

Corentium Report & Analysis SW v2.2

User manual

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1 Introduction

This document describes the usage of the ‘Corentium Report and Analysis SW’ version 2.2, in short referred to as the ‘CRA SW’. The SW can be used to analyse and generate reports from radon measurements acquired by one (or more) Pro radon monitors by Corentium. The SW is currently only available on PCs running Microsoft Windows operating system.

Refer to the document ‘[CRA-Installation-Guide-English-V22.pdf](#)’ found on your USB memory stick for how to install the CRA SW and HW drivers as well as SW and HW pre-requisites for your computer to be able to run the CRA SW. The Pro system is shown in figure 1-1.

The main points to remember during installation and first time running of the SW are:

- **DO NOT CONNECT THE PRO MONITOR TO THE PC BEFORE THE SW HAS BEEN INSTALLED!**
- **AFTER THE SW INSTALLATION YOU MUST PLUG IN THE MONITOR BEFORE THE SW IS STARTED FOR THE FIRST TIME!**



Pro: Radon monitor with cabled USB interface.

USB cable: For connecting Pro monitor to the PC.

USB-SW: Memory stick that contains the SW and the user manuals.

Figure 1-1: Pro system.

1.1 Naming conventions

In this document all SW buttons, menu tags, drop-down menus etcetera are marked with an underscore. As an example, a button in the Software named Plot Options will typically be referred to as ‘Plot options’.

1.2 Differences between Pro and earlier Pro monitor models

An earlier version of the Pro instrument interfaced to the PC wirelessly. Please refer to manuals in version 2.0 or earlier for this type of instrument.

There are additional differences between older and newer radon monitors beside the obvious difference related to how they interface, the older versions wirelessly and the newer versions by USB cable.

The main improvements to the latest generation of Pro monitors are:

1. The newer Pro monitor remembers earlier data sets. The SW will allow you to read out earlier data sets stored in the monitor. When the user wants to start a new data set one will press the RESET button on the back side of the monitor. For the internal clock of the Pro to be set correctly the user always have to read out the first data set taken with a new Pro monitor after batteries have been inserted, or as a minimum connect it to the SW for it to be auto-detected. The internal Pro clock is set equal to your PC clock at the time the instrument is auto-detected by the SW. However, after this first data set has been acquired and read out, the user can acquire multiple data sets separated by RESET and read them all back at the end. An example would be to send the monitor away to let a user measure three rooms in a building. The user would measure a few days in each room and terminate each measurement with a RESET (also after the last acquisition) before the monitor is returned. The user of the CRA SW can now easily read out and generate a report for each of these rooms.
2. Newer Pro monitors have memory storage for up to 10 years of hourly radon concentration data. An older Pro monitor can only read 10 weeks at an hourly resolution before the monitor has to be read out.
3. A newer Pro contains multiple sensors, such as temperature, humidity and atmospheric pressure and zenith angle were these are sampled once an hour. The older Pro only has an un-calibrated temperature sensor read once a day that will allow the user only to see relative temperature differences from day to day.
4. A newer Pro monitor will start a new data set no matter if you take out and re-insert the batteries or if you RESET it. An older Pro monitor will continue the data set if batteries are exchanged.

2 Running the CRA SW

The CRA SW is started by double-clicking on its desktop shortcut icon or locating the CRA program using the Windows Start button.



Figure 2-1: Desktop shortcut icon for starting the CRA SW.

When the SW is started, the window in figure 2-2 will appear.

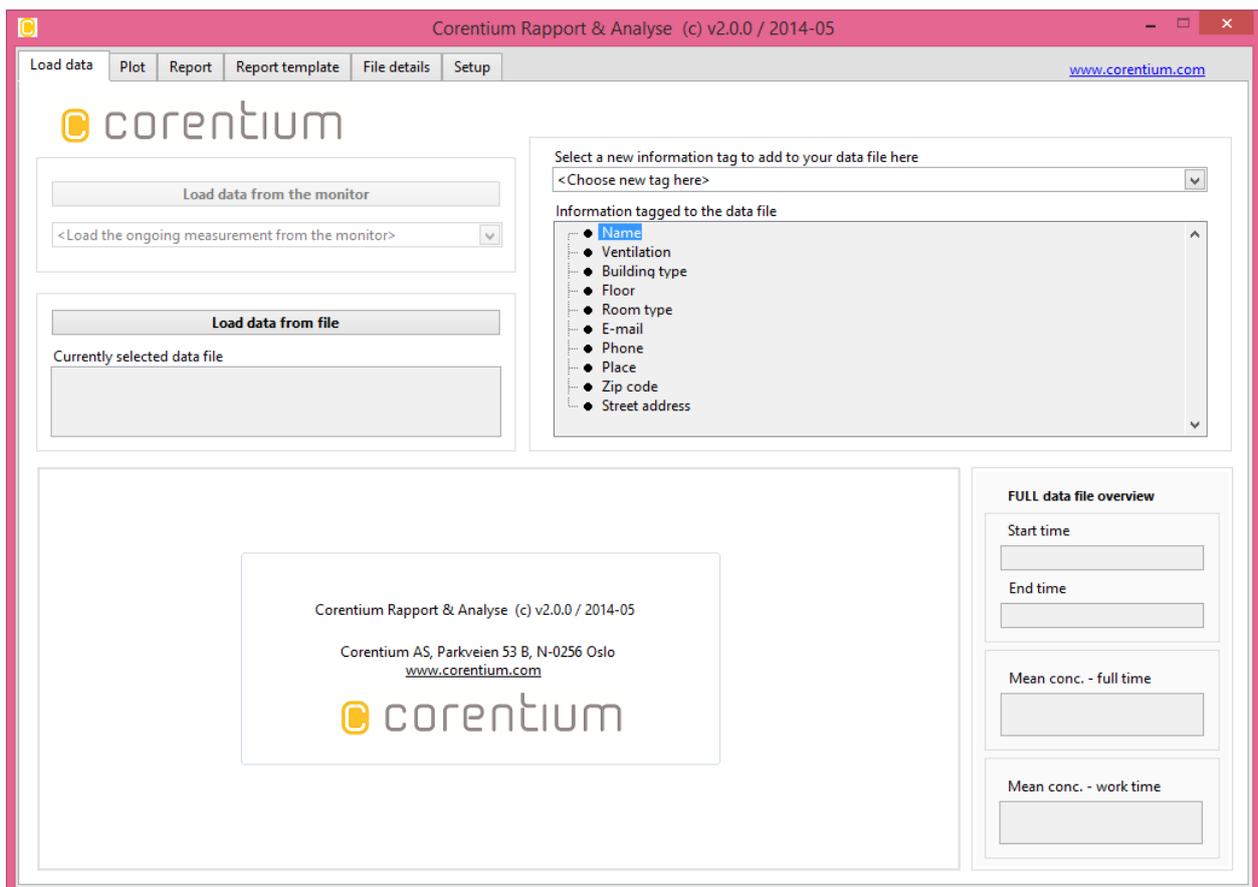


Figure 2-2: Main window view of the CRA SW application.

The CRA SW is based on a 'Tab' view. The application has six main tabs that can be clicked-on (were the last two tabs are for advanced users only) and these are:

1. Load data : Uploads data from a Pro monitor, or alternatively loads a data file that is stored earlier on the PC.
2. Temporal plot: Plots the radon concentration variation over time (i.e. *temporal* variations in the radon concentration). Can also calculate radon concentration average for the actual period. One can also plot the average radon concentration per week or per day, or part of the week or day.
3. Report: Sets the options and generates a radon report. The report can be opened in a web browser or exported to a pdf file.
4. Report template: Customize a report template. Can be done by generating a new report template from scratch, or by modifying some of the existing report templates supplied with the CRA SW.
5. File details: Shows some details about the current data file as well as the currently selected data folder. Only relevant for the advanced user.
6. Setup: Here you can select the language used by the SW. In version 2.0 and newer are English, German, French, Swedish and Norwegian supported. You can on this tab force the SW to interface to one particular radon monitor in case you want the SW to bypass the normal auto selection of the last monitor plugged in. You can select the measurement unit used by the SW. The default is Bq/m³, but US users can select pCi/L. And, finally, the user can set restrictions on how many older data sets will be shown on the 'Load data' tab.

3 How to use the 'Load data' tab

The purpose of the 'Load data' tab is to load measurement results into the CRA SW. This can be done by either loading the data directly from a Pro monitor, or - alternatively - by loading the data from a file that was stored earlier.

3.1 Load data from a Pro monitor

In order to load data from a Pro monitor to the PC, you should follow this procedure:

- The USB-cable is inserted in the PC AFTER (preferably, but not necessary) the SW has been started. You will then observe the 'Load data' button changed state from inactive (greyed out) to active (bold). If the SW do not detect the USB connection just try to take out the USB-RF/cable and re-insert it. Refer to figure 3-1 how the load button appears BEFORE and AFTER you have inserted the USB-RF/cable into the PC.
- One should observe that the LCD screen shows something similar to the picture to the right in figure 3-2 when the unit is connected to the PC with the USB cable.
- Press the 'Load data from monitor' button on the CRA SW located in the upper left corner of the 'Load data' tab, refer to figure 3-1 again.
- The ongoing measurement must be longer than 24 hours before it can be read out. If the measurement is shorter the 'Load data' button will typically be greyed out (disabled) and show a text like this: 'Load data from the monitor – PRO>SEr-66 – NOT READY'

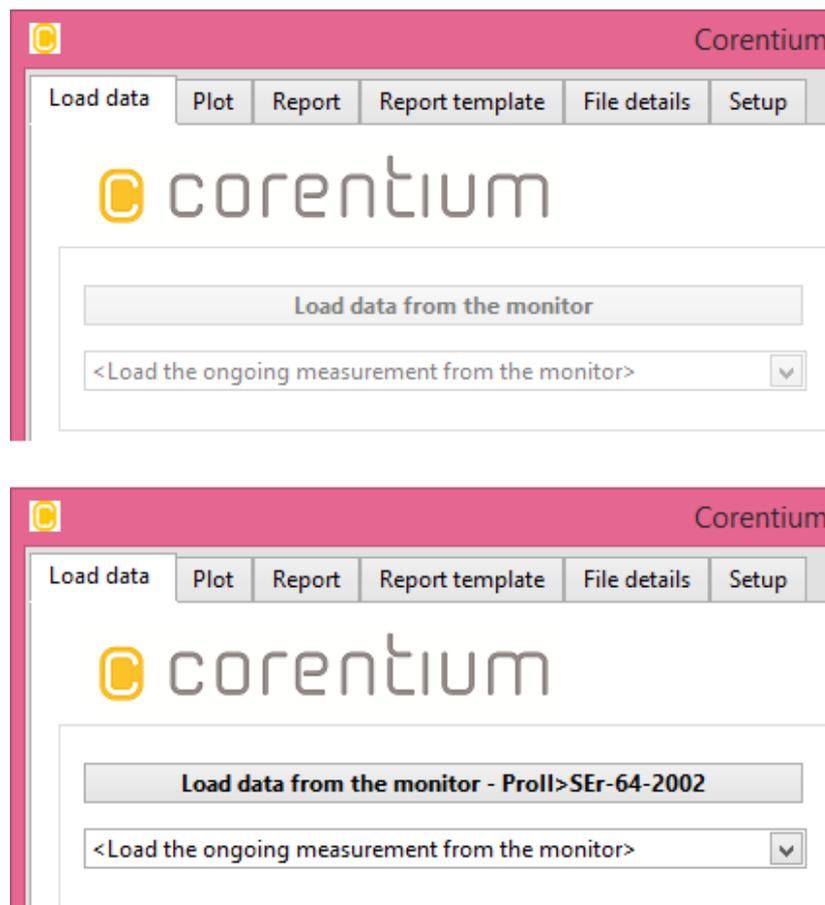


Figure 1: The two pictures above show the SW BEFORE (above) and AFTER (below) you plug a Pro monitor in your PC. After the monitor is detected you see that in this case it is detected as a Pro monitor with serial number 64-2002 ('Pro II>SEr-64-2002'). This corresponds to the information that can be read from the LCD screen on the monitor connected to PC.

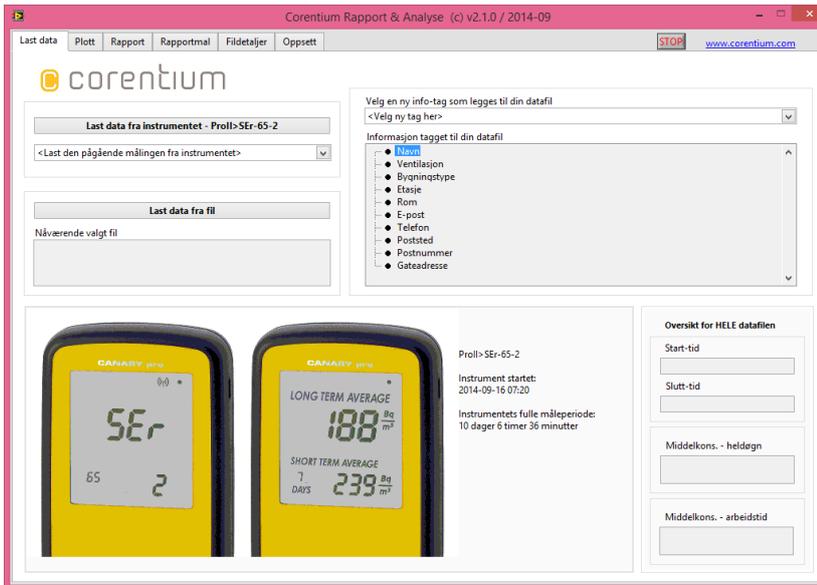


Figure 3-2: To the left: a picture of the SW screen after it has auto-detected a monitor plugged in the USB port. To the right: the monitor shows a LCD-screen similar to this picture when it is plugged into the PC. The serial number of the monitor in the form SEr-65-2 is shown. (The numbers will be different on different monitors).

When the 'Load data from monitor' button is pushed a window with a progress indicator opens. The data loading should take approximately 20 seconds to complete, see figure 3-3.

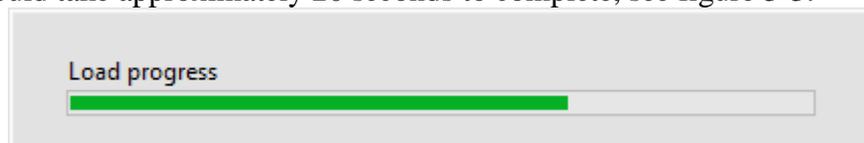


Figure 3-3: Radon monitor load progress window.

In the case an error happens during the read-out, an error message window is shown as in figure 3-4. If this should happen, just try to re-read the monitor.

In the case the data loads correctly a file dialog window (figure 3-4) will pop up when the progress bar reaches 100%. Here the loaded monitor data has to be saved to a file. The file can have any name and can be stored in any folder, but it is a requirement that the file is stored with a file extension of **.cor**, for example **datafile.cor**. If the **.cor** extension is not provided the SW will automatically append it to the end of the file name.

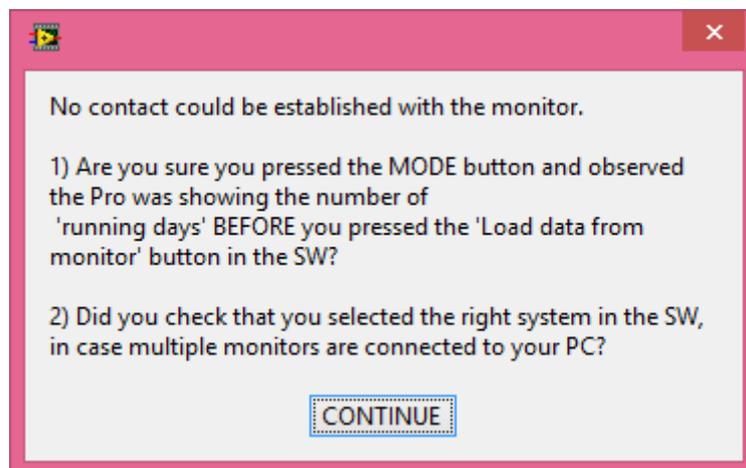


Figure 3-4: Load data error from the monitor.

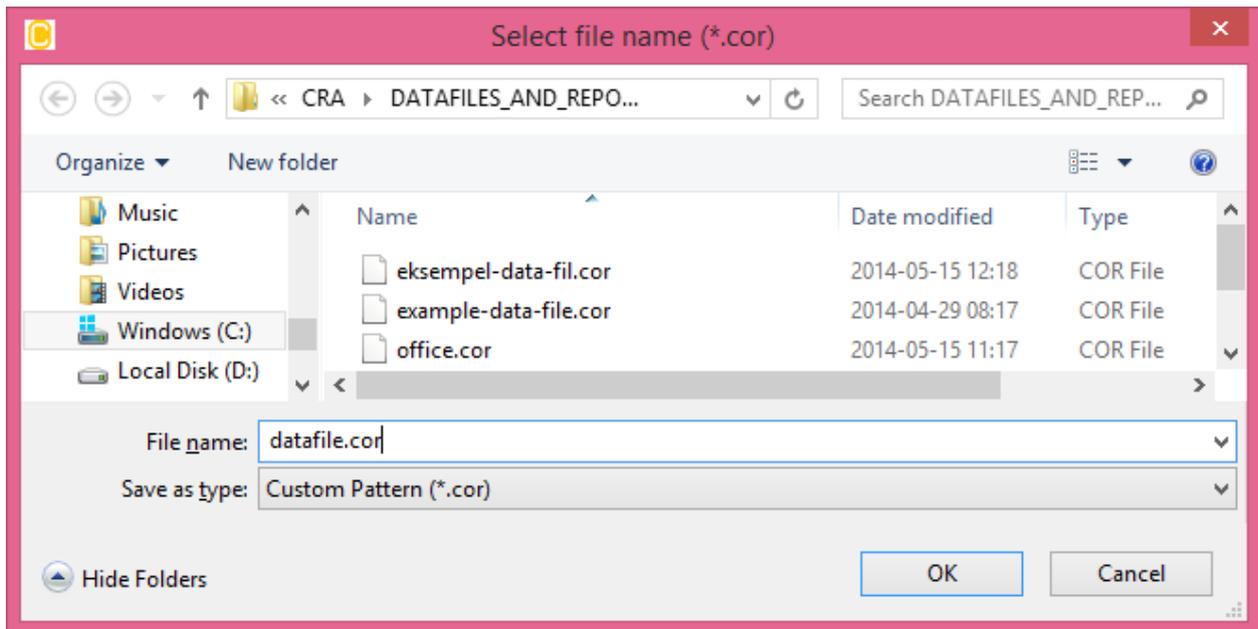


Figure 3-5: File dialog to enter the name for the data file to hold the measurement data uploaded from the radon monitor. In this example the user is about to save the data to a file with the name 'datafile.cor'.

When data has been loaded from the Pro, the monitor is free to start a new radon measurement in a new location. Remember to press the RESET-button on the backside of the monitor when you place it in the new location.

The Pro monitor should always be kept with batteries inserted, even when the monitor is not in use. The batteries last at least 18 months and should be replaced as soon as the indicator 'LOW BAT' is shown in the upper left part of the LCD display.

3.2 Load data from a data file stored earlier

One can choose to load data that you have stored in a file earlier. This can be done to generate a new report from the data or to tag some additional information to the existing data file.

To load an older file (that has *.cor file extension) use the 'Load data from file' button at the upper left corner of the 'Load data' tab. In the file dialog menu that appears, just navigate to and select the relevant data file.

In the SW folder (after installation) some test data files are provided in the C:\Program Files\CRA\DATAFILES_AND_REPORTS folder. One of them is named 'example-data-file.cor' and is used in the examples found in this manual.

3.3 Summary of loading data into the SW

When a data file has been loaded either from an existing data file or from a Pro (and stored to a new *.cor file) the name of the current active data file will appear in the text field named 'Currently selected data file' below the two load buttons, see figure 3-6.

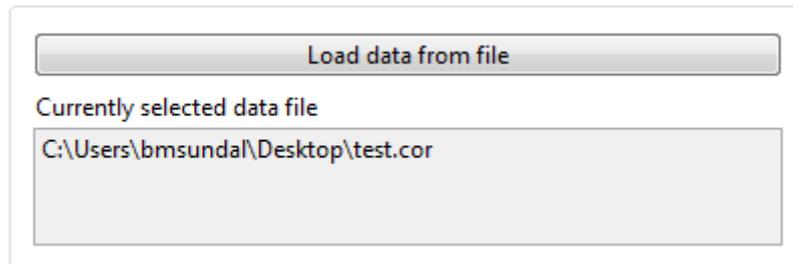


Figure 3-6: The name of the currently active data file appears under the load buttons.

Some overall summary data from the file will appear in lower half of the 'Load data' tab. An example is shown in figure 3-7, based on the example data file 'example-data-file.cor'. On the left is seen a plot of the radon concentration day by day for the full length of the measurement period found in the data file. At the right side of the plot is a summary section for this plot, giving the start time, end time, mean radon concentration in the whole period and average radon concentration in the part of the week defined as the 'work time'. For 'work time' see more details later in this manual.

If the data file has earlier been used to generate a report, the last selected report time interval is highlighted by using a green background color in the plot. This is seen in figure 3-7 where not all of the data set is in green background color.

Pro monitors and the length of the data set

Concerning the amount of temporal data that a Pro can store, the basic guideline is that temporal data with hourly time resolution is available for up to 11 weeks in older models. When the older Pro has been running in the current measurement period (since first startup or since last reset) for more than 11 weeks, there will be less and less available data at hourly time resolution. After about a year, there will be stored only temporal data at hourly resolution for only the last two weeks. Data at a time resolution of one day will be available for up to 80 weeks.

Since the Pro is typically used to study temporal variation in the radon concentration throughout a time period of several days or weeks we recommend that no data sets acquired should be longer than just above 10 weeks. To be able to study weekly variations we also recommend that no measurement is shorter than 1 week.

Newer Pro models (with USB cable interface) can store data with an hourly resolution for up to 10 years. For this reason it is no reason to limit the data set to max 11 weeks like we recommend for older Pro's. Newer Pro models can indeed be used to measure the true annual temporal profile for a location with a time resolution of one hour.

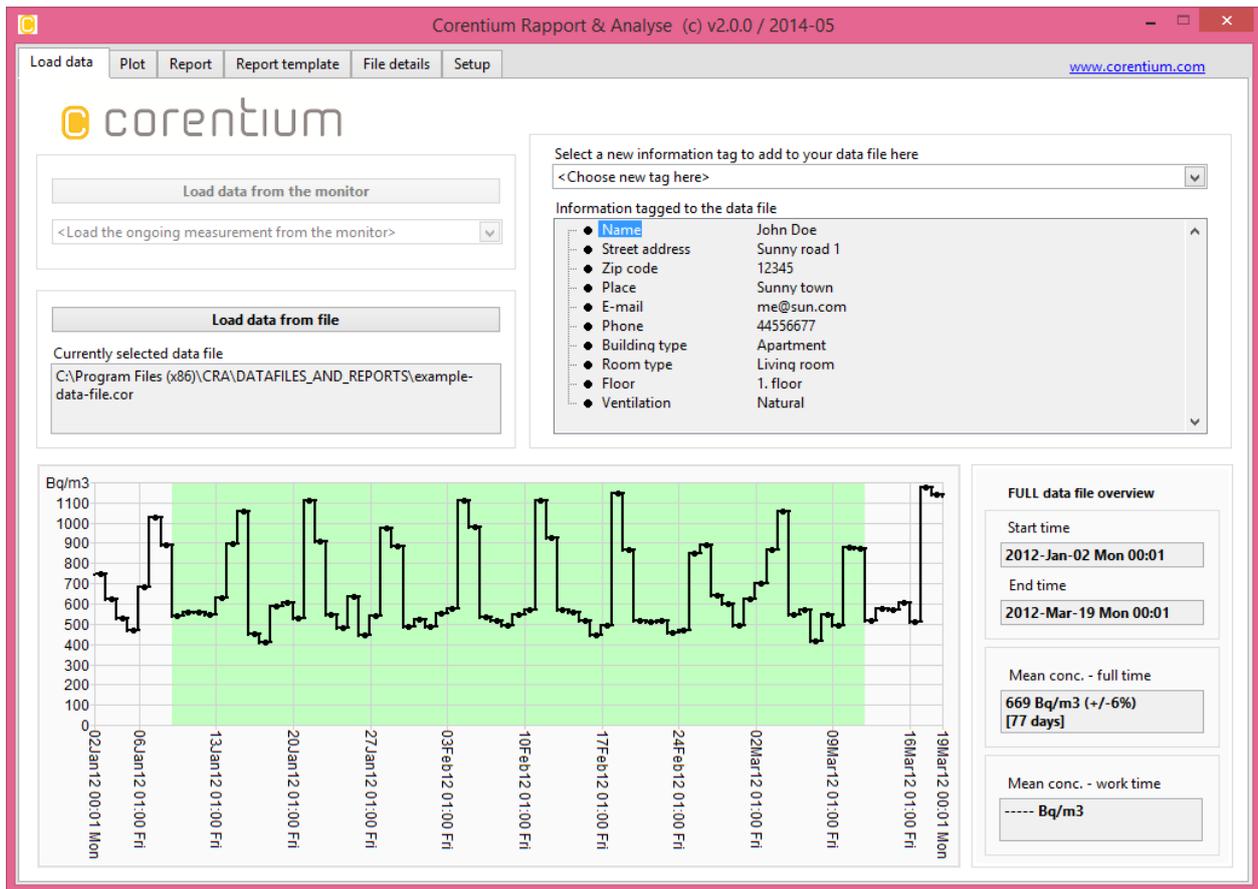


Figure 3-7: Basic summary that appears after loading data into the CRA SW.

3.4 Tag comments and other information to the data file

When a data file has been loaded (either by loading a Pro monitor and storing its data in a file or by loading an older file) it is possible to tag additional information to this data file ('meta-data'). The information that can be tagged to the file is typically similar to data that one would tag to files taken by a digital camera. Examples are: name, address, place, country etcetera.

Select a new information tag to add to your data file here

<Choose new tag here>

Information tagged to the data file

Tag name	Tag value
● Name	John Smith
● Street address	Sunny road 1
● Zip code	12345
● Place	Sunny town
● E-mail	me@sun.com
● Phone	44556677
● Building type	Apartment
● Room type	Living room
● Floor	1. floor
● Ventilation	Natural

Figure 3-8: The tagging of additional information (meta-data) to your data file.

It is the upper right part of the 'Load data' tab that is used to tag information to the currently selected data file. This part is shown in figure 3-8.

Here we observe that this file already has many information tags added to it. For example a field called 'Name' with a value of 'John Doe'. Another example is 'Phone' with the value of '44556677'.

To alter a tag, just double-click a tag line and a menu will pop up that allows you to modify it. This is seen in figure 3-9. On this pop-up menu the button 'Delete this information tag' at the bottom will delete this tag from the currently selected data file. Press OK when the tag has been altered, or you can alternatively use the pull-down menu at the top of the window to go to another info-tag one would like to change.

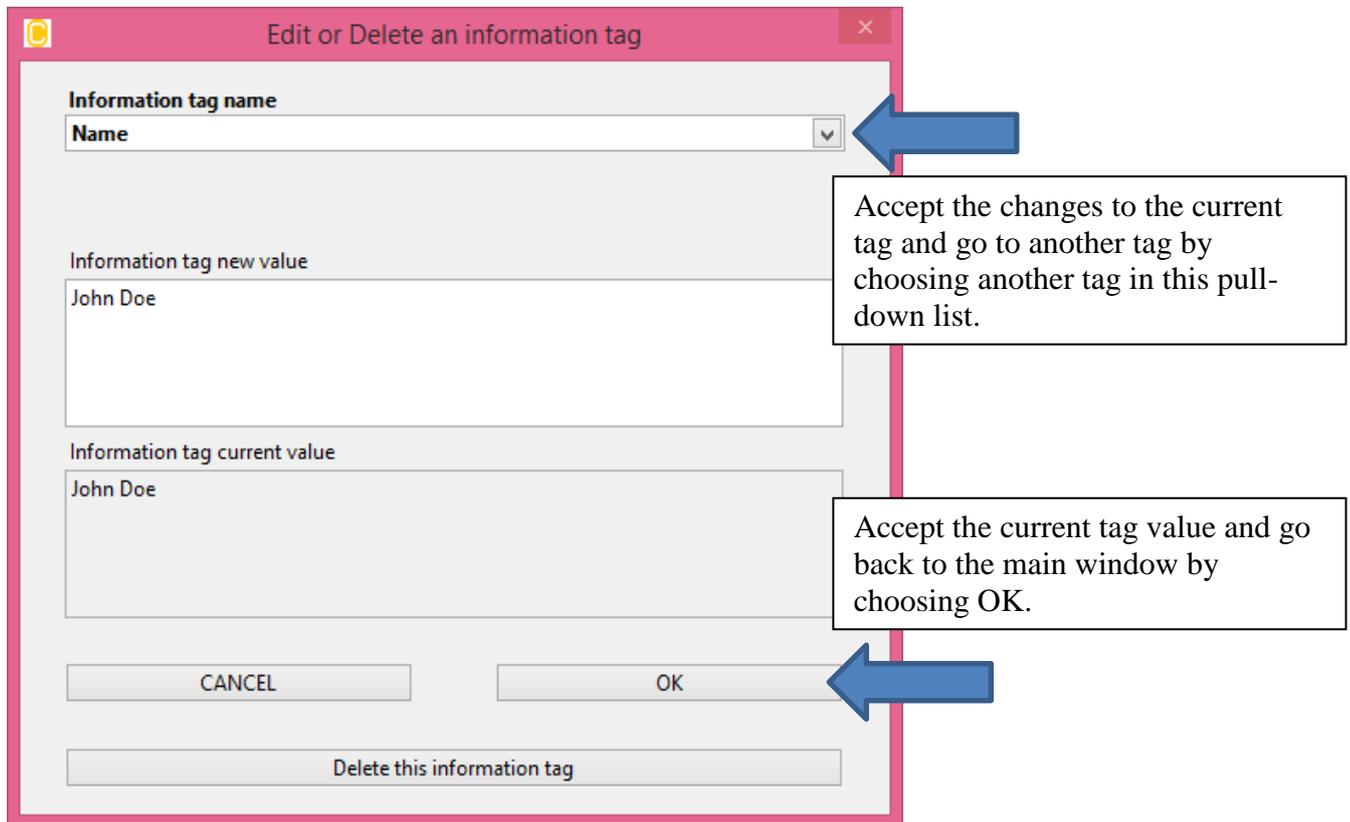


Figure 3-9: Pop-up menu to allow the user to edit an information tag or to delete it completely from the current data file.

3.5 Information tags and reports

In the list of information tags some (or all) may be marked by a solid bullet at the start of the tag line. This just means that this type of tag is in use in the current report template that is chosen (more on generating reports and using report templates later in this document).

3.6 Existing information tag types and how to make new ones

For adding a new information tag to the data file, use the drop-down list 'Select a new information tag to add to your data file here' found at the top of figure 3-10. This drop-down menu has many pre-defined information tags. These tags are relevant to set the user, the location, type of ventilation etcetera (see figure 3-10).

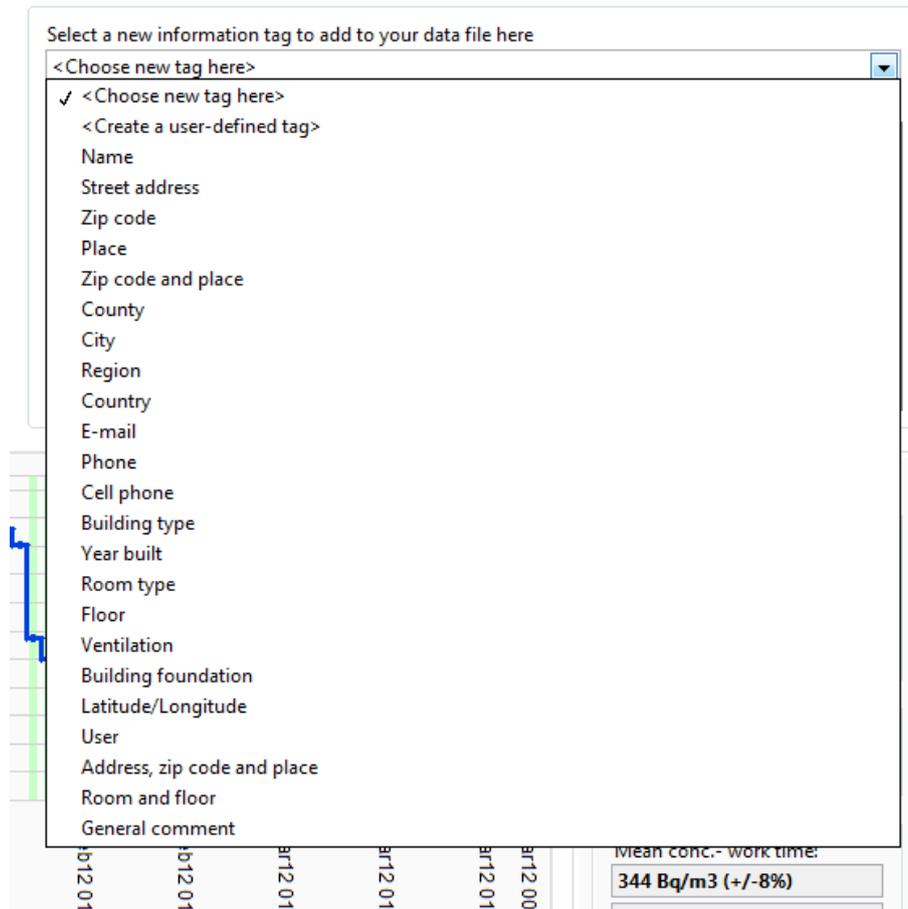


Figure 3-10: Pre-defined information tags.

In addition one finds that the second element in the pull-down menu is <Create a user-defined tag>. If this one is selected, a pop-up window will allow you to define a new information tag type that could be used for the data files. An example could be your company's serial number for the monitor, another example could be the company name if the measurement takes place at a workplace.

Figure 3-11 shows the user about to create a new tag type called 'Company name'. After the new tag type has been created it will now be found at the bottom of the drop-down menu and may be added to the current file (or to other data files).

Figure 3-12 shows the user adding this new tag type ('Company name') to the current data file. One will see the Company name appear as one of the tag items. It is possible to change the order of tags by dragging the tags at any position in the list. Figure 3-13 shows the tag list after the Company name has been dragged to second position in the list and the user has double-clicked the item to set the value of the 'Company' field to 'Corentium'.

The name of the new information tag type you want to create

Company name

Accepted name - extra spaces and multiple lines are not allowed

Company name

CANCEL OK

Figure 3-11: The user adding a new information tag type.

Select a new information tag to add to your data file here

<Choose new tag here>

- ✓ <Choose new tag here>
- <Create a user-defined tag>
- Name
- Street address
- Zip code
- Place
- Zip code and place
- County
- City
- Region
- Country
- E-mail
- Phone
- Cell phone
- Building type
- Year built
- Room type
- Floor
- Ventilation
- Building foundation
- Latitude/Longitude
- User
- Address, zip code and place
- Room and floor
- General comment
- Company name
- Company name

Figure 3-12: The user selecting a (user defined) information tag to the currently selected data file.

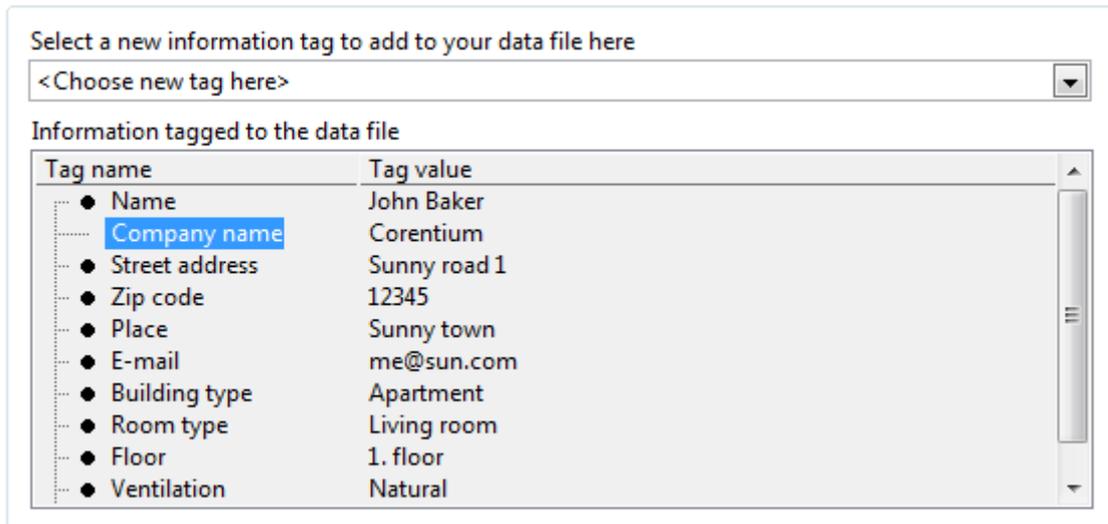


Figure 3-13: The user has created a new tag type ('Company name'); added the tag type to the current data file, and set its value to 'Corentium'. Then the tag item was dragged to second position in the list, just after the tag item 'Name'.

3.7 Read an older measurement from a Pro monitor

In a Pro monitor the user can read older data sets stored in the monitor (i.e. data sets acquired prior to the last reset). This is done by first checking if older data sets are available in the memory of the monitor by using the second line item in the pull-down list under the 'Load data' button in figure 3-14.

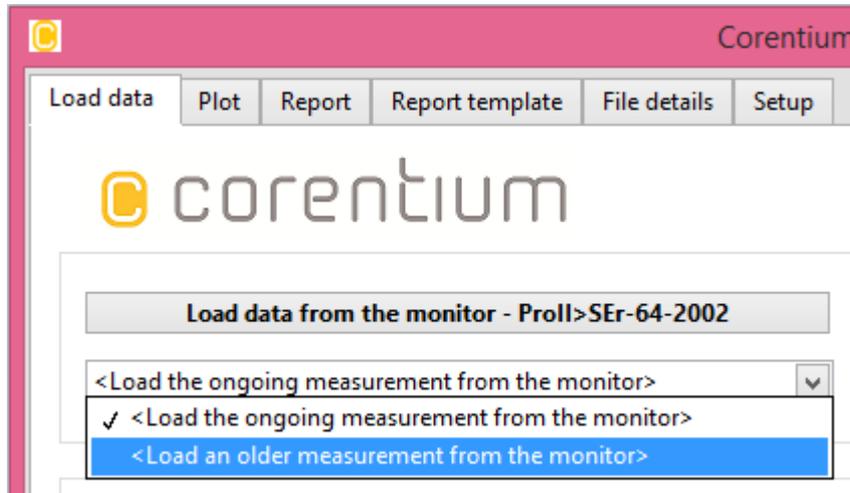


Figure 3-14: Look for older data sets in a Pro monitor.

When one selects this item (<Load an older measurement...>) a progress bar similar to the one in figure 3-3 will appear. When it is finished the list will change appearance and look similar to figure 3-15, where older data sets (if available in the monitor) will be shown. The data sets are in chronological order with the newest data sets at the top. Now the user just selects one of these sets in order to read it into the SW.

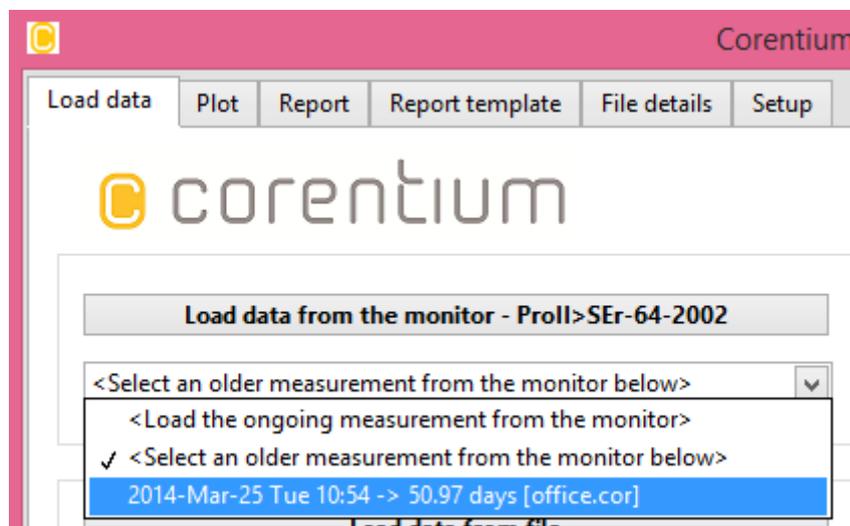


Figure 3-15: Choose an older data set from the Pro monitor.

If the older data set has been read before, the file name it got last time it was read out will be shown in parenthesis behind its start time and duration. In the example in figure 3-15 we see that the data set that was started on March 25 at 10:54 is almost 51 days long and was last saved to file as 'office.cor'.

3.8 Combining data sets from multiple monitors

If multiple Canary monitors have been placed at the same location the data from these monitors can be combined to form a virtual instrument with lower measurement uncertainty than what the individual monitors have. Corentium has a pending patent related to this SW feature.

This is done at the time the button ‘Load data from file’ is pushed. If you navigate to a folder that contains multiple cor-files and choose the whole folder rather than an individual cor-file, all the files will be combined to one data set. See figure 3-16 how the loading of multiple data files is done.

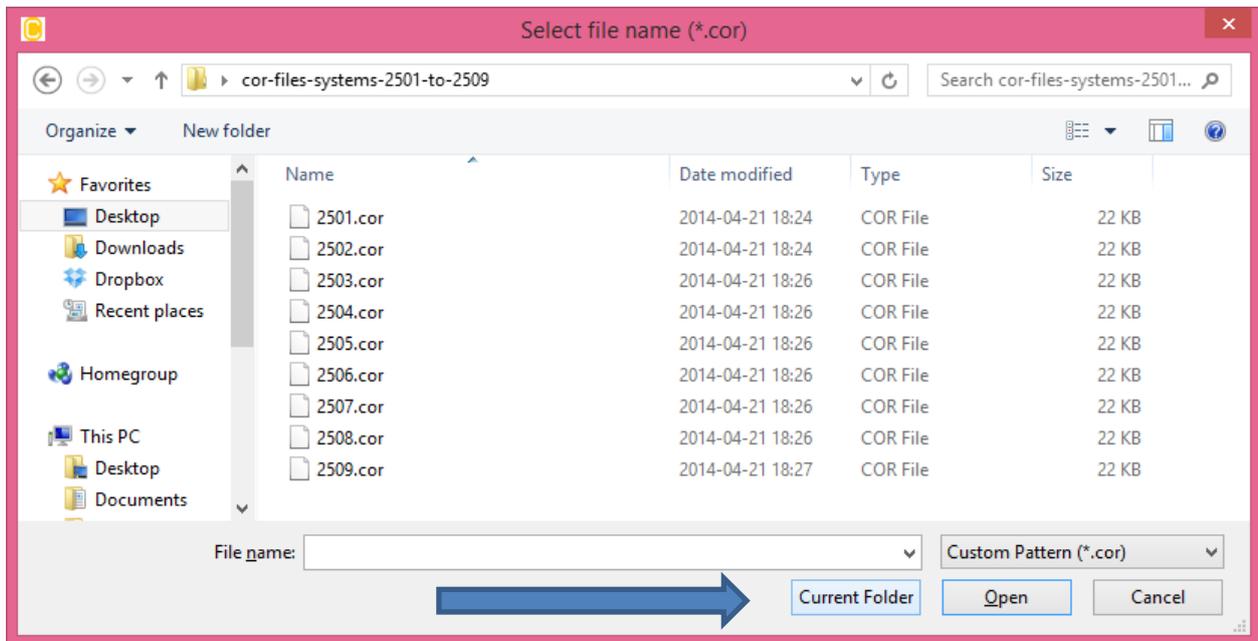


Figure 3-16: Combine data from multiple monitors by choosing ‘Current folder’-button rather than selecting an individual cor data file with the ‘Open’ button.

The SW folder C:\Program Files\CRA\DATAFILES AND REPORTS contains a sub-folder, ‘profile-merging’, that can be used to demonstrate this feature. In this folder data from 9 monitors that measured in the same location and in the same time interval. You can load individual files and look at these, or at load time select the whole folder and see the combined/merged measurement result. If you enable uncertainty indication in the plots you would observe that the uncertainty of each measurement point in the plot is smaller for the combined data set.

4 How to use the 'Plot' tab

The purpose of the 'Temporal plot' tab is to allow the user to plot the radon concentration as it has varied over time, and to zoom and pan in the time series by using the keyboard arrow keys or by right-click and drag towards right (zoom in) or towards left (zoom out) in the plot.

4.1 Select daily or hourly temporal data

One can select which temporal data to plot, either temporal data at an hourly resolution or at a daily resolution. This is selected by using the drop-down menu at the upper left part of the 'Temporal plot' tab, see the red arrow in figure 4-1.

The drop-down menu offers the choice 'Day-by-day plot' to select time series with a daily resolution, and the choice 'Hour-by-hour plot' to select time series with hourly time resolution.

Daily resolution means that each data point shows the average radon concentration over a full day (i.e 24 hours). Hourly resolution means that each data point shows the average radon concentration over an hour interval.

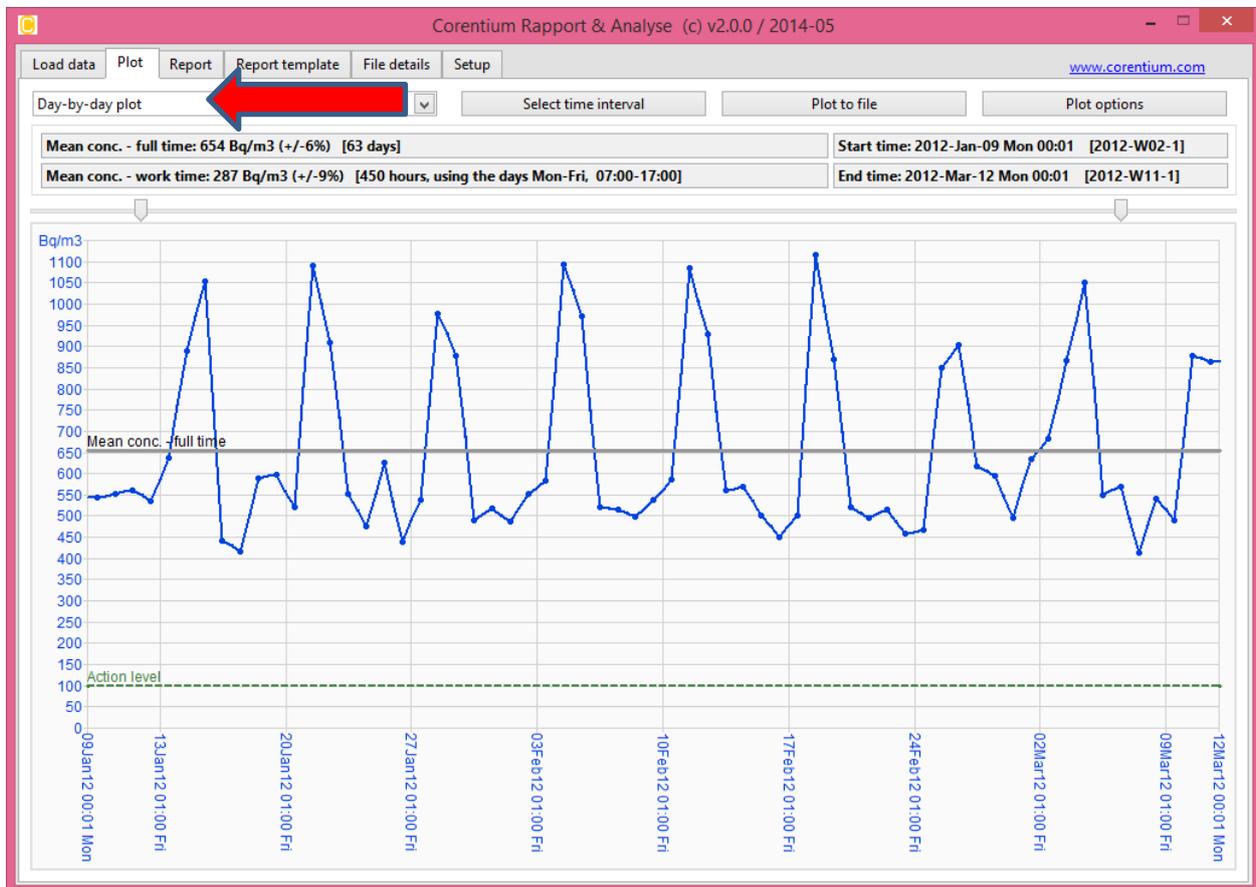


Figure 4-1: The 'Temporal plot' tag of the CRA SW. The drop-down menu where one selects either daily or hourly time series is indicated with a red arrow. Averaging plots (described later) can also be selected with the same drop-down menu.

4.2 Select the time interval to plot

In addition to choosing which data to plot (hourly or daily) one can also choose the time interval to plot by pushing the 'Select Time Interval' button. By default the plot is showing the full time interval available from the data file (or in case for Pro when more than 11 weeks of data has been acquired, for the part of the data set that has hourly data available).

We will now as an example plot a selected month of data. Figure 4-2 shows the window that pops up when pushing the 'Select Time Interval' button and we have as an example picked out a time interval that is the first 28 days of February 2012.

The selected times are shown in large bold font in the pull-down lists below the texts 'Currently selected start time' and 'Currently selected end time'. The duration of the selected time interval is seen just above the CANCEL/OK buttons. This is the full amount of days and hours between the start and end time.

Figure 4-2: The window for changing the report time interval.

Above each pull-down list is an arrow that can be dragged towards left or right in order to change the selected time.

One can use the 'filters' found below the pull-down lists as well, these are marked 'Year-Month', 'Day', etcetera. From these one can select specific months, day of month, week day etcetera or to clear the field by choosing the uppermost item in the list that clears the selection.

If you use these 'filters' and there are less than 30 choices left, each of the choices will be available by clicking directly on the fields that show the currently selected time. This is seen in figure 4-3.

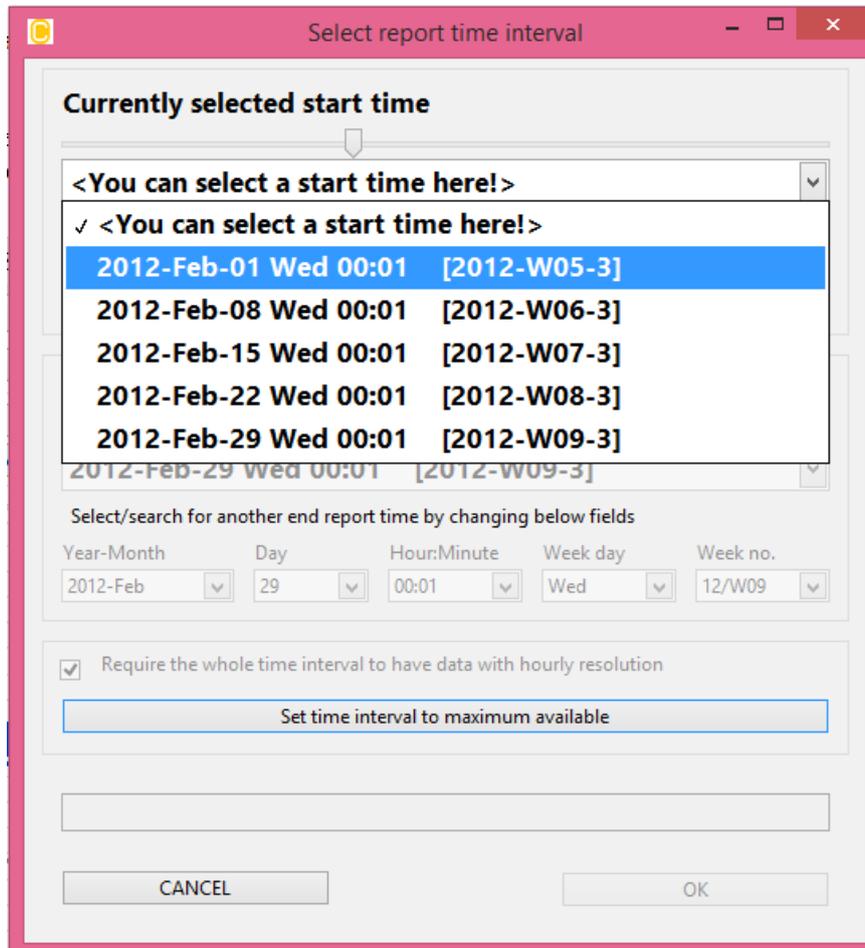


Figure 4-3: Selecting a time interval from the pull-down list if a limited amount of choices are left.

The window has a button for setting the time interval to the maximum possible time interval available from the data set, this button is named 'Set time interval to maximum possible'.

After you have selected the time interval shown in figure 4-2 and pushed the OK button the plot should appear as in figure 4-4.

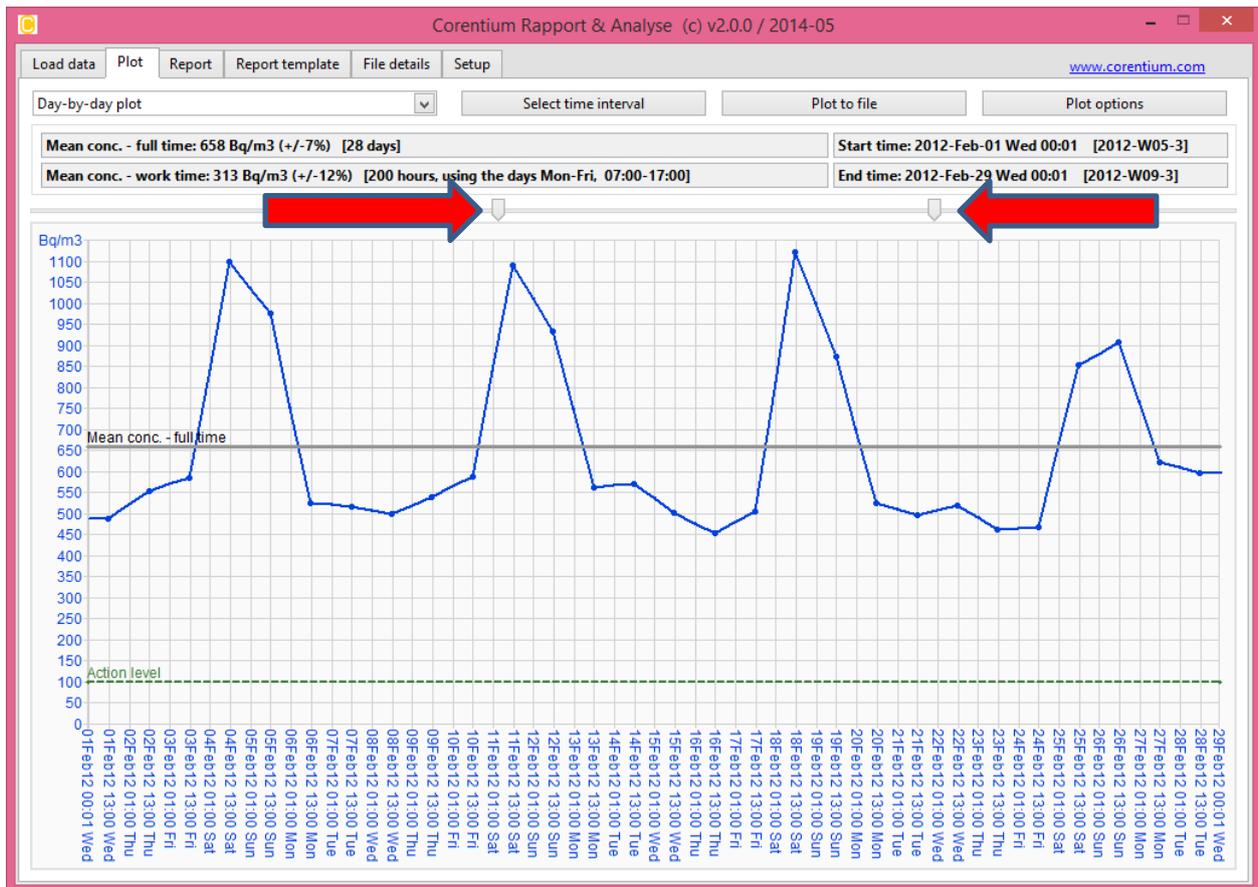


Figure 4-4: The 'Temporal plot' after having selected a time interval of 28 days from 01Feb until 29Feb.

4.3 Using the arrow keys to zoom and pan in the temporal plot

In addition to selecting the time interval to plot as described in the previous section, one can also select a time interval by pulling the time selectors (read arrows shown in figure 4-4) or using the arrow keys on the keyboard. The function of each keyboard key is described in the following table.

Key	Function
<u>Home</u>	Go back to original view were the full measurement time interval is shown.
<u>Arrow up</u>	'Zoom in' and show a smaller time interval. The center of the new time interval will be at the time where the mouse is pointing.
<u>Arrow down</u>	'Zoom out' and show a larger time interval. The center of the new time interval will be at the time where the mouse is pointing.
<u>Arrow left</u>	'Pan left'. Keep the observed time interval as long as it is, but show a time interval that starts earlier than the current time interval.
<u>Arrow right</u>	'Pan right. Keep the observed time interval as long as it is, but show a time interval that starts later than the current time interval.

Table 4-1: Shows the function of each of the keyboard keys that can be used to zoom and pan in a temporal plot.

One can zoom in the plot as well by clicking inside the plot with the right mouse button at the desired start time and dragging towards right and release the button at the desired end time. This is

shown in figure 4-5.

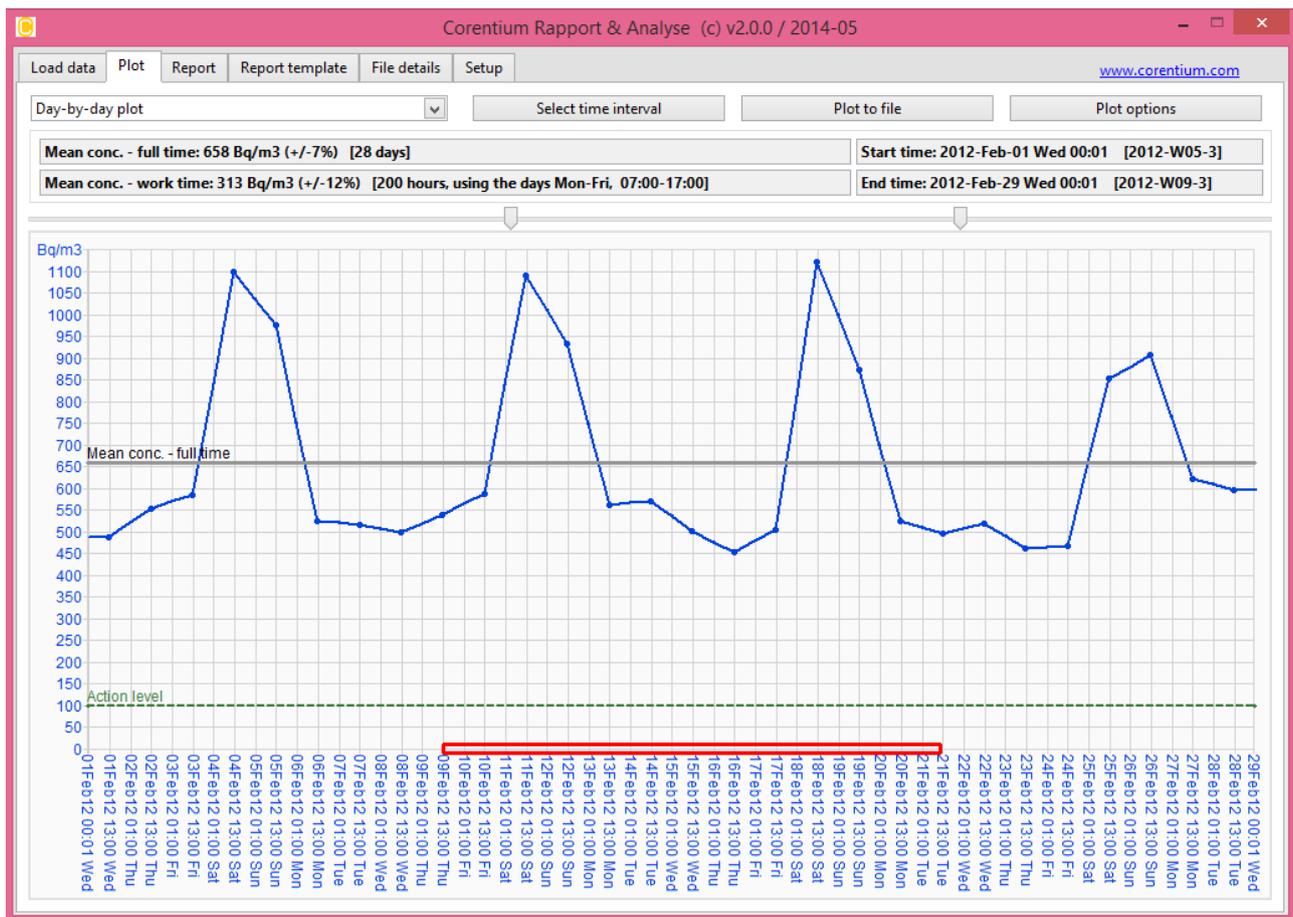


Figure 4-5: When zooming with the mouse left click at the desired start time and drag towards right to zoom in and towards left to zoom out.

To zoom out you left-click with the mouse and drag towards left instead. It will then select the next larger standard time interval.

4.4 Using the 'radon calculator'

Just above the graphical plot on the 'Temporal plot' tab there is an enclosed text field referred to as the 'radon calculator' (figure 4-6) that calculates the average radon concentration for the time interval that you have currently selected.

Mean conc. - full time: 658 Bq/m3 (+/-7%) [28 days]	Start time: 2012-Feb-01 Wed 00:01 [2012-W05-3]
Mean conc. - work time: 313 Bq/m3 (+/-12%) [200 hours, using the days Mon-Fri, 07:00-17:00]	End time: 2012-Feb-29 Wed 00:01 [2012-W09-3]

Figure 4.6: The 'radon calculator' on the 'Plot' tab.

The calculator shows at the left the mean radon concentration (Bq/m³) in the whole time interval as well as the part of the time interval defined as the work time. On the right the 'calculator' shows the If one looks at a plot with daily resolution one may be interested in finding the radon concentration only on week days Monday through Friday, or as another example to look at the concentration only on Mondays.

It is the text field 'Mean conc. – work time' (figure 4-6) that shows which parts of the week that is used in the radon concentration calculation for the work time. In this figure the time interval is

listed as **‘200 hours, using the days Mon-Fri, 07:00 to 17:00’**. ‘Mon-Fri’ means that week days from Monday through Friday are included. We see that the average radon concentration is 302 Bq/m³ in the work time. But, the average radon concentration in the whole period is more than twice as high at 635 Bq/m³.

To change which days of the week and which hours of the day is included in the work time calculation you must change those one the **‘Report’** tab.

We can now change the plot from daily to hourly resolution.

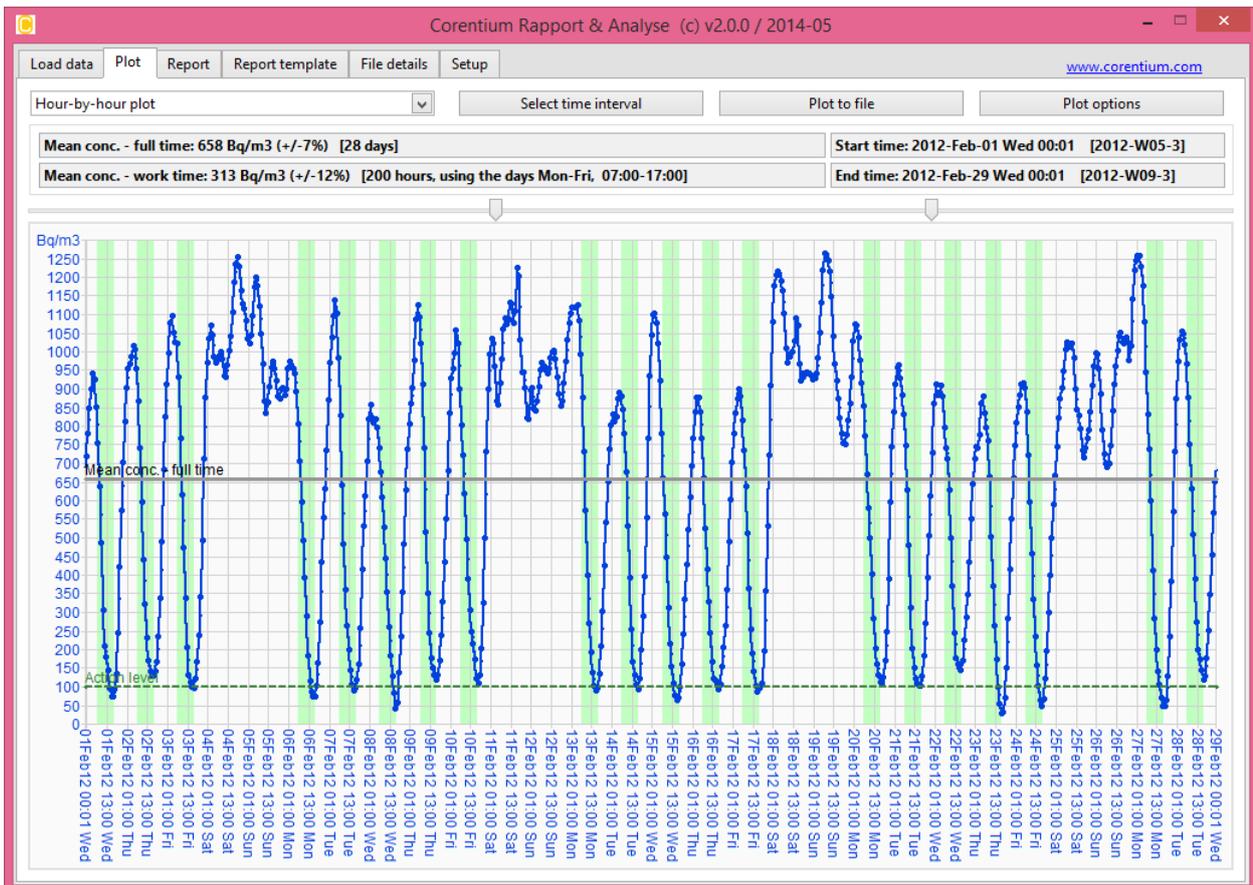


Figure 4-7: The plot from figure 4-5 now shown with hourly time resolution.

Note that the part of the measurement data included in the calculation is marked with a different background color than the rest of the data. As standard background color for included data we use light green were as non-included data has white background.

These colors can be change by using the button **‘Plot options’** in the upper right corner of the **‘Plot’** tab. More details about this button in the next sub-chapter.

4.5 Select the plot options

The **‘Plot options’** button in the upper right corner of the **‘Plot’** tab allows you to alter the various plot options, such as plot color, plot line thickness etc. The pop up window is showed in figure 4-8.

Most options in this window are self-explanatory. However, some of the features deserve a closer explanation. These are the **‘Data smoothing’** setting and the **‘Activate the error bar’** setting.

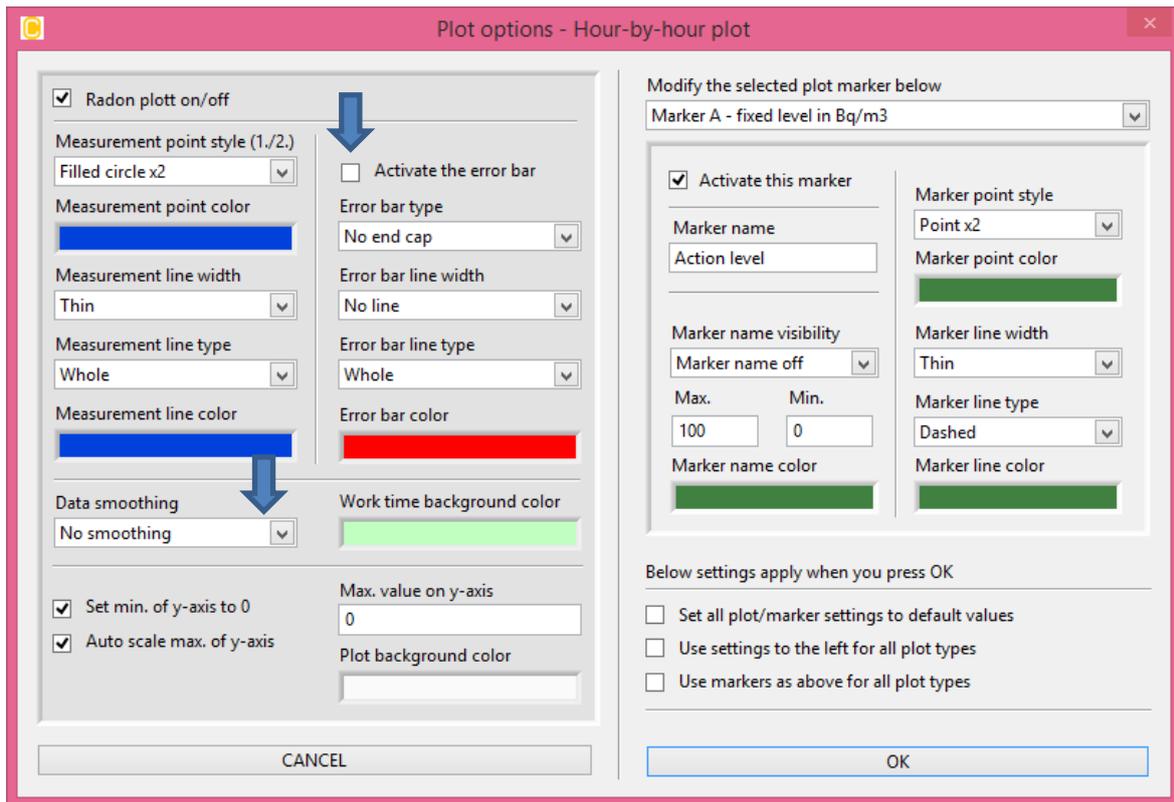


Figure 4-8: Plot options. The settings 'Data smoothing' and 'Activate the error bar' are indicated with arrows.

It is earlier explained that each data point plotted is either the radon concentration over hours (in case hourly temporal data has been chosen) or over one full day (in case daily temporal data has been chosen). This is true only in the case the 'Data smoothing' has been set to 'None' as seen in the lower left part of figure 4-8.

However, in the 'Data smoothing' drop-down menu one can choose the number of hours to average over (if you are using hourly plots) or the number of days to average over (if you use daily plots). We can give an example with smoothing set to 3 days in a daily time series. If plotting a daily time series, the data point that is given for example for Feb 17th is in fact the average concentration of 3 days, i.e. the 16th, 17th and 18th of February. Similarly, in an hourly plot, the time interval for each data point is one hour, but when selecting smoothing of 6 hours it will be the average in the time interval of ± 3 hours around the indicated time point.

The 'Activate the error bar' setting will allow the plot to indicate the degree of uncertainty found in each data point in the plot. At low radon concentrations the measurement uncertainty is rather large. If considered too large, it is advisable to increase the data smoothing setting.

Figure 4-9 shows the same temporal plot as in figure 4-4, but this time with the error bar activated.

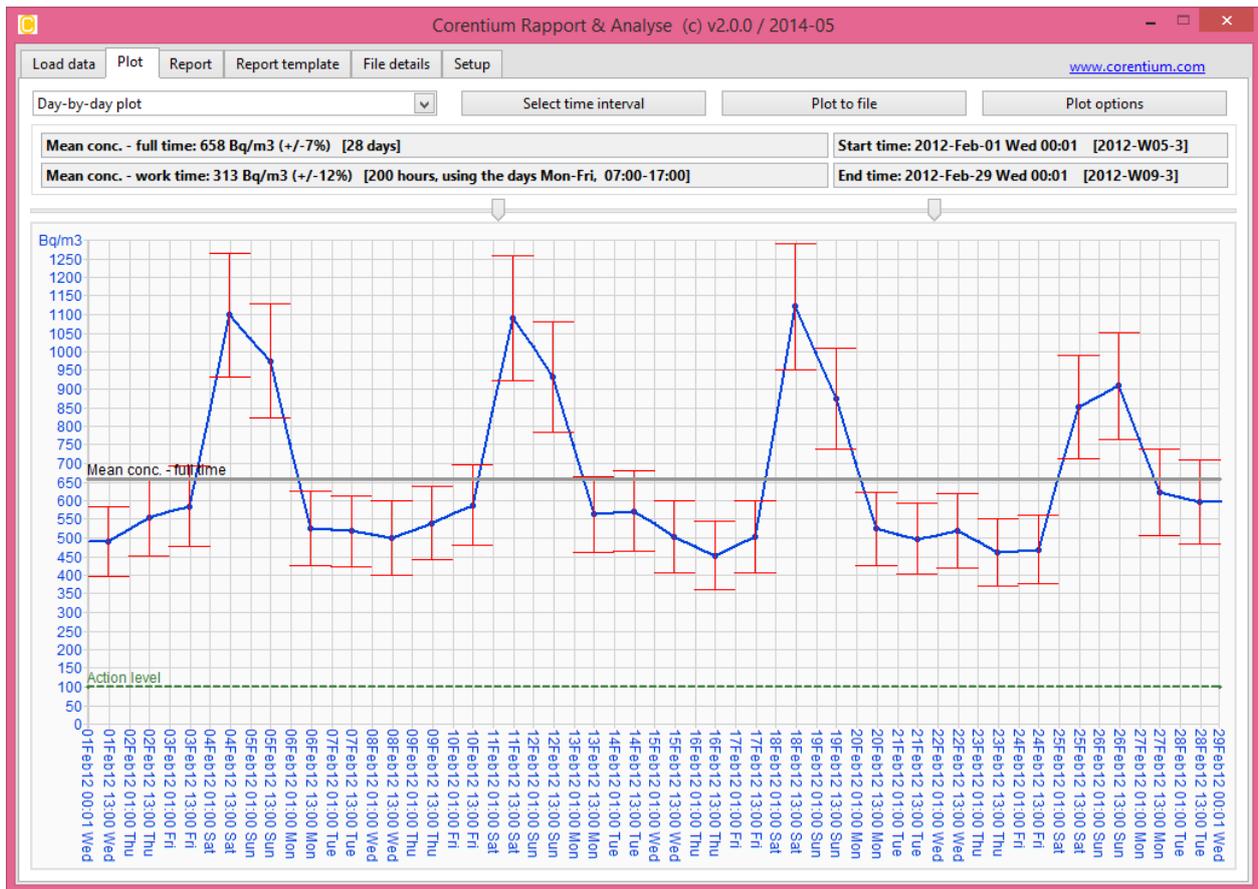


Figure 4-9: Temporal plot with the error bar activated.

The right part of the 'Plot options' window (Figure 4-8) allows to put additional information into the plot. There are minimum 5 possible types of information; each can be controlled by selecting the appropriate item in the drop-down list 'Select additional plot marker info' at the top right of the plot window. The five items are:

1. 'Fixed Bq/m³ marker A':
 - A fixed level marker. It can be used to mark for example the radon 'action level' used in the respective country.
2. 'Fixed Bq/m³ marker B':
 - A fixed level marker. It can be used to mark for example the radon 'max level' used in your country.
3. 'Marker – the average radon conc.':
 - A level marker that indicates the average radon concentration in the plotted time interval.
4. 'Marker – average work time radon conc.':
 - A level marker that indicates the average work time radon concentration in the plotted time interval.
5. 'Measure temperature'
 - The monitor measures temperature once per day. This information can be shown in the plot. If you have a newer Pro monitor the temperature is measured every hour.

If you have a newer Pro monitor the following sensors are also available with an hourly resolution:

6. ‘Measured relative humidity’:
 - Relative air humidity measured in percent (%RH).
7. ‘Measured pressure’:
 - Atmospheric pressure measured in milli-bar (mbar).
8. ‘Zenith angle’:
 - The angle between the normal vector of the front face of the monitor and the vertical. If the monitor is flat with the LCD display up it will show values close to 180 degrees, if it faces down it will show ~0 degrees, and if it is hanging it will show ~90 degrees.

For each of the makers one can select them as ‘active’ or not. Figure 4-10 shows what the plot looks like after having activated the fixed level markers A and B and set them to 100 and 200 Bq/m³, respectively.

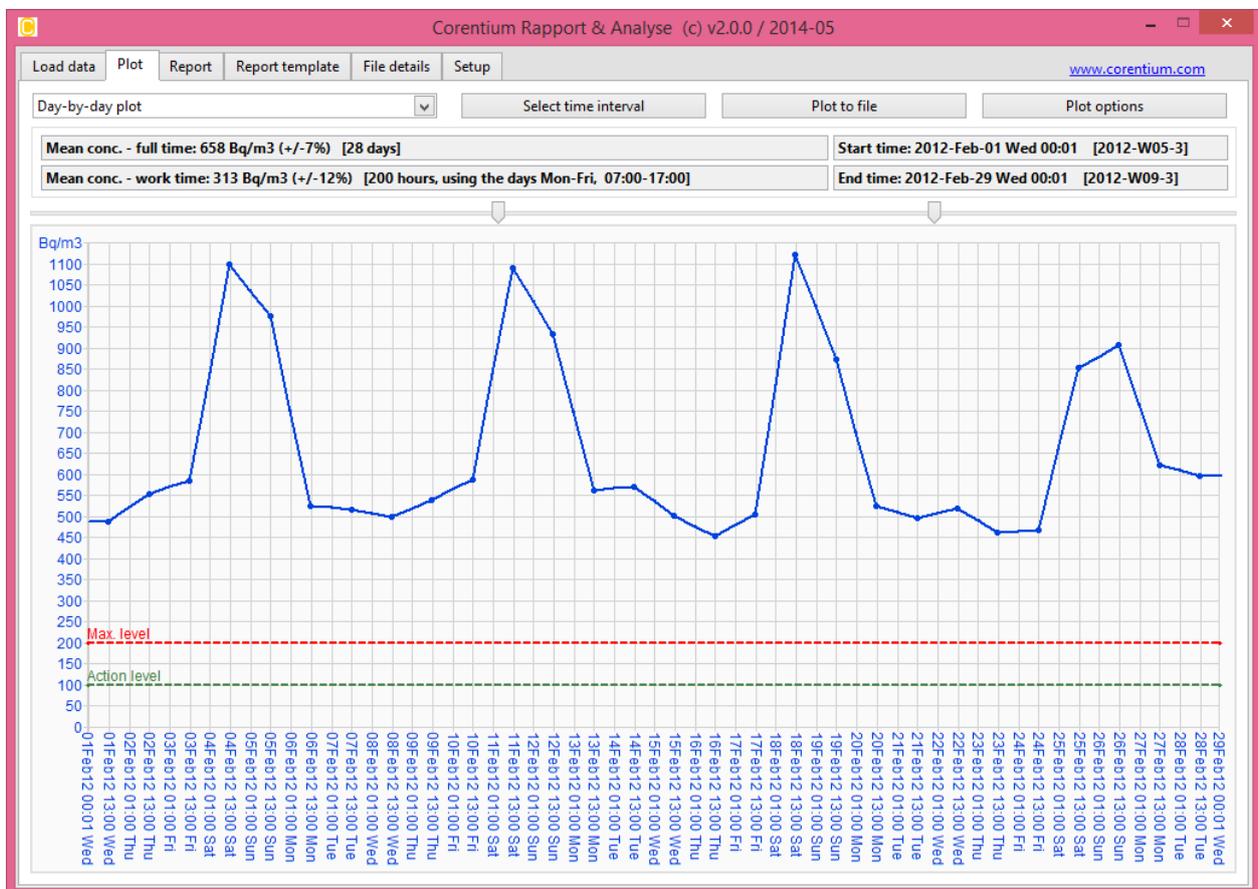


Figure 4-10: A temporal plot with fixed level markers activated.

4.6 How to use the averaging plots on the ‘Plot’ tab

In section 4.1 we described the use of the ‘Plot’ tab for plotting radon concentration in a time interval (temporal plots) by choosing the plot types ‘Hour-by-hour plot’ and ‘Day-by-Day plot’.

You find also two other plot types available, these are named ‘Average week plot’ and ‘Average day

plot'. These plot types allow you to plot the average/typical profile of the radon concentration for a week or a day.

The plot generated can be considered a typical week profile or a typical day profile for the whole time period selected. As an example, if the selected time interval is 9 weeks long the plotted average week plot will show the average of these 9 weeks, were as the average day profile will be the average of these $9 \times 7 = 63$ days.

4.7 Select 'typical week' or 'typical day' plot

One can select to plot 'typical' periods; 'Average week plot' or 'Average day plot'. This is selected from the drop-down menu in the upper left corner of the 'Week or Day plot' tab. This is illustrated for an 'Average week plot' in figure 4-11. Here we have chosen the first 28 days of February like we did in the earlier examples in this chapter.

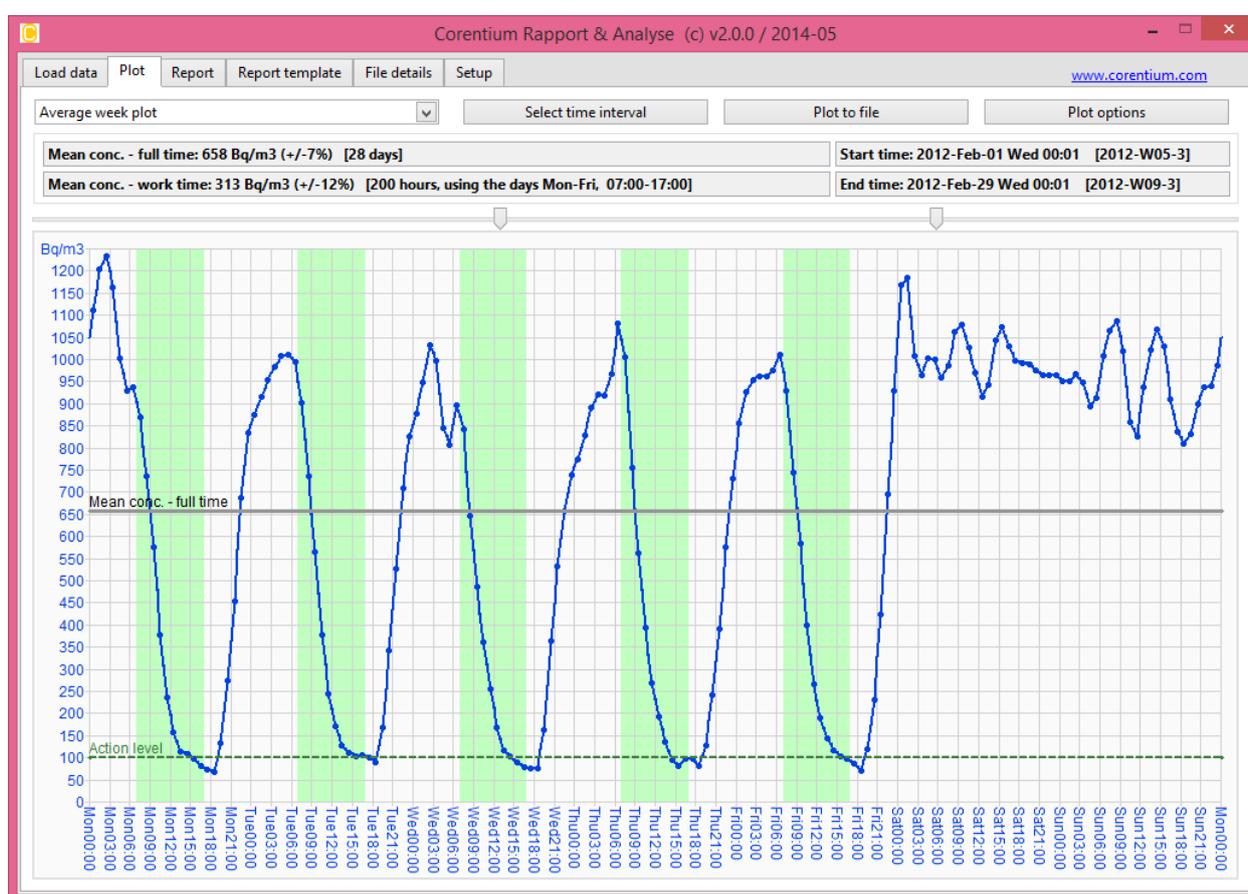


Figure 4-11: Typical week profile.

The plot shows how the radon concentration varies from 00:00 at Monday (midnight between Sunday and Monday) and for a complete week, i.e. the radon concentration plotted for every of the 168 hours that constitute a full week. The example shows a very distinct weekly profile, where the radon concentration is low during the daytime of Monday through Friday, while it is high during the nights and through the week-end. This is a typical profile found in work places and schools where the ventilation system is turned off outside of working hours.

In figure 4-12 we have chosen to show the average day in the same time period, but only the work days from Monday through Friday is included in this average day plot. Since the selected time

interval was 28 days (i.e. 4 full weeks) there are only 20 work days in this period included in this average day plot.

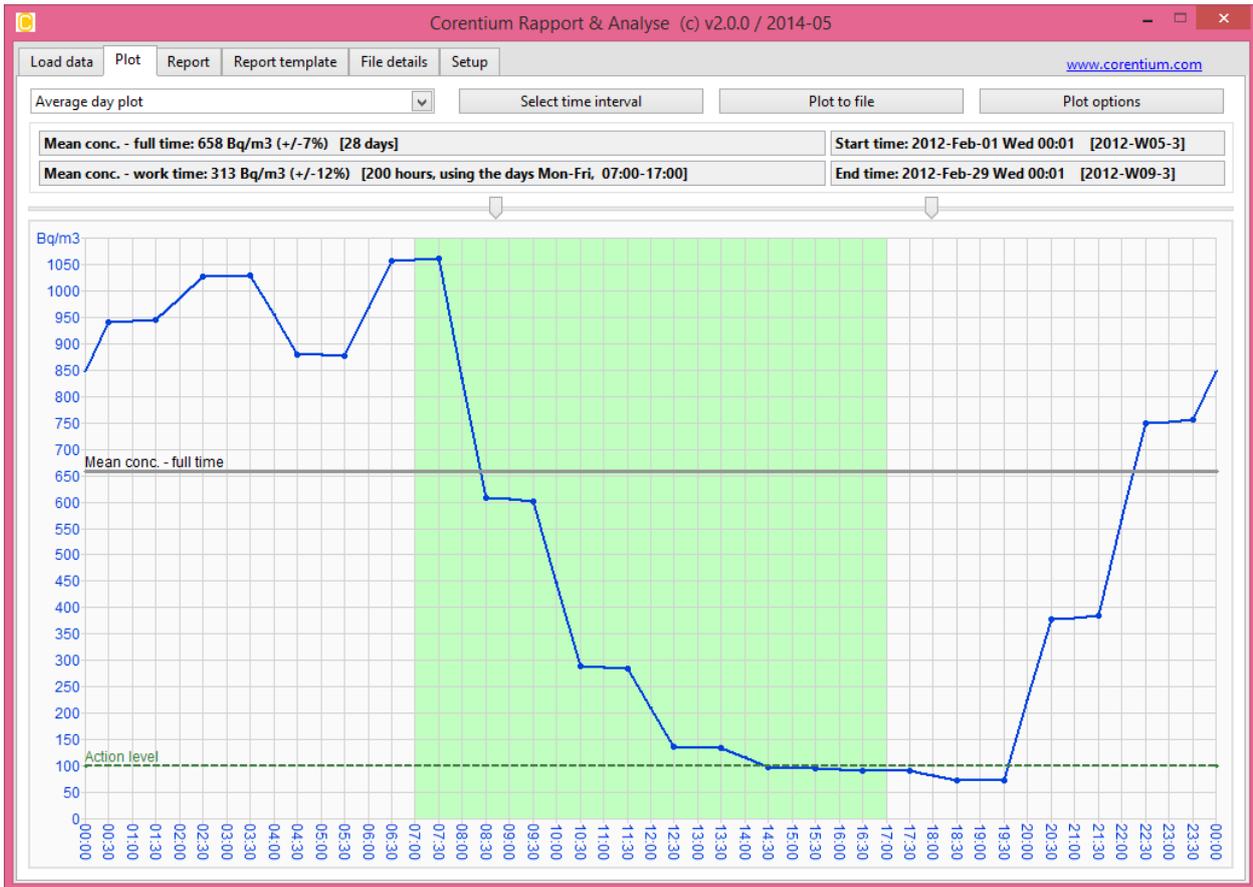


Figure 4-12: Plot of the average day for the work days in the period Feb. 1 until Feb. 29, 2012.

4.8 Exporting a plot to a spreadsheet file or an image file

The plot can be exported to a 'comma-separated' spreadsheet file (*.csv). The exported file can be opened in Microsoft Excel (or another spreadsheet program you prefer) in case one is interested in making own plots or doing own calculations of the data. The spreadsheet file is self-explanatory. Each column of data is explained in detail with a short one-line description at the start of the spreadsheet file. The file uses as default semi-colon to separate entries in the file.

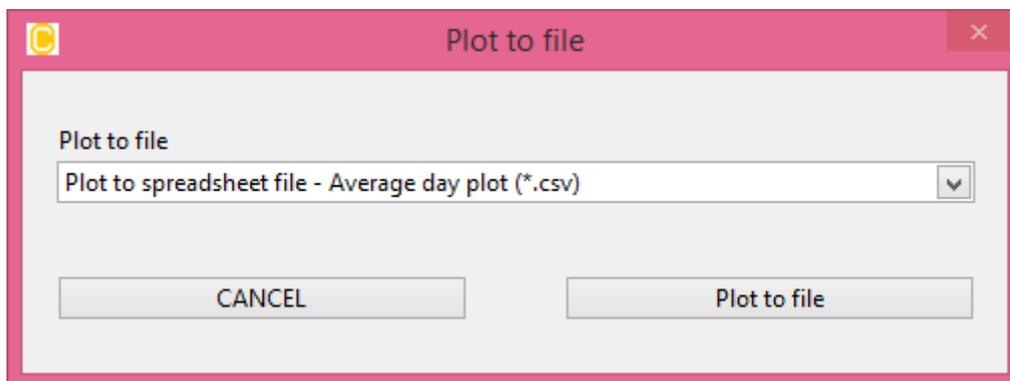


Figure 4-13: Export of plot data to spreadsheet file (or image file).

You can export the plot to an image file as well, the user can chose the image format. The formats supported are JPG, PNG and BMP image files. You generate the spreadsheet or image file by

pushing the button 'Plot to file' above the plot on the 'Plot' tab.

Figure 4-13 shows the menu window that pops up when you press the 'Plot to file' button. It is in the pull-down list on this window you select which file type to export to.

If you forget to give the file an extension it will be added automatically ((*.csv, *.jpg, *.png or *.bmp) depending on which file type you have selected.

4.9 Click in a plot to read off radon concentration values

By clicking in a plot a small pop-up window will appear. The pop-up window shows the time and radon concentration for the clicked point. The clicked value is marked in the plot with a red circle. One can close the pop-up window by clicking its close symbol (X) in the upper right corner of the window, see Figure 4-14: The window showing when you click in a plot. The radon concentration is given with the uncertainty and in bracket parenthesis the number of hours integrated over. In this example 6 hours, which means over a time interval starting 3 hours before until 3 hours after the time given. Further down is the value of the various sensors available given for the point in time closest to the clicked radon concentration value.. Clicking can be done in the plots on the 'Temporal plot' tab and on the 'Week or Day plot' tab, but not in the plot on the 'Load data' tab.

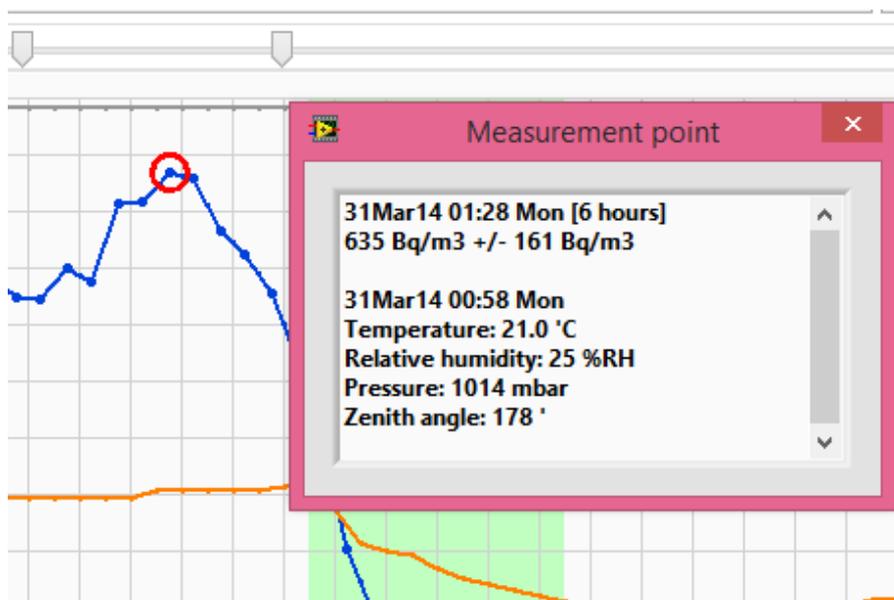


Figure 4-14: The window showing when you click in a plot. The radon concentration is given with the uncertainty and in bracket parenthesis the number of hours integrated over. In this example 6 hours, which means over a time interval starting 3 hours before until 3 hours after the time given. Further down is the value of the various sensors available given for the point in time closest to the clicked radon concentration value.

5 How to use the 'Report' tab

This chapter explains how to generate radon reports.

5.1 Generating the report

A major reason for using the CRA SW is to generate a report on the radon concentration conditions in a building. The 'Report' tab in the SW allows the user to do that.

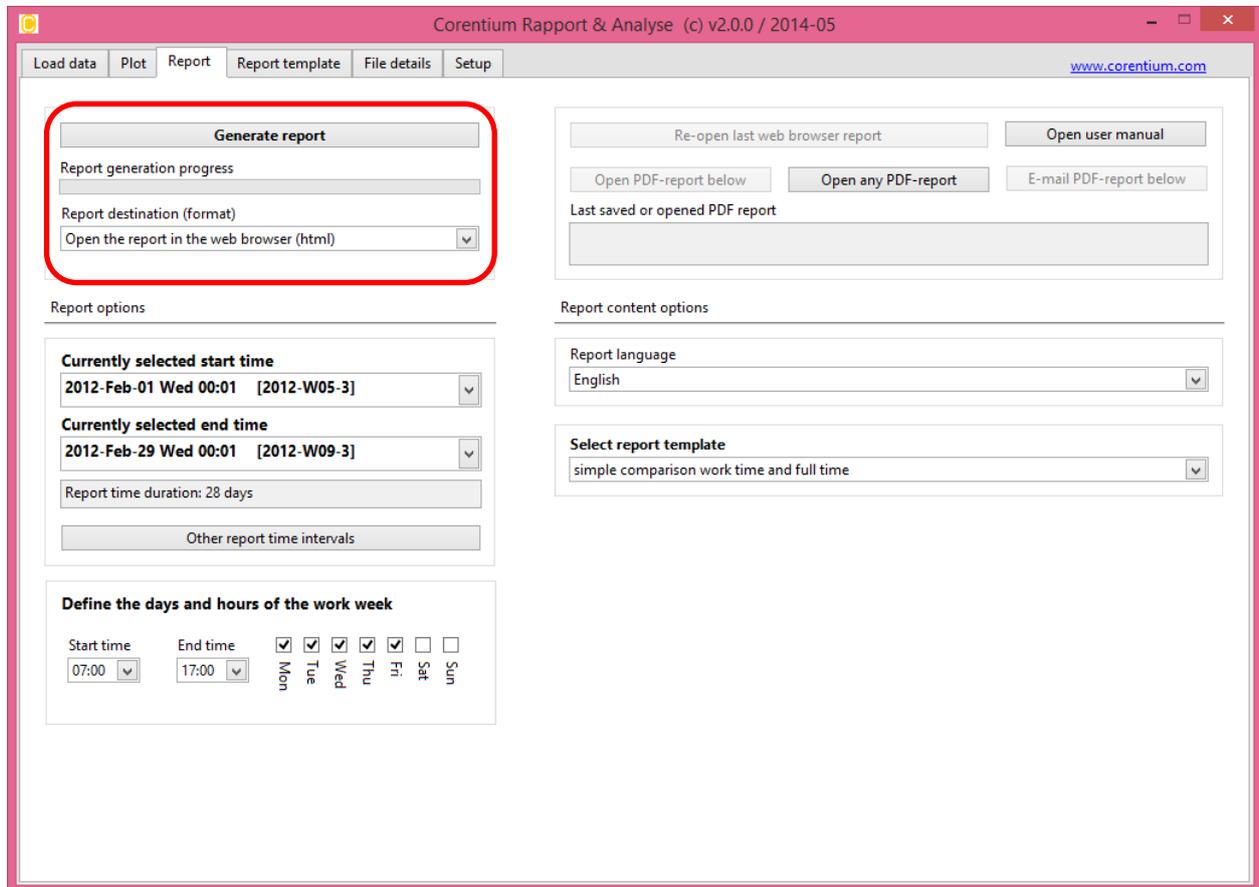


Figure 5-1: The 'Report' tab part of the CRA-SW. The parts related to report generation is highlighted with a red rectangle.

By clicking the 'Generate report' button a report will be generated in one of four different ways, depending on the setting of the 'Report Destination' drop-down menu:

1. Open the report in the default web browser
2. Send the report to a pdf file in color, you will be queried for a file name. By default the file name will be the same as the data file name, but with a *.pdf extension.
3. Like 2 above, but up to 24-bits of colors. This may lead to large size reports (>5 Mbytes) if many plots are included.
4. Similar to 2 and 3 above, but the pdf file will be in grey scale rather than in color.

These menu items of the 'Report' tab are enclosed in a red rectangle in figure 5-1.

The report can be opened in a web browser for inspection. For distributing it to a customer electronically one should use the generated pdf file. Printing the report to paper is best done by opening the report in Acrobat Reader and print it from there.

Alternatively one can print the report to paper straight from the web browser, but depending on which browser is used

and how it is set up, the quality can be quite different from PC to PC. It can also be printed to a pdf file from your browser if a pdf printer driver is installed on the computer (CutePDF is one such printer driver). However, also in this case the quality can be quite different from PC to PC. The experience is that printing the report directly to printer or pdf file from the web browser works best with the Firefox web browser.

For the rest of this chapter it is assumed that the user has already opened the report in the web browser and then later on generated a pdf version of the report.

5.2 Choosing the report content

The content of the report is defined by using report templates. Templates are selected in the 'Load existing template' pull-down menu found under the 'Report content options' column. See figure 5.2 where this part of the 'Report' tab has been highlighted with a red rectangle.

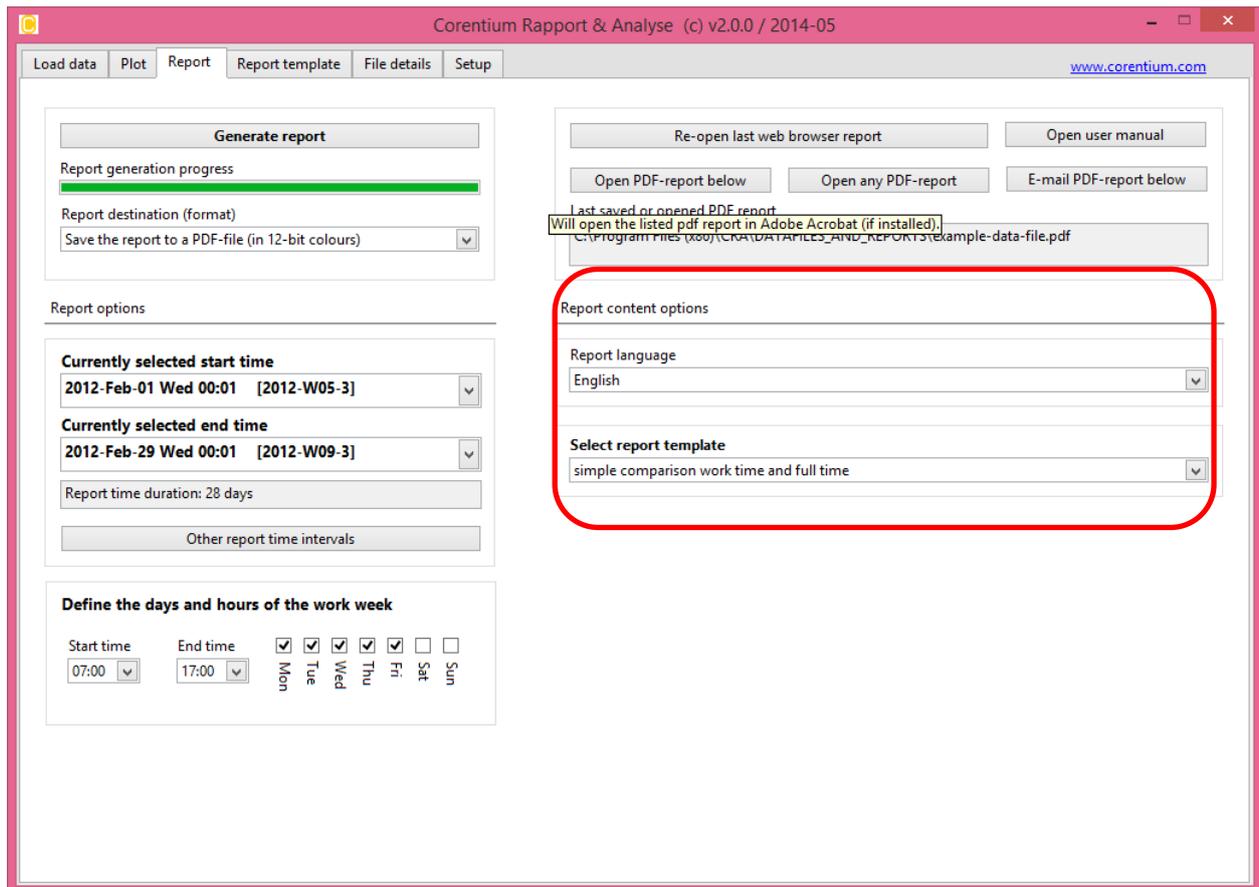


Figure 5-2: Report content setup.

The 'Load existing template' pull-down menu contains various report templates that should be sufficient for the typical user. Advanced users may wish to define their own report templates, or to modify one of the existing templates. This can be done from the 'Report Template' tab and is described in the next chapter.

The only other option that can be selected for the report content is the report language, found in the pull-down menu 'Report language'. In version 2.0 of the CRA-SW English, German, French, Swedish and Norwegian is supported as the report language.

5.3 Report options not set by the report template

The report options that are not defined in the report template are found in the left column 'Report options' on the 'Report' tab, see the part marked with a red rectangle in figure 5-3. These are the

options that define the time interval the report is based on, as well as the work time interval of the week (relevant if the report will contain some work time radon concentration numbers).

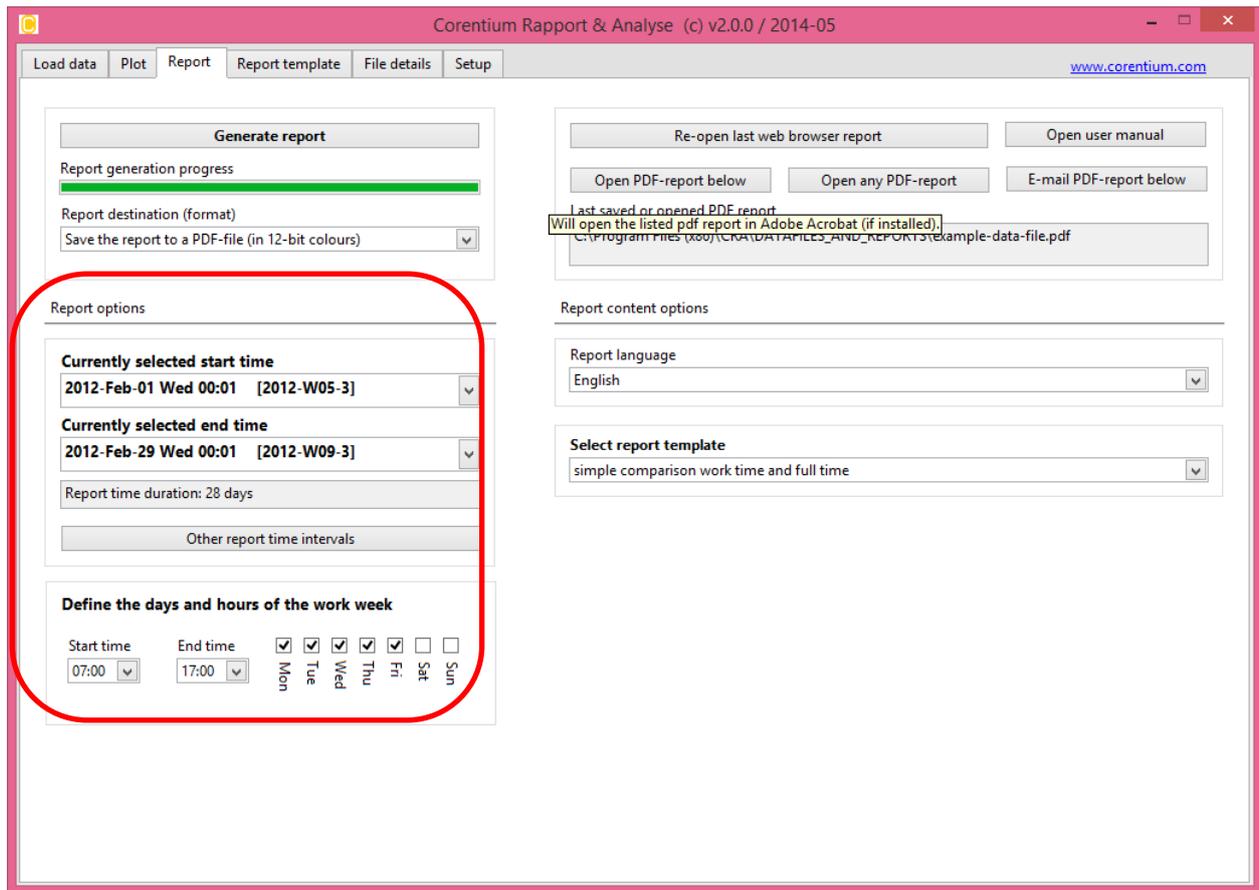


Figure 5-3: Report options not defined by the report template.

The report can contain report elements that give the average radon concentration for a certain time period. We can refer to this as the ‘**full average**’. However, parts of the report can give radon concentration for the ‘work time’ part of the week, for example one may also want to give the radon concentration for Mondays through Fridays from 08:00 in the morning until 17:00 in the afternoon. This can be referred to as the ‘**work time average**’

To setup the time interval for a ‘**full average**’ within two points in time one can use the button ‘Other report time intervals’ which will pop up the familiar window from figure 4-2. The currently chosen time interval is listed above the button. If you only want to adjust the start or end time up or down a few hours or days this can be done by clicking directly on the start and end times since these are really pull-down lists that allow you such adjustments. If you have a long measurement time we strongly suggest that you chose the total report interval as a whole number of weeks (i.e a multiple of 7 days, such as 7, 14 or 21 days), and if you do not have such a long report time try to choose at least a whole number of days. The reason is that the radon concentration has cyclic patterns were the dominating periods are one day and one week.

At the time that a data set is read in from a monitor (or an older data set from a file) the time interval is by default set to the full measurement period. For example if the monitor was in a location from Jan 15 until Mar 15 this will appear as the default time interval.

To setup the time interval used by the ‘**work time average**’ use the buttons (see figure 5-4) below the text ‘Define the days and hours of the work week’ on the ‘Report’ tab. Tick the week days, the start time of day and the end time of day you want to be included.

Define the days and hours of the work week

Start time	End time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
07:00	17:00	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Figure 5-4: Setting up the work time interval.

5.4 Support functions on the 'Report' tab

On the upper right part of the 'Report' tab there are a few buttons to make viewing and emailing reports simpler, see the part of figure 5-5 enclosed in the red rectangle.

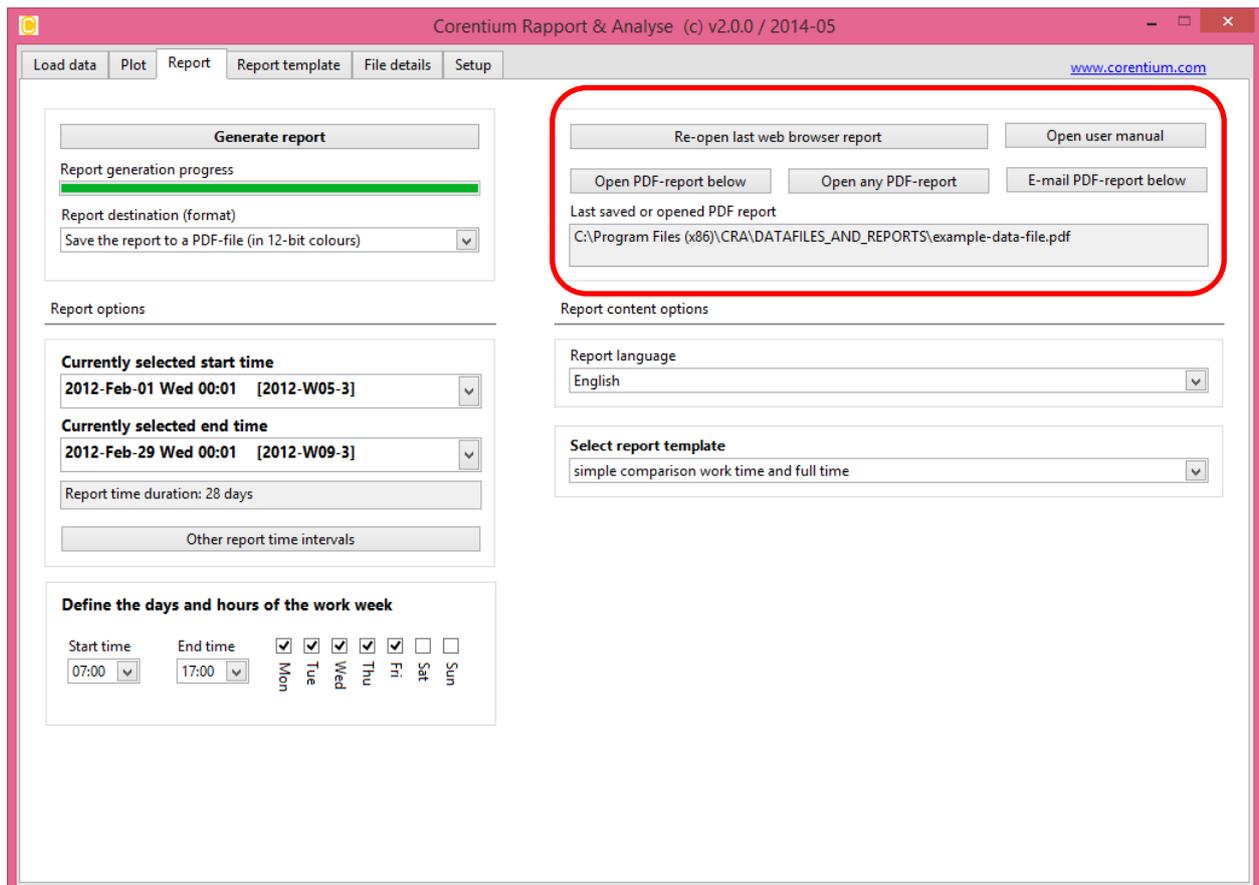


Figure 5-5: Support functions on the 'Report' tab.

The support functions are:

1. The 'Re-open last web browser report' button will re-open the last report opened in the web browser. Typically this button is used if the browser window is closed already.
2. The 'Open below pdf report' button opens the pdf report referred to in the text field 'Last saved or opened pdf report' in Adobe Reader. The file name shown in this text window will always be the last generated pdf report, or the last pdf report opened using the 'Open any pdf report' button.
3. The 'Open any pdf report' button will open a file menu that allows browsing to any pdf report (or other pdf file) on the computer and open it in Adobe Reader. When this pdf file is opened, it will be set as the active file in the text field 'Last saved or opened pdf report'.
4. The 'Email below pdf report' button will open a separate window that allows email to be sent to the current report shown in the text window to an e-mail recipient.

5.5 Emailing a report

When pushing the ‘Email below pdf report’ a separate window will open as seen in figure 5-6.

One can set up the email recipient, an additional cc recipient (optional), the email subject and the email message. Below these fields, one will see a reference to the pdf file that will be attached to the email. At the bottom the return address as well as the mail server to use is defined. For the mail server one needs to choose one of the active e-mail servers. Typically, this found by checking the settings in your default mail program. Most often it is on the form ‘mail.company-name.com’.

Figure 5-6: E-mailing a radon report to a recipient.

When all fields are filled out one can either press the ‘Email the report’ button or the ‘Email the report – and – remember above settings’ button’. In the first case the email will be sent, but none of the fields that were filled out will be remembered (and prefilled) the next time an email should be sent.

However, using the second button, all settings will be remembered. This is the preferred button the first time a report is to be sent, since most settings would be the same each time you email an report, e.g. the cc recipient , email subject and email message, return address’ and ‘mail server’.

These settings will be remembered each time the CRA SW is used.

The only setting not remembered is the email recipient.

6 How to use the 'Report template' tab

The CRA SW is equipped with a few typical report templates that can be selected before generating the report on the 'Report' tab of the SW.

However, advanced users may want to customize their reports and to add more information than found in the standard templates. This can be done on the 'Report template' tab of the SW.

Figure 6-1 shows the 'Report template' tab as it appears after having selected 'English' as the language and selected the report template with the name 'report with measurement result' on the 'Report' tab.

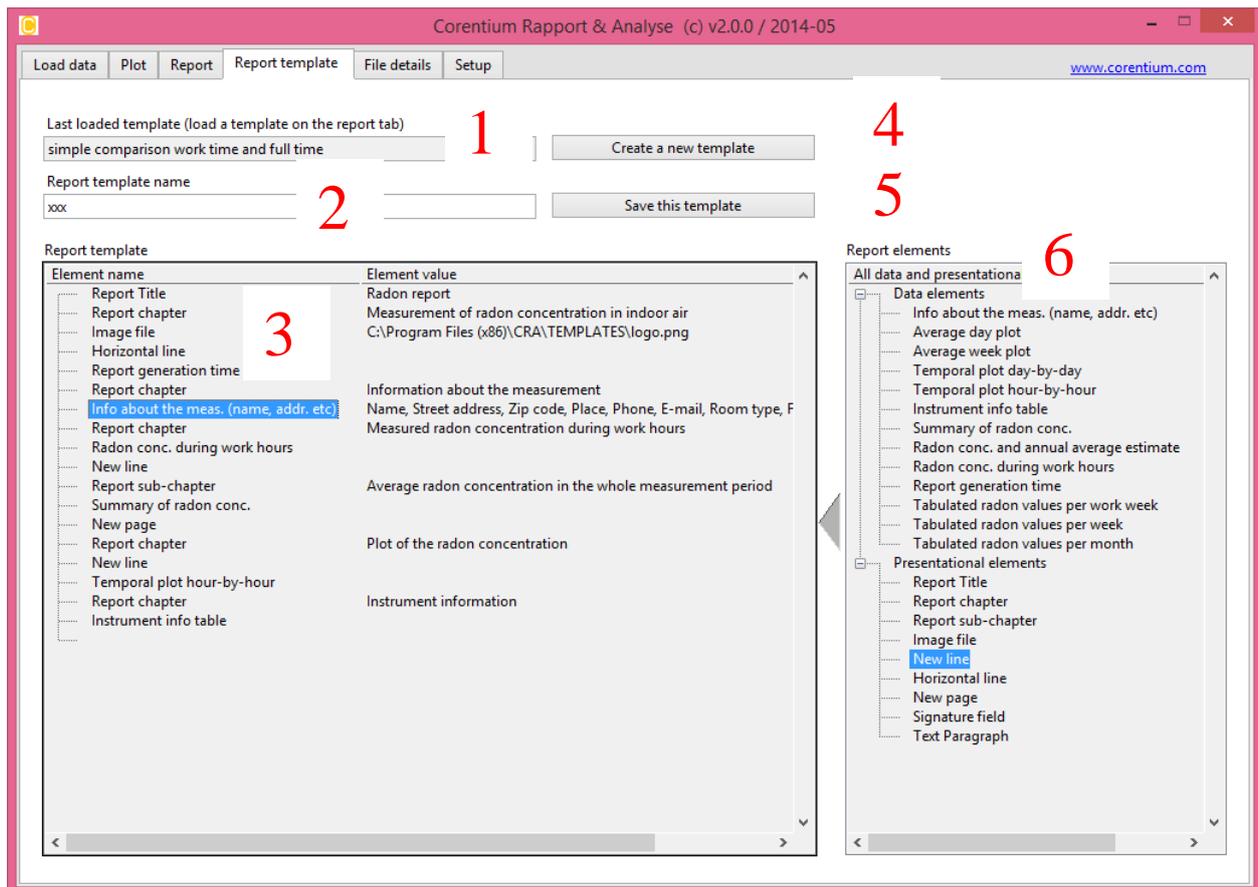


Figure 6-1: The 'Report template' tab of the CRA SW.

The screen contains the following items that are indicated with red numbers in figure 6-1:

1. The name of the last template that was loaded on the 'Report' tab is shown in the text window 'Last loaded template...'. It is an indicator only and can only be changed from the 'Report' tab.
2. The name the new/edited report will get if pressing the 'Save this template' button is given in the text field 'Report template name'. This text field can be modified. It has the name 'Xxx' before it is edited.
3. The content of the report generated if pressing 'Generate report' button on the 'Report' tab is found in the tree view named 'Report template'.
4. A button to 'Create a new template'. Will start with an empty report template in the tree

view 'Report template'.

5. A button to 'Save this template'. Will save the report template currently being shown in the tree view 'Report template' with the name being shown in the text field 'Report template name'. If a report template with this name already exist one will be asked to confirm if you want to override it or alternatively if you want to cancel the save.
6. A tree view name 'Report elements' shows all the kind of elements one can have in the report template. Report elements are in one of two categories; either 'presentational elements' used to custom the report layout, or 'data elements' which contain the measurement data information to include in the report.

6.1 Adding report elements to your report template

To add report elements from the 'Report elements' tree view to the 'Report template' tree view one double click an element in the 'Report elements' tree. The element will then appear in the 'Report template' tree just under the currently selected item in the 'Report template' tree.

An example is shown in figure 6-2. By double clicking the 'New line' element in the 'Report elements' tree, it will be appended to the report template after the element 'Info about meas.' That is the currently selected item in the 'Report template' tree. The 'Report template' tree will now be updated with a 'New line' element as seen in figure 6-2.

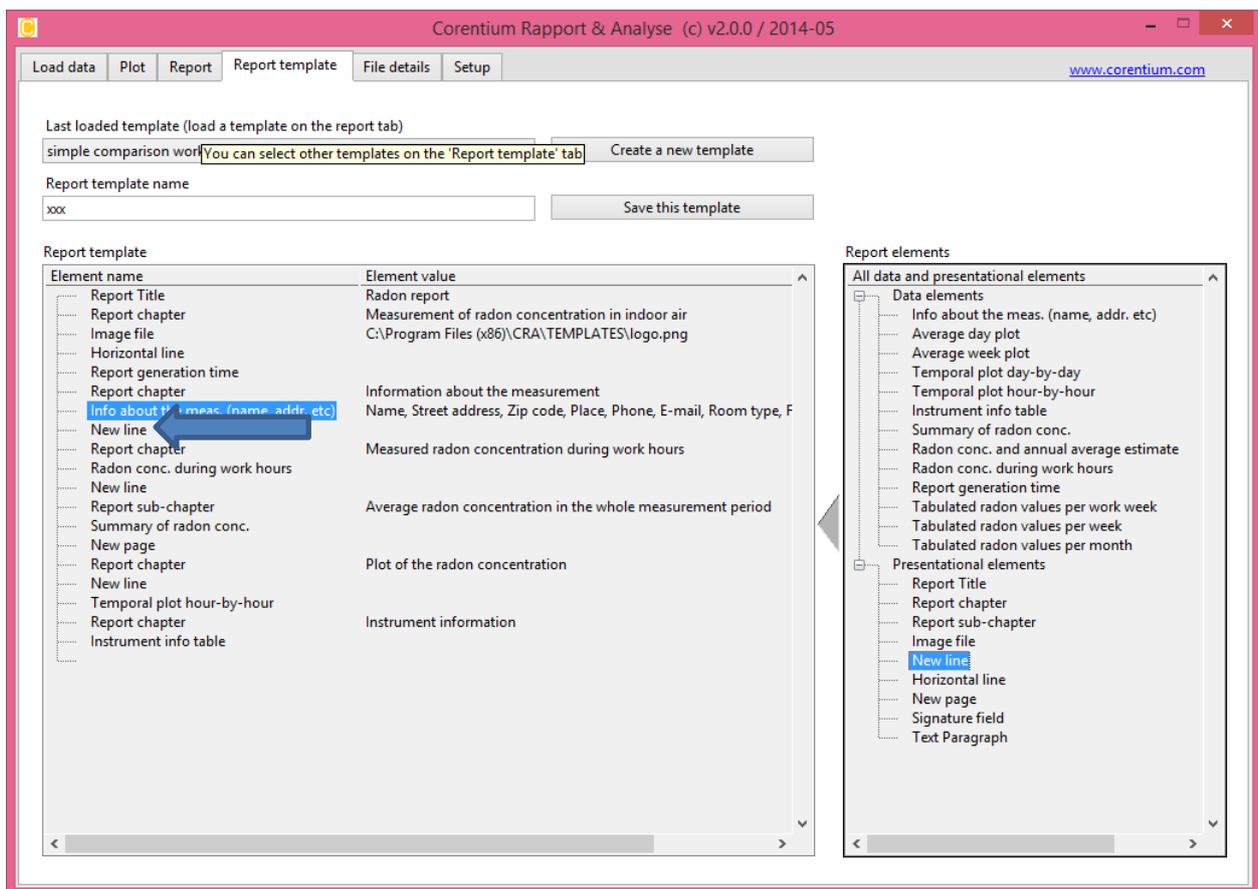


Figure 6-2: The updated 'Report template' after having added a 'New line' report element. Compare to figure 6-1.

6.2 Editing or deleting elements in your current Report template

Elements in the 'Report template' can be re-arranged by dragging and dropping them at any position within the tree structure.

Some of the elements in a report like the 'New line' and 'Horizontal line' elements are very simple and are not configurable. By double clicking these elements in the 'Report template' they will be deleted from the 'Report template' after clicking YES on the pop-up confirmation menu that appears.

The non-configurable elements are:

- All 'Data elements' listed in the 'Reports elements' tree, except the 'Info about the meas.' element.
- The 'Presentational elements' named:
 - 'New line'
 - 'Horizontal line'
 - 'Signature field'

For the report template elements that have some configurable options one double-clicks on them in the 'Report template' tree and a pop-up window will open that let one configure the element. One of the options in the pop-up window will be to delete this report element from the report template.

6.3 *Editing textual presentational report elements*

Figure 6-3 shows an example of the pop-up window that will be shown if one double-clicks the report element named 'Report Title' in the current report template.

Figure 6-3: Editing a report template element.

The pop-up window is similar for the following textual report elements: 'Report Title', 'Report chapter', 'Report sub-chapter' and 'Text Paragraph'.

The pop-up window shows the 'Current value' that the report element has. In this case it is 'Radon report'. The text field 'New value' is where the new value can be added. On the upper right there is a drop-down box 'Text alignment' that decides whether the text is left, right or center justified when

printed in the report. When you are done editing, press the ‘OK’ button. If you want to abandon your modifications, press the ‘Cancel’ button. Report elements (in this case ‘Report Title’ element) can be removed from the report template by pressing the button ‘Delete this report element’.

6.4 Editing the image file report element

An image can be added to the report template. This can be any *.jpg, *.png or *.bmp image file. One would typically use an image file to show a company logo, or a page in the report with some kind of standardized message/image.

An image should have a resolution of around 300 dpi to be reasonably well represented. An image with the size of 1944 pixels (X) by 2768 pixels (Y) will completely fill one report page (A4 size) and still have the normal margins around the image.

If including a logo or some other image that just fills the width of the page it should have a width (X) of about 1944 pixels.

In figure 6-4 s shown the pop-up window used to select an image file for the report template. The file is selected by using the ‘Browse’ button. If one selects an appropriate image file one will see its size (width and height in pixels) next to the browse button. On the upper right one can select whether the image is aligned towards left or right margin, or whether it is placed at center of the page width.

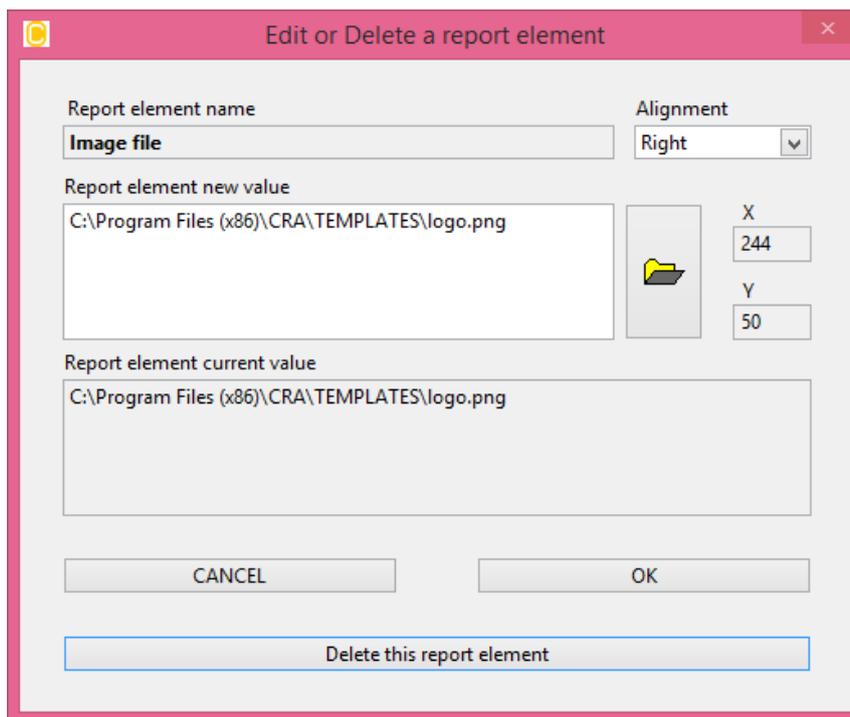


Figure 6-4: Editing an image report element.

6.5 Editing the ‘Info about the meas.’ report element

Typically the report will contain a table of some user and other information about the measurement.

Which information this table should contain is defined with the ‘Info about the meas.’ report element. In figure 6-5 is seen the pop-up window that appears when this report element is double-clicked.

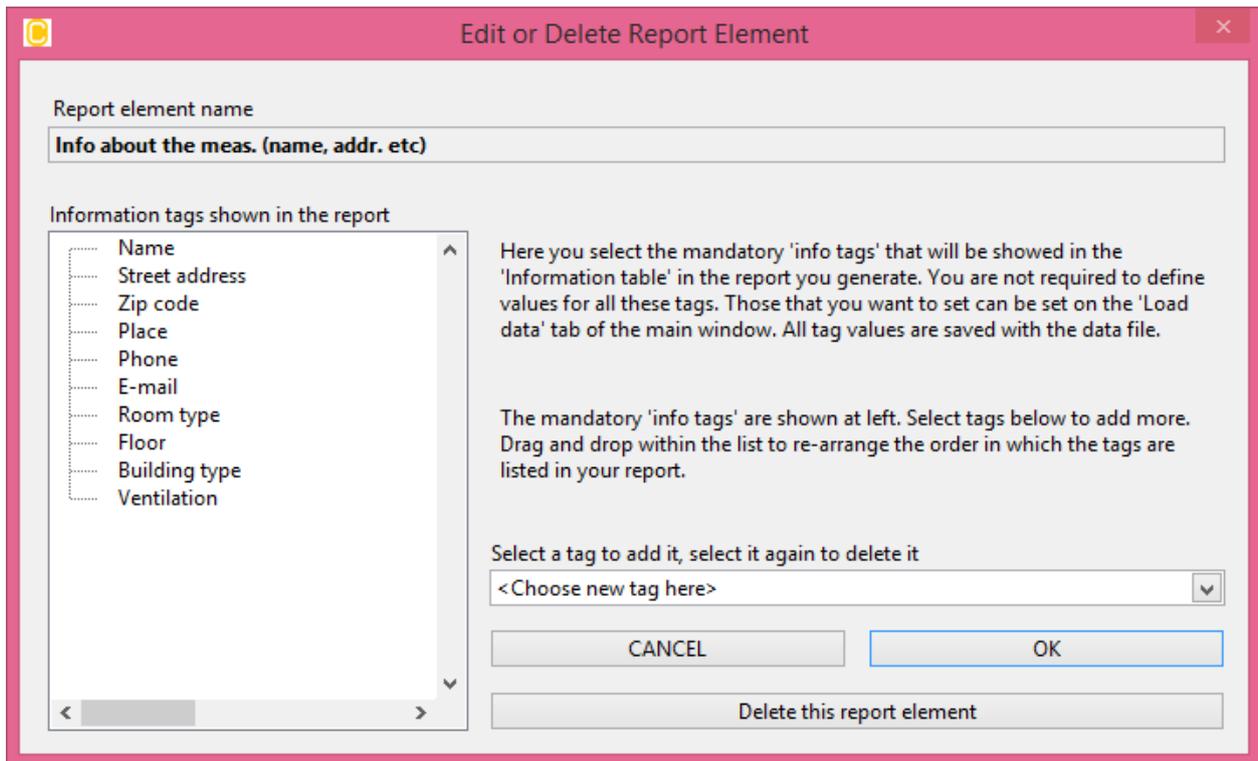


Figure 6-5: The pop-up window for defining the 'Info about the meas.' report element.

The information tags selected so far, and which order they will appear in in the report, is listed in the tree view at the left.

One can re-arrange the order by dragging and dropping the items. If wanting to add more information tags one selects from the pull down menu on the right. To delete an information tag from the list one selects it in the pull down menu again.

The list contains the pre-defined information tags supported by the CRA SW as well as any information tags one may have defined. New information tags can be added on the 'Load data' tab of the SW.

If you want to remove the 'Info about the meas.' element completely from the report, push the 'Delete this report element' button. When you are happy with the information tag list, push the 'OK' button. Push the 'Cancel' button to return and discard any changes that have been made.

6.6 Example report

The next two figures shows page 1 and 2 of the report generated by the SW when the user pressed the 'Generate report' button using the report template as seen in figure 6-2.

Radon report

Measurement of radon concentration in indoor air

corentium

Report generated 2014-05-15 13:12

Information about the measurement

Name	John Doe
Street address	Sunny road 1
Zip code	12345
Place	Sunny town
Phone	44556677
E-mail	me@sun.com
Room type	Living room
Floor	1. floor
Building type	Apartment
Ventilation	Natural

Measured radon concentration during work hours

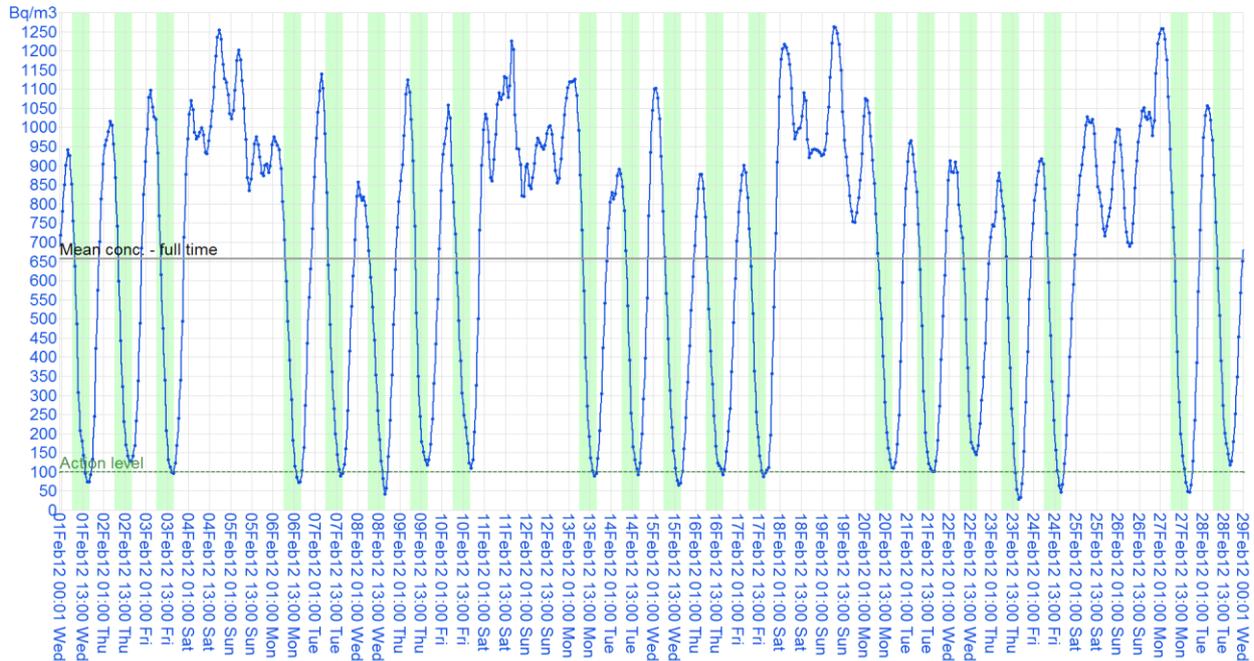
Measurement started	Measurement ended	⁽¹⁾ Measured value radon conc.
2012-Feb-01 Wed 00:01	2012-Feb-29 Wed 00:01	313 Bq/m³ (±12%)
Mon-Fri, 07:00-17:00 (200 hours)		
⁽¹⁾ The measured value is given as the measured radon concentration ± an estimated measurement uncertainty (one standard deviation).		

Average radon concentration in the whole measurement period

Measurement started	Measurement ended	⁽¹⁾ Measured value radon conc.
2012-Feb-01 Wed 00:01	2012-Feb-29 Wed 00:01	658 Bq/m³ (±7%)
28 days measurement duration		
⁽¹⁾ The measured value is given as the measured radon concentration ± an estimated measurement uncertainty (one standard deviation).		

Figure 6-6: Page 1 of an example report.

Plot of the radon concentration



The plot shows the time interval from 2012-Feb-01 Wed 00:01 to 2012-Feb-29 Wed 00:01 (672 hours). Average radon concentration in this period is **658 Bq/m³** ($\pm 7\%$). If one includes only Mon-Fri, 07:00-17:00 (a total of 200 hours), one finds an average radon concentration of **313 Bq/m³** ($\pm 12\%$).

Instrument information

Monitor data file	example-data-file.cor
Monitor serial number	Corentium-64-2816-0000-1D-10-0-0-1.
Monitor full measurement duration	77 days 7 hours 54 minutes. Instrument started on 2012-01-02 00:01. Instrument uploaded on 2012-03-19 07:55.

Figure 6-7: Page 2 of an example report.

6.7 For the advanced user

If experienced with web site development and having knowledge about customizing web pages using CSS style sheets, one would have an additional way of further customizing the report pages according to own preferences by modifying the CSS style sheets used by the CRA SW.

When the CRA SW presents a report in the web browser the CSS style sheet used is found at:

- C:\Program Files\CRA\TEMPLATES\standard.css

When the CRA SW sends a report to a pdf file the CSS style sheet used is found at:

- C:\Program Files\CRA\TEMPLATES\ standard-2x-no-margins.css

If one decides to alter these files in order to customize for example fonts, colors, table borders etcetera, make sure to back-up the original files in case ending up in a situation where the report generation does not work properly anymore. That will prevent the need for re-installing the CRA SW in case of problems.

7 How to use the 'Setup' tab

On the 'Setup'-tab a few different SW options can be altered.

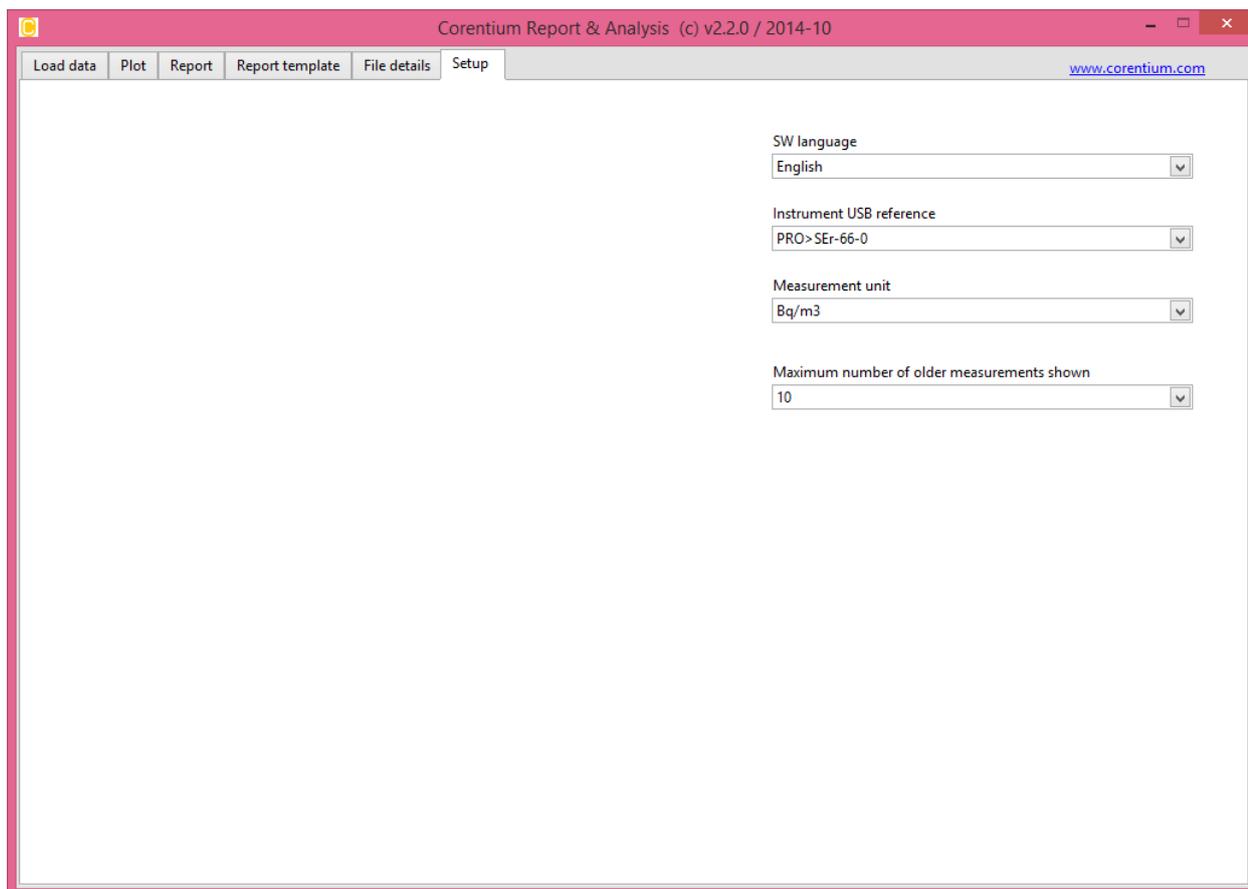


Figure 7-1: Picture of the Setup tab.

The options that can be altered are:

1. The language used by the SW is set using the pull-down menu 'SW language'. Norwegian is default, but the user can select English, German, Swedish or French.
2. Which monitor the CRA SW will load data from. This is tied to the button 'Instrument USB reference'. As default the SW will always choose the latest monitor plugged in, but the user can force the SW to select one particular instrument in the case multiple monitors are connected by USB. We still recommend the user to keep only one instrument plugged in at any given time.
3. 'Measurement unit' can be set to 'Bq/m³' or 'pCi/L'.
4. The pull-down menu 'Maximum number of older measurements shown' is used to limit the number of older measurements listed in the pull-down menu on the 'Load data' tab when selecting the item <Select an older measurement from the monitor below>. As default 10 older measurements are listed, but it can be changed to 30, 100 and 300. We recommend that you use the default setting.

The last selection in the pull-down menu 'Maximum number of older measurements shown' is named 'Lock older measurements'. When you click on it a window pops up that allows you to select one particular date. When you later select <Select an older measurement from the monitor below> on the 'Load data' tab the pull-down list will hide all data sets older than the lock time. The lock time pop-up window is password protected (i.e a passkey which is a number of up to 9 digits) and has initially the value 123456 until you change it for the first time.