart in the instrument e-log to establish their linearity by least squares regression. The slope should be 1+/- 0.10, the intercept 0 +/- 1 and $R^2 > 0.995$. Where these acceptance criteria are not met the data should either be invalidated back to the last instrument adjustment or the previous calibration in consultation with the AQ scientist.

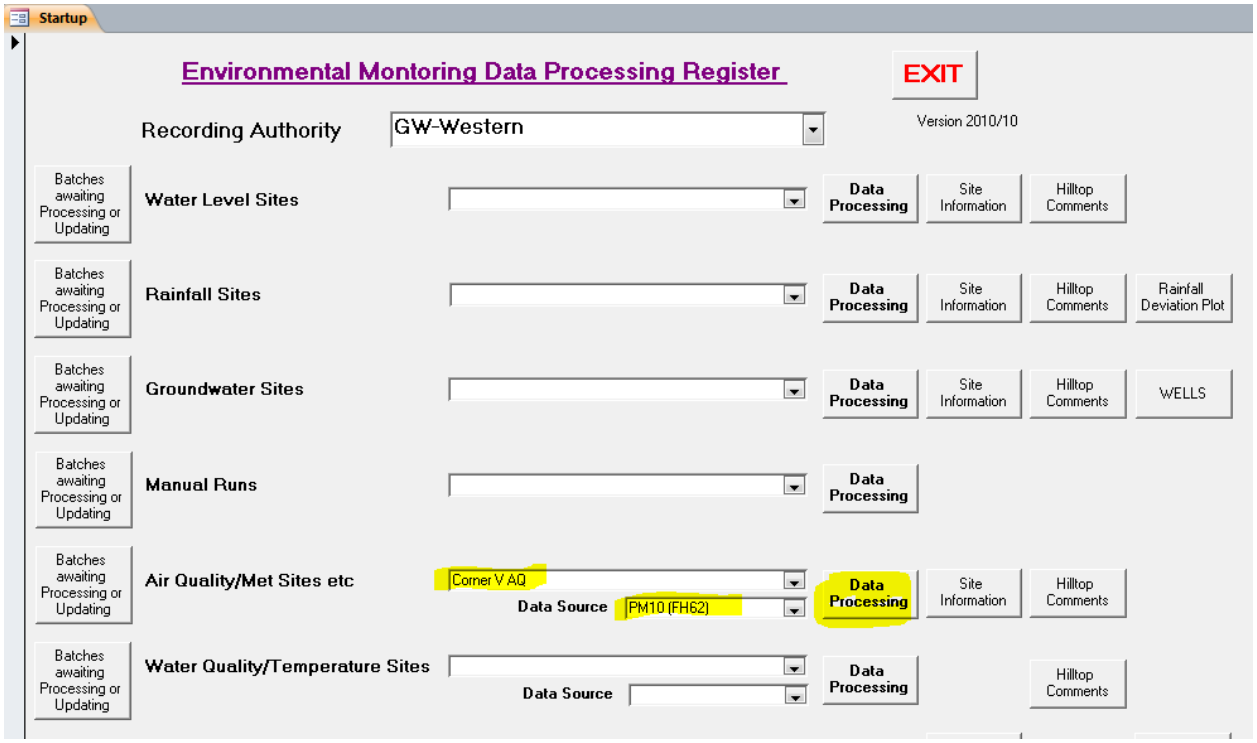
8. Procedure – checking edited data

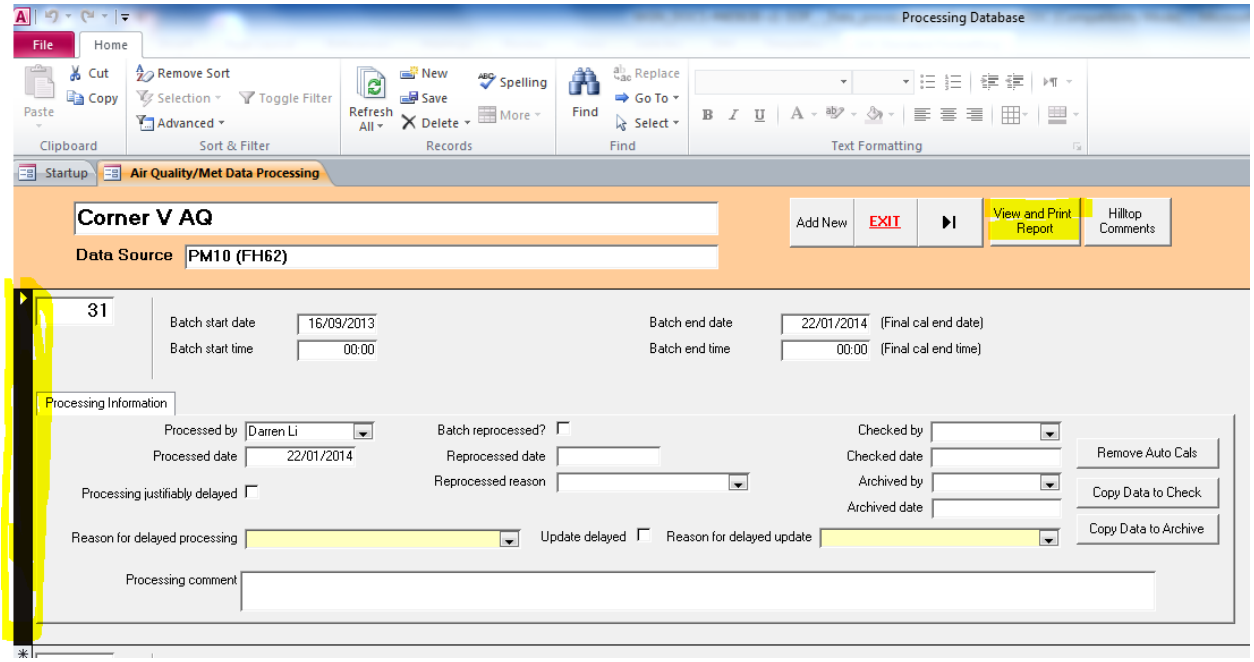
All data that has been editted and is ready for checking should be placed in the in-tray on the AQ scientist's or team leader's desk.

The QA process involves:

- Checking that the calibration ratings have been loaded correctly from the e log templates and invalidate any calibrations where net zero or span drift exceeds the tolerances specified in Table 7.1.

- Checking that all calibration data has been removed and that a data comment has been entered.
- Perusing site logs and check that data comments have been entered where necessary.
- Checking that the data looks normal especially during periods where there have been site visits.
- Checking for correct relationship between NO, NOx and NO_2 (NO values should not exceed NOx or NO_2)
- Check that gaps in Hilltop match Hilltop comments




Processing Database
File
Home
Cut
Copy
Paste
Remove Sort
Selection
Toggle Filter
Advanced
Clipboard
Sort & Filter
Refresh All
New
Save
Delete
Spelling
More
Records
Find
Replace
Go To
Select
Find
Text Formatting
Startup
Air Quality/Met Data Processing
Corner V AQ
Data Source
PM10 (FH62)
Add New
EXIT
View and Print Report
Hilltop Comments
31
Batch start date
16/09/2013
Batch start time
00:00
Batch end date
22/01/2014
(Final cal end date)
Batch end time
00:00
(Final cal end time)
Processing Information
Processed by
Darren Li
Processed date
22/01/2014
Processing justifiably delayed
Batch reprocessed?
Reprocessed date
Reprocessed reason
Checked by
Checked date
Archived by
Archived date
Remove Auto Cals
Copy Data to Check
Copy Data to Archive
Reason for delayed processing
Update delayed
Reason for delayed update
Processing comment

Comer V AQ **PM10 (FH62) Batch No 31**

	Date	Time
Batch Start	16/09/2013	00:00:00
Batch End	22/01/2014	00:00:00

Processing comment:

Hilltop comment added? No

Processing delayed? No *Reason for delayed processing*

Processed by: Darren Li *Date processed:* 22/01/2014

Update delayed? No *Reason for delayed Update*

Checked by: *Date checked:*

Archived by: *Date checked:*

Hilltop Comments

18/09/2013 14:10:00	Deleted data for 2.5 hours on 18/09/2013 from 141000 to 164000 due to PM10 head clean/replacement.
22/10/2013 10:08:00	PM10 head replaced.
18/11/2013 09:00:00	Missing record for 2.33 days from 18/11/2013 090000 to 20/11/2013 170000 due to instrument COM failure. FH62 # E0989 replaced #644 on 20/11/2013.
10/12/2013 11:20:00	Deleted data for 2 hours on 10/12/2013 from 112000 to 132000 due to instrument three mothly services and calibrations.
8/01/2014 09:20:00	PM10 head replaced.

Hilltop Gaps

18/09/2013 14:10:00	18/09/2013 16:40:00	2.5 hours
18/11/2013 09:00:00	20/11/2013 17:00:00	2.33 days
10/12/2013 11:20:00	10/12/2013 13:20:00	2 hours

Once the data has been checked the Data Processing Database is updated. A processing comment may be added by the air quality scientist or team leader where data re-processing is required. The data batch will be returned to the EMO for reprocessing if needed.

Once the processed data has been checked and re-processed if needed, hard copies of the batch record printout, E-log, calibrations ratings pairs are filed on the relevant site folder kept in the office.

9. Procedure - data validation

The data ratification process involves examining a longer period of data (typically a year's worth of data) and making any adjustments to the data to ensure it is representative of ambient conditions and is consistent across the monitoring network.

The following aspects are examined:

- Baseline shift over time

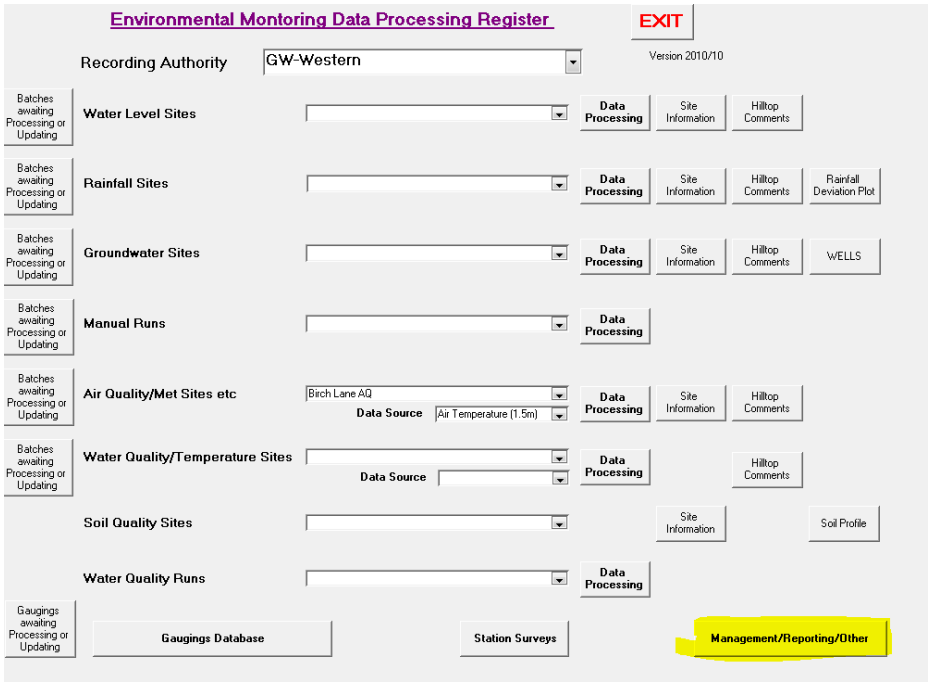
- Possible causes for any data outliers (eg, local effects such as construction activities, instrument problems or excessive temperature changes inside the monitoring station)
- Consistency with expected seasonal or diurnal patterns
- Consistency with other pollutants measured at the same site
- Consistency with the pollutants measured at other comparable sites in the region

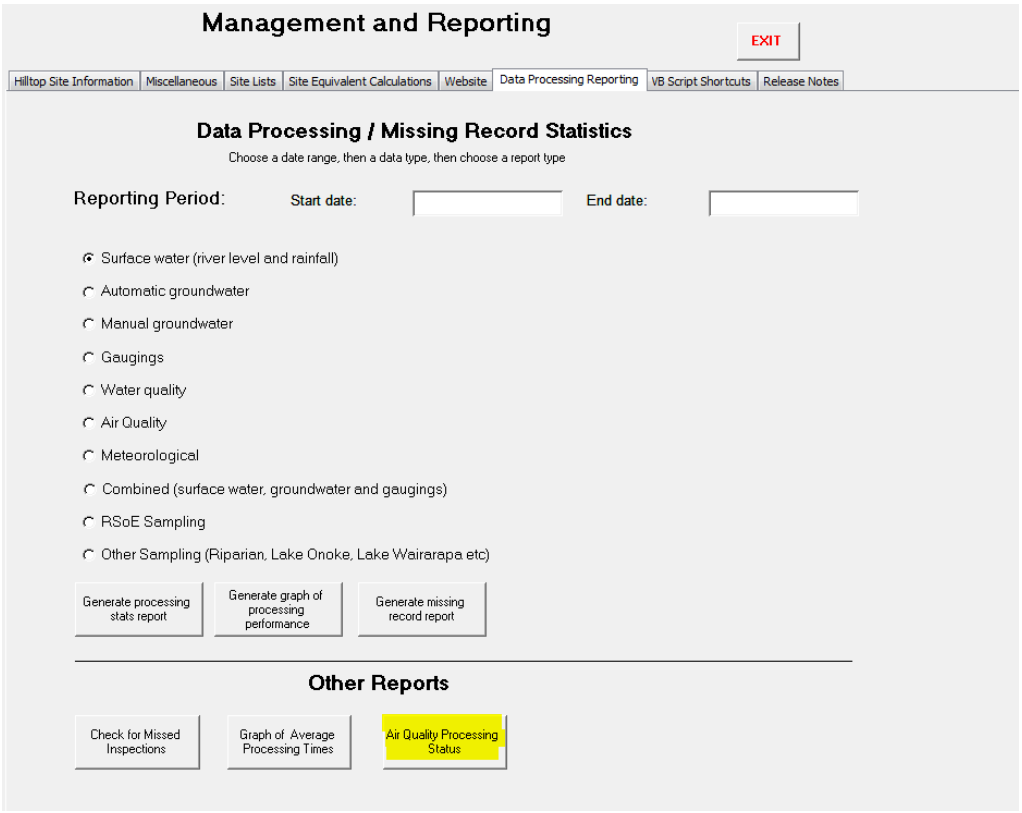
10. Procedure – archiving validated data

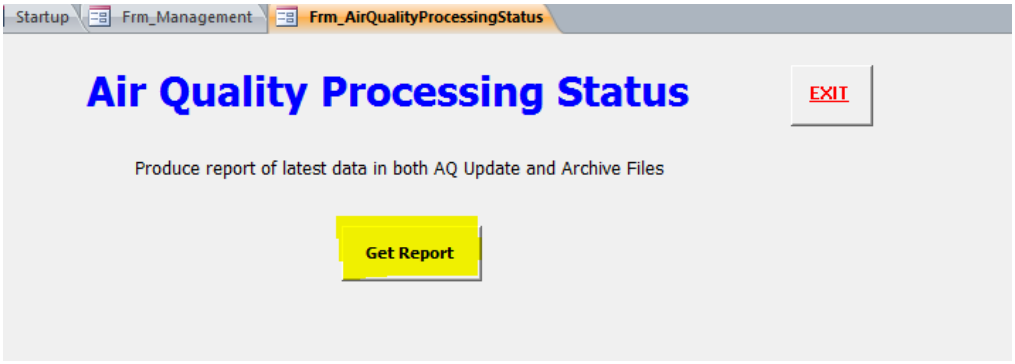
The team leader is responsible for transferring validated data to the archive. Archiving data uses the transform function in Hilltop to transform calibrated data sources back to a normal data source (eg, from calibrated carbon monoxide to carbon monoxide). Nitrogen dioxide and PM_{10} data are simply copied into the archive as calibration ratings are not used.

Once the data has been archived the Data Processing Database is updated with the data archived date and the name of the team leader.

Report showing status of data archiving




Management and Reporting
EXIT
Hilltop Site Information
Miscellaneous
Site Lists
Site Equivalent Calculations
Website
Data Processing Reporting
VB Script Shortcuts
Release Notes
Data Processing / Missing Record Statistics
Choose a date range, then a data type, then choose a report type
Reporting Period:
Start date:
End date:
Surface water (river level and rainfall)
Automatic groundwater
Manual groundwater
Gaugings
Water quality
Air Quality
Meteorological
Combined (surface water, groundwater and gaugings)
RSoE Sampling
Other Sampling (Riparian, Lake Onoke, Lake Wairarapa etc)
Generate processing stats report
Generate graph of processing performance
Generate missing record report
Other Reports
Check for Missed Inspections
Graph of Average Processing Times
Air Quality Processing Status


Startup
Frm_Management
Frm_AirQualityProcessingStatus
Air Quality Processing Status
EXIT
Produce report of latest data in both AQ Update and Archive Files
Get Report

Air Quality Processing Status

SiteName	Measurement	Last Date in AQ Update	Last Date in Archive
Birch Lane AQ	Air Temperature (1.5m)	1/01/2013	1/01/2012
Birch Lane AQ	Air Temperature (10m)	1/01/2013	1/01/2012
Birch Lane AQ	Carbon Monoxide	19/03/2012 23:50:00	1/01/2012
Birch Lane AQ	Max Wind Gust (10m)	1/01/2014	1/01/2012
Birch Lane AQ	Min Wind Speed (10m)	1/01/2014	1/01/2012
Birch Lane AQ	Nitric Oxide	11/01/2012 15:00:00	1/01/2012
Birch Lane AQ	Nitrogen Dioxide	11/01/2012 15:00:00	1/01/2012
Birch Lane AQ	Nitrogen Oxides	11/01/2012 15:00:00	1/01/2012
Birch Lane AQ	PM10 (FH62)	22/01/2014 12:00:00	1/01/2012
Birch Lane AQ	PM10 (TEOM)	13/12/2011 09:10:00	11/11/2011 13:20:00
Birch Lane AQ	Relative Humidity	1/01/2013	1/01/2012
Birch Lane AQ	SD Wind Direction (10m)	1/01/2012	1/01/2012
Birch Lane AQ	SD Wind Speed (10m)	1/01/2012	1/01/2012
Birch Lane AQ	Solar Radiation	1/01/2014	1/01/2012

11. Data reporting

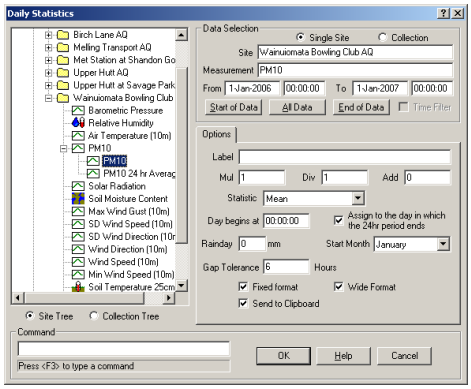
11.1 PM_{10}

For comparison with the NES, the averaging period is 24 hours, calculated at midnight for the preceeding 24 hour period (the 24-hour average for 1 July 07 is calculated from data collected from 1/7/07 00:00 to 1/7/07 23:50). Only 24-hour periods with at least 75% data capture (ie 6 hours can be missing) are used. Missing data are left as a gap, ie no interpolation is carried out in accordance with MfE best practice. However, attention should be paid to where the gap is occurring during the 24-hour period to ensure that daily average calculated is generally representative. For example, a gap in the middle of a pollution episode would not be representative.

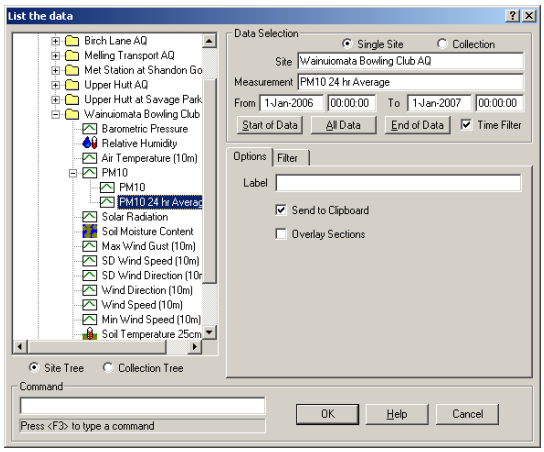
11.2 Calculating annual statistics using Excel

To calculate the annual statistics 2006 for PM_{10}:

Run PDay for PM_{10} at site from 1/1/06 to 1/1/07 with a gap tolerance of 6 hours. This ensures that 24-hour periods with less than 75% data capture are excluded from the dataset.



Run List data for PM_{10} 24-hour average at site from 1/1/06 to 1/1/07



Copy clipboard results to Excel spreadsheet.

In Excel:

- remove gaps, and deleted the first 24-hour average listed for 1/1/06 00:00 as this value actually applies to the previous 24-hour period (31/12/05).
- Shift the dates column down one cell so the dates and averages match those produced by the PDay table.
- Remove all periods where the gap tolerance not met by comparing to the PDay table
- Use Functions in Excel to run the desired statistics, eg MIN, MAX, MEDIAN, PERCENTILE etc
- Use Excel to round final 24-hour averages to 0 decimal place.

11.3 Calculating annual statistics using R

Alternatively save the Excel file as a csv file and read into R for further analysis.

11.4 Virtual measurements

The following virtual measurements are available and can be used for data reporting:

- Carbon monoxide 8-hour moving mean as ppm or mg/m3. Calculated on the hour for the previous 8 hour period.
- Carbon monoxide 1 hour fixed mean (mg/m3)
- PM_{10} 24-hour average (midnight to midnight) ug/m3
- PM_{10} 1-hour average ug/m3
- Wind speed calm days. Calculates the percentage of time during a 24-hour period that 10 minute averages were less than 1 m/s

- NO calibrated 1-hour average ppb or ug/m3
- NOx calibrated 1-hour average ppb or ug/m3
- NO_2 1-hour average ppb or ug/m3

11.5 Reporting units

In accordance with MfE 2009 air quality statistics are reported to the following significant digits:

CO x.x mg/m3
NO_2 x.x ug/m3
PM_{10} x ug/m3

11.6 Annual data capture rates

Percentage annual valid data for reporting purposes is calculated as the number of averaging periods less the number valid averaging periods achieved. For example, in calculating NO_2 averages there are 8760 hours per year – however, only 8000 of these might contain at least 75% valid data. Therefore the percentage valid data is 8000/8760 = 91.32%

The data capture rate allows for planned maintenance and calibrations not to count as 'missing record'. Using the example above, if there were 200 hours of planned maintenance and calibrations then:

Data capture rate = 8000/8760-200 = 93.45%

Unplanned data loss = 6.55%

11.7 Non-compliance with MfE good practice guide

It is recommended by MfE that labelling of the midnight hour should be 24:00 instead of 00:00. Unfortunately the Hilltop software does not allow this. Air quality data is logged as 10 minute averages as follows:

24/5/09 23:50

25/5/09 00:00