QuantaSmart™ For The TriCarb® Liquid Scintillation Analyzer Getting Started Manual

Release History

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Any comments about the documentation for this product should be addressed to:

User Assistance
PerkinElmer, Inc.
2200 Warrenville Road
Downers Grove, Illinois 60515
USA

Or emailed to:

info@perkinelmer.com

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Safety

Electrical Safety

WARNING

Use proper plugs and good earth ground connections.

WARNING

For systems operating at voltages other then 115 volts AC or 220 volts AC, a locally approved 3-prong plug may be required to correctly power the system.

CAUTION: *Do not move the fully assembled unit. Use both hands when lifting or moving any part of the system. Carry each part from the bottom.*

Wiring Specifications

Live	(L) Brown lead
Neutral	(N) Blue lead
Earth	(E) Green/yellow lead

Cleaning the System

Clean the outer surfaces of the system by wiping them with a damp cloth and common laboratory cleaner.

System Ventilation

For adequate ventilation of this equipment, a distance of 15cm must be kept from this unit and any other surfaces.

Explanation of Symbols

You may find one or more of the following symbols used on labels on your system.

Symbol	Explanation	L'explication	Erklarung
	Alternating Current	Courant alternatift	Wechselstrom
	Protective Earth Ground	Mise a la terre	Schutz -Erdun
	On (Supply)	Marche (alimentation)	Ein
	Off (Supply)	Arret (alimentation)	Aus
	Caution-Attention: Risk of Electrical Shock	Attention Risque de choc	Vorsicht Spannug Gefahrliche
	Caution (refer to accompanying documents)	Attention: Voir les documents cijoints	Vorsicht Siehe Begleitinformation
	Serial Out	Sortie serie	Serieller Ausgang
	Printer	Imprimante	Drucker
	Monitor	Moniteur	Bildschirm
	Fuse Label 1 Current Warning	Etiquette d'advertissement relatif au type et au courant du fusible	Sicherung/Stromstarke

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Chapter 1

The System Computer

The system comes supplied with a built-in Pentium® computer.

The system can also be attached to a network. We sell a networking kit to attach the system to a network. For additional information on the networking kit, contact your PerkinElmer representative.

Software Security

Security is built-in to QuantaSmart. The same software cannot be loaded on multiple systems due to this security feature.

Chapter 2

The System Software

The QuantaSmart™ program is the Windows XP® interface for the TriCarb® Liquid Scintillation Analyzer series of instruments. This innovative tool allows you to take advantage of all the instrument features via a main software window. The main window uses standard Windows® conventions. It allows you to easily access and control all the system features and capabilities via different functional components. The Protocols Tree in the main window provides you with graphical representations of existing assay associations. The Output Report and SpectraView™ windows display information regarding sample data and sample analysis. Any assay data that is collected may be reanalyzed, without recounting samples using the optional Replay™ feature.

The system utilizes a set of Libraries to store standard and sample information. The Nuclide Library allows you the flexibility of selecting and using the same standards sets in any number of different assays. It also provides you with a convenient means of saving and reusing specific nuclide parameters and sample counting regions.

The Getting Started Manual

The purpose of this manual is to provide you with basic information regarding the QuantaSmart program. It will enable you to perform simple tasks, using many of the system's default settings. For information regarding advanced features of the system, please refer to the online help documentation.

The Online Help

The Online Help is a comprehensive system designed to provide you with detailed reference and operational information for the QuantaSmart program. It should be considered the primary resource of information for the software.

The QuantaSmart program provides you with access to the help system via help buttons. By clicking these buttons, you will display the help documentation for the current window. Once in the help system, you can utilize the table of contents, index, search feature or hypertext links to access information regarding other help topics. You can also access these help features via the Help menu in the QuantaSmart main window.

The Table of Contents

The table of contents displays main topics using a book symbol. Each book may contain one or more pages representing topics. Clicking on a book reveals the topics included in that book. Double clicking on a page displays the documentation for that topic.

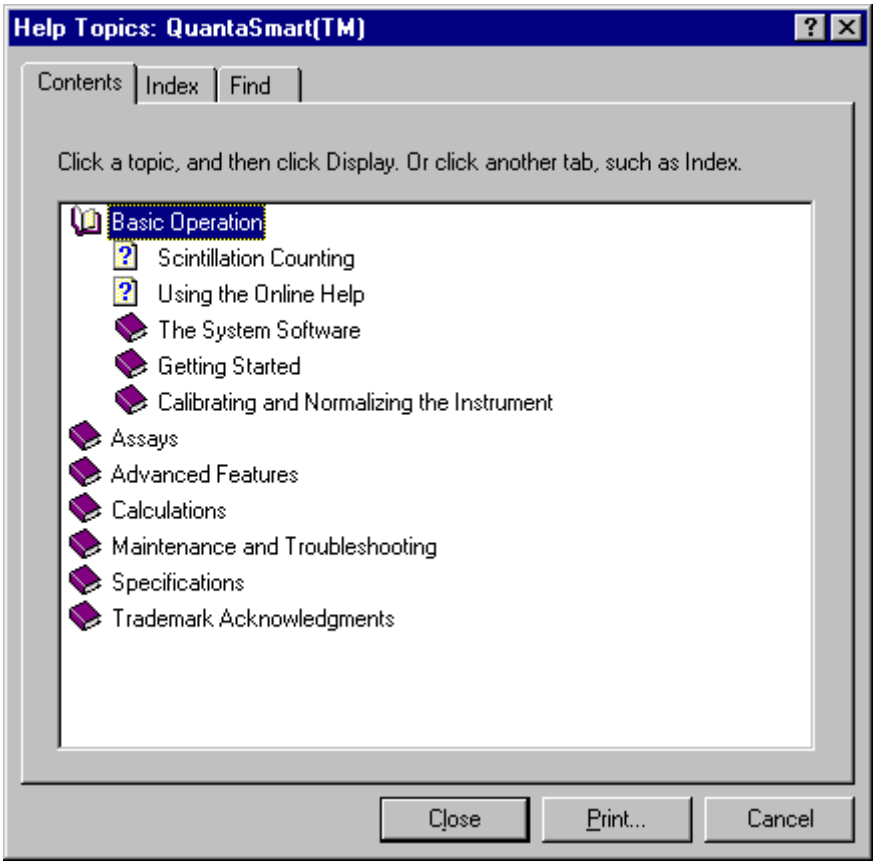

Figure 2-1The Online Help Documentation Table of Contents.

The Index

The index displays a comprehensive, alphabetical list of topics available in the online help documentation. Double clicking on any of the indexed items displays the documentation for that topic.

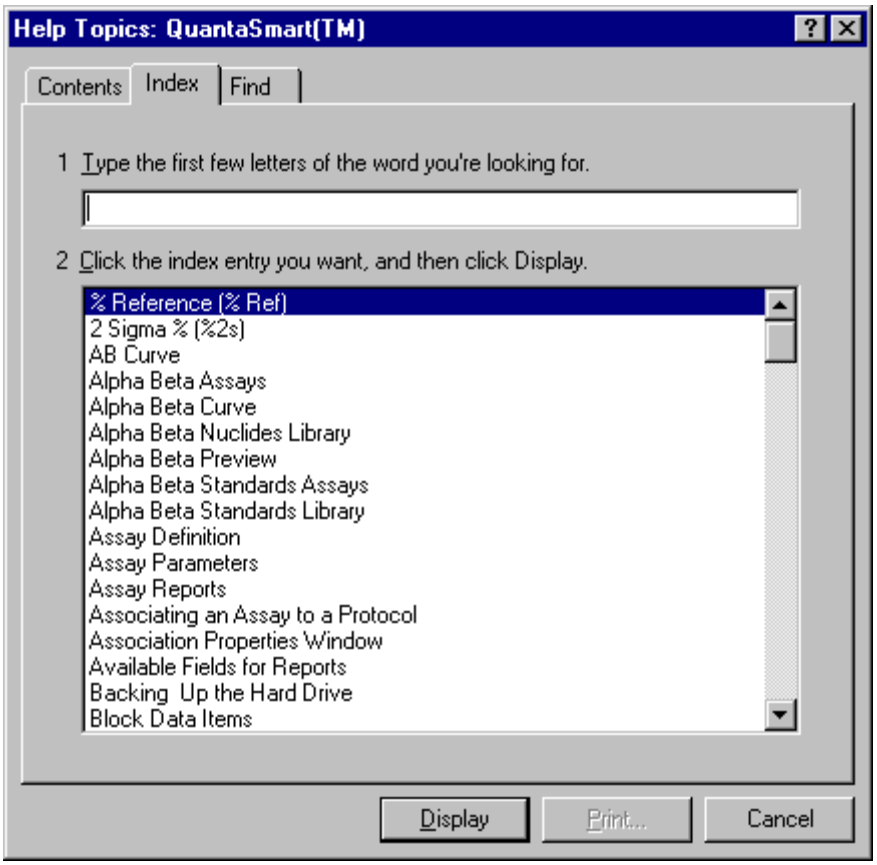

Figure 2-2The Online Help Documentation Index.

The Search Feature

The Search (Find) feature allows you to search the online help documentation for a word or words. After entering the word you would like to find, a list of topics is provided of all the topics in the documentation where instances of the word occur. Double clicking on the item in the list displays the documentation for that topic.

Note: Since every instance of a word or phrase is found by the Help system, duplicate entries may be displayed in the Find tab.

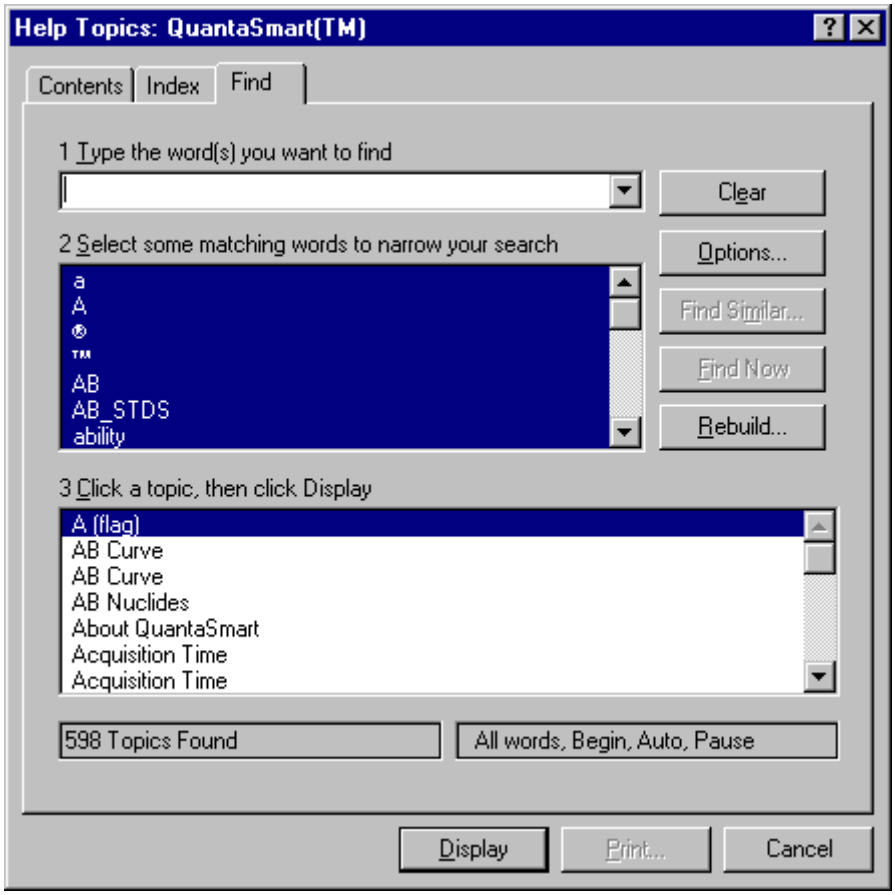

Figure 2-3 The Online Help Documentation Find Feature.

Assays

In the QuantaSmart program, an assay represents a comprehensive set of parameters that the system uses for the purpose of sample analysis. Assays are defined using seven Assay Definition tabs, each of which allows you to enter information specific to one aspect of the assay. Once an assay is defined, it may be saved, used or edited at your discretion.

Protocols

All of the assay information that you define and save becomes a functional entity only after it is associated to a protocol. These protocols are recognized by the instrument via a protocol flag. This device contains an encoded, reflective metal which the instrument uses to identify the protocol number and sample counting parameters that you have defined and elected to use. The QuantaSmart program enables you to define an unlimited number of assays and associate them with up to sixty protocols (flags). Each of the sixty protocols and the assays to which they are associated, are displayed in the Protocols Tree of the main window.

The Main Window

The Main software window is comprised of six functional elements. These elements provide you with a means of accessing all of the instrument devices and features and include:

Main Menu

Tool Bar

Protocol Tree

Replay Tree

SpectraView Window

Report Window

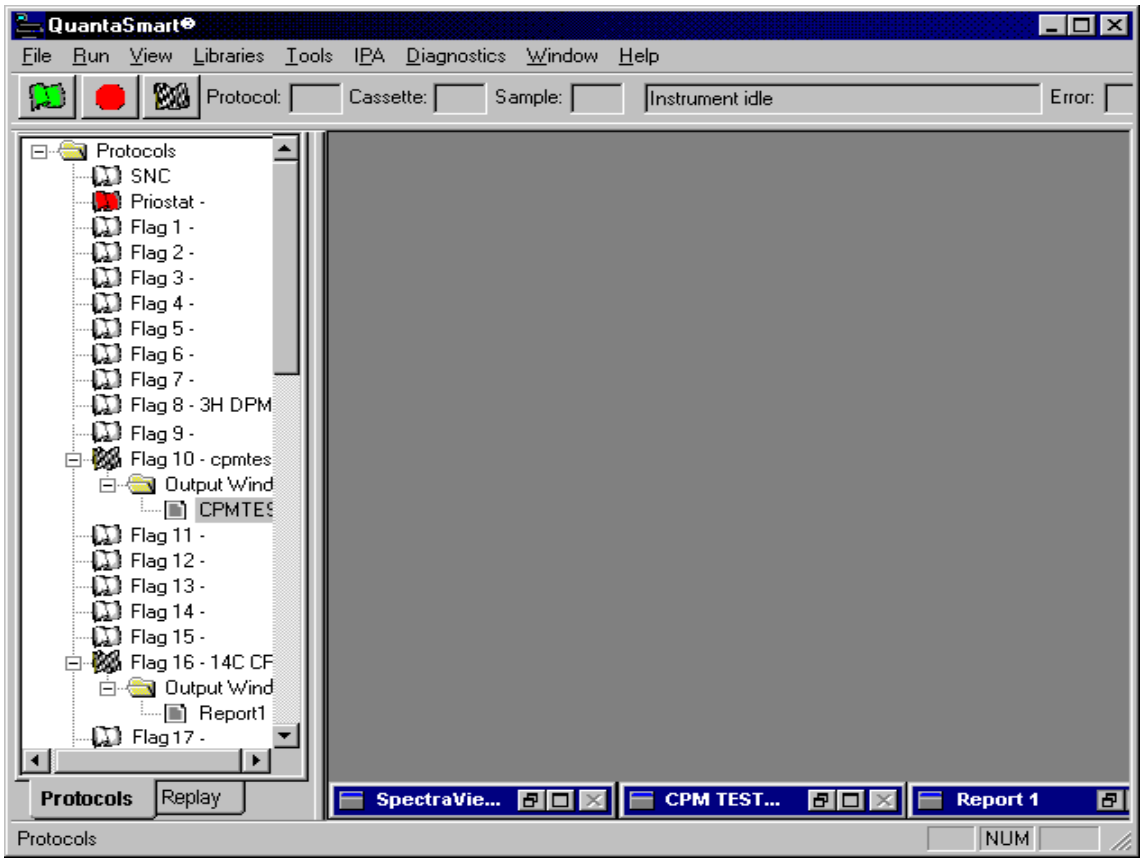

Figure 2-4 The Main Window.

The Menu Bar

At the top of the QuantaSmart main window is the Menu bar. The Menu bar consists of the File, Run, View, Libraries, Tools, IPA, Diagnostics, Window and Help menus, each of which offers a variety of selections and commands. Make menu selections by using the mouse pointer to select a menu bar item. Click on an item to display a list of options within that menu. To select a menu option, point to that item using the mouse and click on the item.

Alternatively, all menu items can also be displayed using the underlined keys indicated. Menus are displayed with the Alt-underlined key selection; menu items can be selected by using the underlined key alone, while the item is visible and enabled. Menu items for functions that are not appropriate in the current circumstance are disabled (dimmed) in the menu.

The File Menu

The items in the File menu allow you to create and open assays, associate and disassociate assays to protocols and print assay information.

The Run Menu

The Run menu allows you to control sample counting and cassette movement on the instrument's sample changer deck. You can also access the Priostat functions via this menu. Priostat allows you to interrupt the current protocol to count a set of priority samples.

The View Menu

This menu allows you to hide or show certain components of the main window, as well as update the Protocols Tree. If your instrument is equipped with the Replay feature, the Replay Tree can also be updated using the View menu.

The Libraries Menu

The Libraries menu allows you access to the Sample Nuclides and Quench Standards libraries. If your instrument is equipped with the Alpha Beta option, the Alpha Beta Nuclides and Alpha Beta Standards libraries will also be available.

The Tools Menu

This menu allows you to access the Radionuclide Decay Calculator, to show certain errors for a protocol and view special spectral displays.

The IPA Menu

The IPA™ menu allows you to assign and display the various parameters used for Instrument Performance Assessment.

The Diagnostics Menu

The item in the Diagnostics menu provides access to troubleshooting and diagnostic functions for your PerkinElmer Technical Service Representative.

The Window Menu

This menu allows you to define a format for the window display on the monitor and restore the SpectraView window.

The Help Menu

The Help menu allows you access to the online help associated with the QuantaSmart program.

The Instrument Status Bar

The Instrument Status Bar contains a series of graphical buttons which allows you to Stop and Start the instrument and end a current protocol. It also provides you with information regarding the status of a current protocol and displays instrument messages.

The Protocols Tree

The Protocols Tree displays each of the available protocol flag numbers and the assay names that you have associated to the flag numbers. Existing reports are also shown in this view. During protocol execution, this window displays different symbols to provide a visual indication of the protocol currently being executed, which protocols have remaining cycles, which protocols have been completed and certain protocol errors.

Symbols Used in the Protocols Tree

During a protocol execution, the following symbols may be displayed in the Protocols Tree:

Flags

The protocol flag associated with an assay will change from white or yellow to green when a sample counting cycle begins. A yellow flag indicates that one cycle count for this assay has been completed, but the assay has remaining cycles. The red flag is for sample counting with Priostat. This flag will turn from red to green when the Priostat protocol begins counting. A checkered flag is displayed when all the assay count cycles are completed.

Report Symbol

A grey box indicates that a report has been defined for an assay. The report name appears next to this symbol in the Protocols Tree.

Prohibitory Symbols

A red prohibitory symbol indicates that a protocol cannot be counted. Typically, this will result when no assay is associated with a protocol flag that the instrument has detected. This symbol could also indicate that an assay file has been deleted. A yellow prohibitory symbol indicates that data analysis cannot be performed. Typically, this will result when an appropriate standard set is missing from the Nuclide Library, or it has been modified in the Library but not recounted after the changes were made.

The Replay Tree

If your machine is equipped with the Replay feature, the Replay Tree displays a directory of folders containing previously collected data which can be reanalyzed using different data reduction conditions, without recounting the samples.

In addition, any electronic data files saved as part of a Replay session will also appear in a dedicated subfolder under the original Replay folder.

The SpectraView Window

The SpectraView window displays a two-dimensional, real-time view of the spectrum for the current sample. It provides you with information about the status of a sample count and the region settings used in the counting procedure. A number of display options are available for the spectrum and are defined in this window.

The SpectraView window is typically used for the following:

1. Monitoring sample counting.
2. Detecting spectral distortions or compressions resulting from sample quench.
3. Observing the effect of altering the counting region settings.
4. Viewing the spectrum in linear or logarithmic scale.

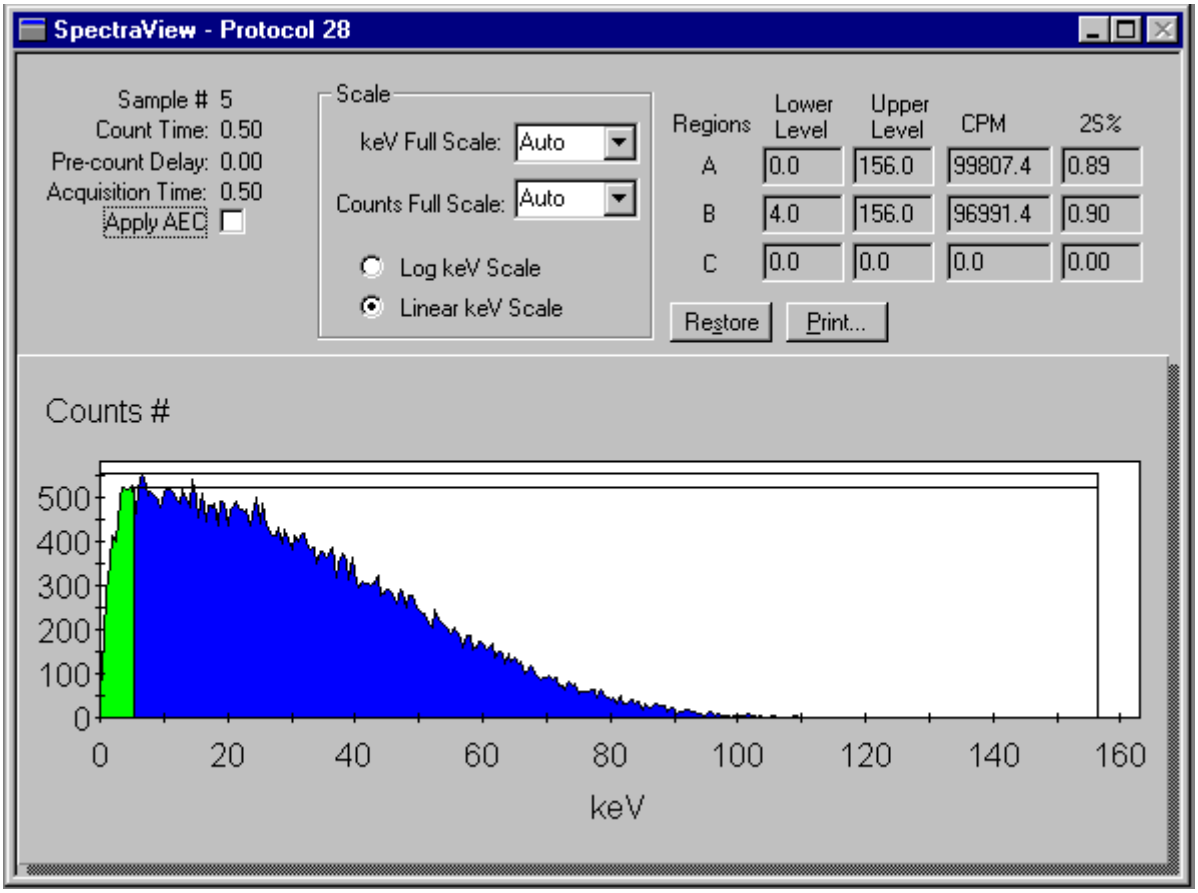

Figure 2-5 The SpectraView Window.

Sample Number

This field indicates the Sample Number of the sample currently counting.

Count Time

This field indicates the length of time each sample will be counted, as defined in the assay.

Pre-count Delay
This field indicates the length of time each sample will remain in the instrument's detection chamber prior to counting.

Note: This process is dark adaption. It allows luminescence emanating from a vial to dissipate prior to counting. Luminescence can distort the count statistics of the sample and is particularly problematic with low count rate samples.

Acquisition Time
This is the length of time the current sample has been counting.

Apply AEC
If tSIE/AEC is selected as the quench indicating parameter for the assay, the sample spectrum can be displayed with or without AEC (Automatic Efficiency Correction). Activating this feature will adjust the region settings to account for sample quench. Mark this box to display the sample spectrum using AEC.

keV Full Scale
This field allows you to alter the scale used to display the X-axis of the sample spectrum. Enter a number in this field if you would like to manually define the endpoint for the X-axis. By using the Auto setting, the X-axis will automatically adjust between zero and the upper level region limit defined in this window.

Counts Full Scale
This field allows you to alter the scale used to display the Y-axis of the sample spectrum. Enter a number in this field if you would like to manually define the count maximum for the Y-axis. By using the Auto setting, the Y-axis will automatically adjust to the count rate of the sample.

Log keV Scale
This field allows you to display the X-axis using a logarithmic keV scale. The default setting plots the X-axis using a linear scale.

Linear keV Scale
This field allows you to view the X-axis using a linear scale. This is the default setting for the X-axis scale. Clicking this button will deselect this feature.

Regions
These represent the Upper Level and Lower Level counting region limits for regions A, B and C.

CPM

These fields display the CPM (Counts Per Minute) for Regions A, B and C. The gross counts per channel cumulatively equal the counts per region. The gross counts per region are divided by the count time to calculate CPM (Counts Per Minute) for each region.

2S%

This represents the gross uncertainty in a count value (with 95% confidence limits).

The Output Window

Output Window(s) display the named reports that you have defined on the Report Definition tab. A separate window will appear for each of the reports that you define and name in the assay. A typical Report Output window is shown below.

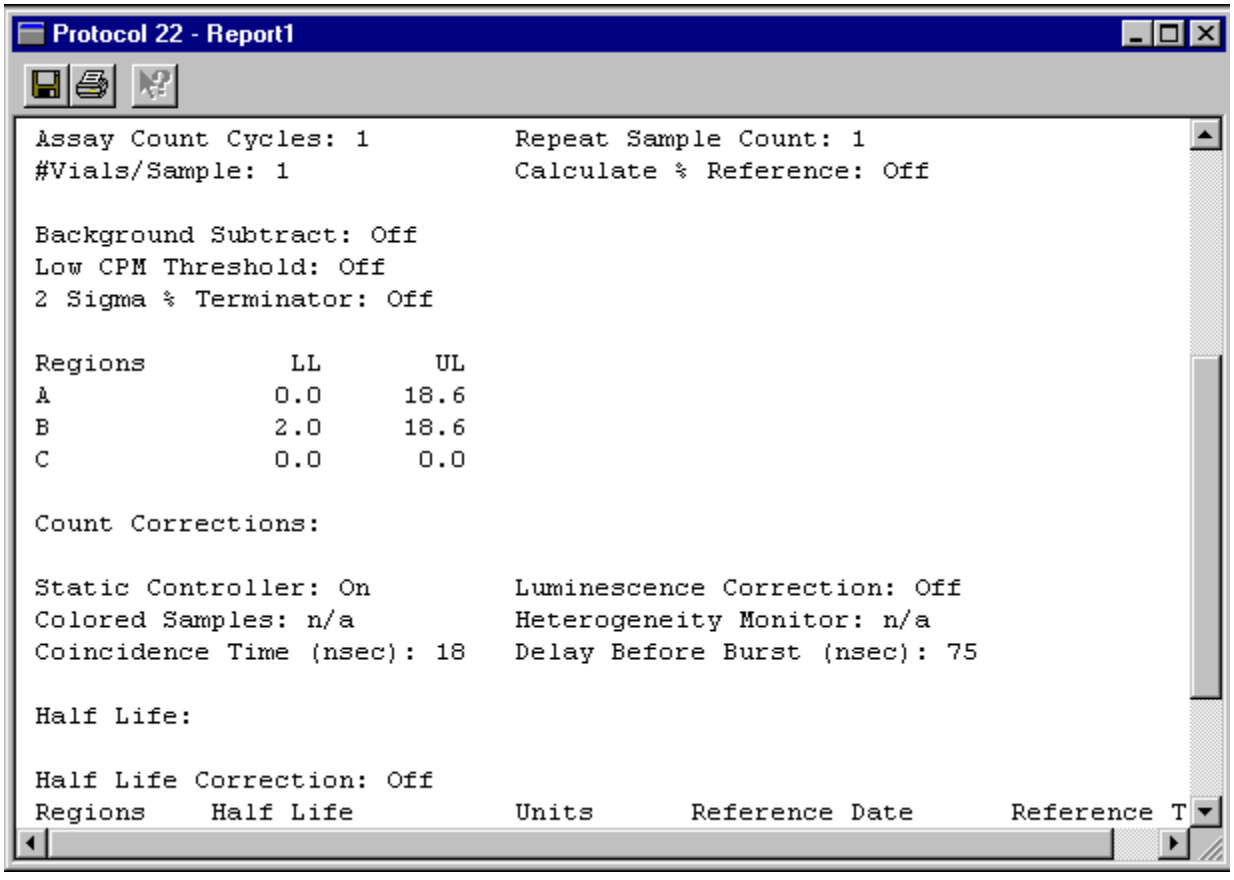

Figure 2-6 Report Output Window.

Libraries

Radionuclide information is stored and accessed in the Nuclide Library. The Nuclide Library consists of the Quench Standards and Sample Nuclides libraries. If your instrument is equipped with an Alpha Beta option, an Alpha Beta Standards and an Alpha Beta Nuclides Library will also be available.

The Quench Standards Library is comprised of quench sets, with each quench set containing individual quench standards. The data generated in quench standards assays is stored in this library and used to construct quench curves for calculating DPM (Disintegrations Per Minute) in DPM Assays. Quench Standards are counted once and the entire spectrum for each quench standard is stored independent of assay information. This allows you to select and use the same quench set in any number of assays and construct a quench curve for each sample at the time the sample is counted.

The Sample Nuclides Library allows you to specify and save nuclide names, counting region limits and quench sets for sample nuclides. Up to three nuclides can be defined for each entry to support the counting of multiple nuclides. These sample nuclide parameters are typically specified as part of the assay definition process and may be edited as needed.

The Alpha Beta Standards and Alpha Beta Nuclides libraries are used in the same manner as the Quench Standards and Sample Nuclides libraries. The information stored in these libraries is relevant only when performing Alpha Beta Assays, where both an Alpha-emitting and a Beta-emitting radionuclide are quantified independently within the same sample vial.

Display the Libraries menu by selecting Libraries from the menu bar.

Chapter 3

About the System

Scintillation Counting

A liquid scintillation counter relies on the interaction between a beta-emitting radionuclide and a scintillator, a component of the scintillation cocktail. The scintillator converts ionizing radiation from the radionuclide into photons of light (scintillation). The intensity of the light produced during scintillation is proportional to the initial energy of the beta particle.

By placing a vial containing a radionuclide and scintillation cocktail into a dark detection enclosure (the instrument's detector), the scintillation counter can measure photon intensity. A photosensitive device amplifies the light emitted from the sample vials and the amplified signal is converted to pulses of electrical energy and registered as counts. The counts accumulated during this process are sorted into separate channels, with the amplitude of the signal determining the energy channel (keV) into which the counts are sorted. The counts that are collected and sorted are used to generate the sample spectrum. Using this spectrum, the system can perform various count correction calculations and determine Counts Per Minute (CPM) for each sample. To calculate Disintegrations Per Minute (DPM), the instrument will determine the counting efficiency of each sample. Using a quench curve, the instrument compares the quench index for the samples to the quench index for the quench standards to determine sample counting efficiency and subsequently calculate DPM for the unknown samples.

The figure below provides an overview of this process:

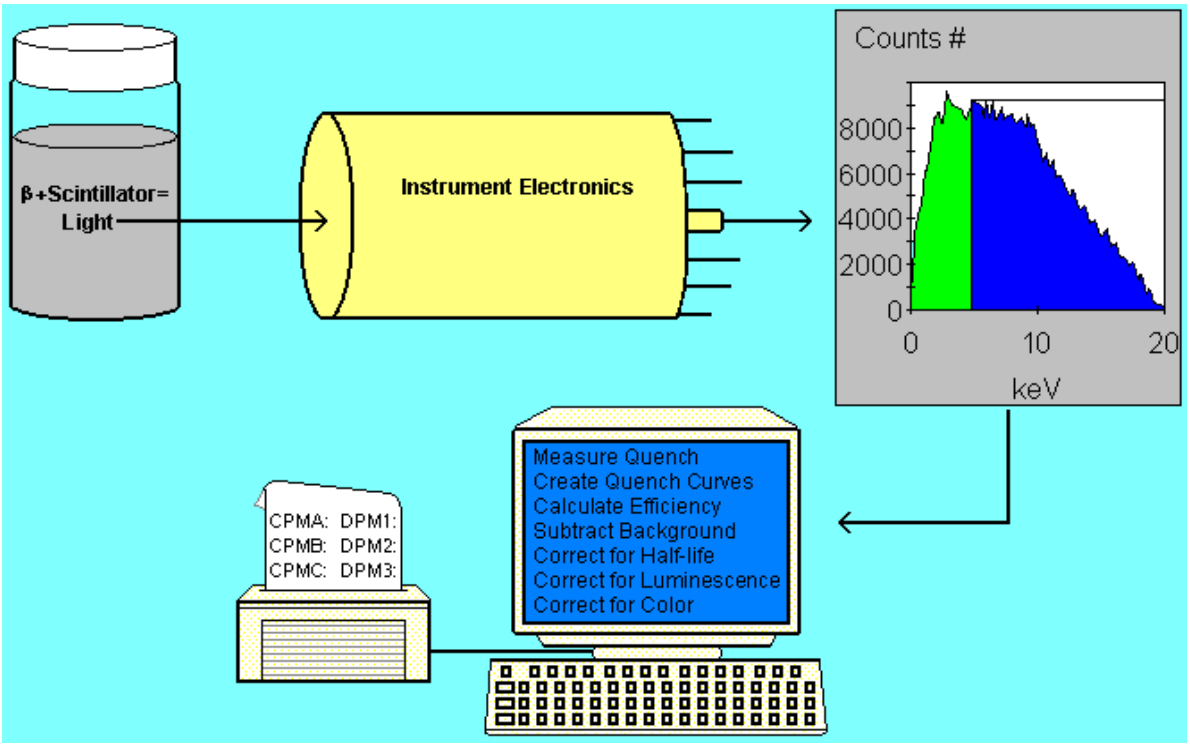

Figure 3-1 An Overview of the Scintillation Counting Process.

Sample Cassettes

Cassettes are the plastic racks which hold sample vials and allow them to be moved on the instrument's sample changer deck. Samples are placed into cassettes that accommodate either standard or small vials without adapters (4ml vials require cassettes with adapters). The standard vial cassette can accommodate up to 12, 15-20ml vials. The mini vial cassette can accommodate up to 18, 6-7ml vials. The optional mini vial cassette can accommodate up to 18, 4ml vials.

The individual cassettes are identified by unique numbers (cassette IDs) located at the end of each cassette. The protocol flag and cassette ID can be used as a means of providing Positive Sample Identification (PID) when utilizing the Worklist feature. The instrument moves the cassettes in a counterclockwise (forward) direction during sample analysis.

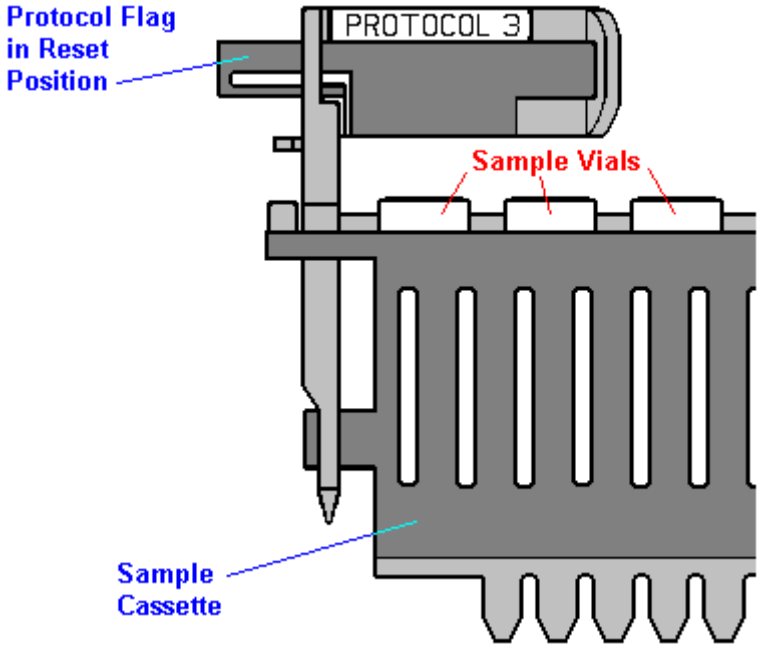

Figure 3-2 Sample Cassette with Protocol Flag.

Protocol Flags

Protocol flags are numbered, plastic devices that contain an encoded, reflective metal that the instrument uses to identify the appropriate assay counting parameters for a set of samples. The counting parameters that the instrument uses correspond to the parameters that you define during the assay definition process (these are predefined by PerkinElmer Life and Analytical Sciences for the Direct DPM Assay). These assay parameters become a functional part of a protocol once you associate the assay to a protocol number.

Prior to counting samples, you must attach the correct protocol flag (the protocol flag number to which you have associated the assay) to the first cassette to be counted. Be sure the protocol flag is in the reset position (the flag is all the way to the left when the flag is on the left end of the cassette). When the protocol number is recognized, a reset flag indicates that the assay is being counted for the first time. If multiple cycles have been defined for the assay, the cycle counting starts over. The system will physically SET the flag after the cassette has been counted. Subsequent counting of the protocol is considered to be the following cycles of the same samples. You should RESET the protocol flag each time that you put new samples into the cassette(s).

Controlling the Sample Changer

Using several of the Run menu options, you can control the movement of the Sample Changer.

The *Stop* menu item ends the current protocol and stops the instrument.

The *Start/Resume Counting* menu item loads the sample currently at the detector position and begins counting.

The *Next Sample* menu item unloads any sample in the detector, moves the next sample into the detector and starts counting.

The *Next Protocol* menu item unloads any sample in the detector and aborts the current protocol. The instrument searches for the next cassette with an active protocol flag and begins running that protocol.

The *End Protocol* menu item unloads any sample in the detector and ends the protocol; data reduction continues until data from the last counted sample is reported. The system begins counting the next protocol.

The *Forward* menu item unloads any sample in the detector and moves the sample changer in a counterclockwise direction.

The *Reverse* menu item unloads any sample in the detector and moves the sample changer in a clockwise direction.

Printing Reports

There are a variety of reports you can generate using the QuantaSmart system. In the Reports Definition tab of the Assay Definition window you can define the reports you would like to generate and you may select individual or block data items (a group of related parameters) for these printouts. Once you begin a counting protocol, the name of the assay and the name of the report(s) that you have defined for this assay will be displayed in the Protocols tab of the main window next to the protocol flag number to which you have associated this assay. Any printed reports you define will automatically print after an assay is completed. To print additional reports, select the report you would like to print from the Protocols tab of the main window. The Output Window is displayed. Click the print button to print the report.

Printing Assay Parameters

To print a list of the parameters you have selected for an assay, select the File-Print Assays menu option. The Select Assays to Print window is displayed. Select an assay that you would like to print and click OK.

Getting Started

When you are ready to begin a counting procedure, you will need to perform the following tasks:

1. Calibrate and Normalize the instrument.
2. Select an assay type: Alpha Beta, Alpha Beta Standards, CPM Assay, DPM Single, DPM Dual, DPM Triple, FS DPM, Direct DPM, Quench Standards or Single Photon Counting. The choice of assay types will differ depending on the TriCarb model you possess.
3. For any DPM Assay except Direct DPM, create quench data by acquiring quench standard data through quench standard assay.
4. Define and save the new assay parameters.
5. Associate (link) the assay parameters to a protocol.
6. Attach the correct protocol flag to the first cassette to be counted and load the cassette(s) with samples.
7. Start the instrument. Do not use the system's CD writer while the instrument is counting.

Refer to the remaining chapters in this manual, or the online help documentation for details regarding the tasks above.

Chapter 4

Calibration, Normalization and IPA

Before any samples are counted, you should calibrate, normalize and assess the performance of the instrument.

Calibration

During calibration, the voltage applied to each of the Photomultiplier Tubes (PMTs) is adjusted until the two tubes have been synchronized in their response to a purged, unquenched, factory-supplied Carbon-14 standard. This process is designed to assure that the instrument accurately quantifies the energy from all beta particle emissions.

Normalization

Normalization is a process that allows the system to establish a scale to assign numerical values for sample quench. During normalization, a purged, unquenched factory-supplied Carbon-14 standard is counted, and a value of 1000 is assigned as the lowest allowable value for the Quench Indicating Parameter, tSIE (transformed Spectral Index of the External Standard). Sample quench is measured and numerical values can be assigned based on the least quenched of 1000 that was established with the unquenched standard.

IPA

During IPA (Instrument Performance Assessment), the instrument measures the following parameters for both Tritium and Carbon-14:

- Background counts.
- Counting efficiency.
- Figure-of-Merit (Efficiency^2/B, or sensitivity).
- Chi-Square (reproducibility).

The IPA feature is standard on the 3100 series, and optional on the 2900 and 2800 series instruments.

When to Perform these Procedures

The calibration, normalization and IPA procedures occur automatically by leaving the Self-Normalization and Calibration (SNC) and IPA cassette (containing the Carbon-14 calibration standard, unquenched Tritium standard and background standard) on the instrument counting deck at all times. Whenever the SNC protocol flag is read by the instrument, a 23-hour timer is checked.

Note:Calibration, Normalization and IPA on an instrument equipped with a BGO detector guard does not occur by virtue of the 23-hour timer. It occurs each time the SNC protocol flag is detected by the instrument.

If 23 hours have elapsed since the previous calibration and normalization, the instrument will perform the SNC/IPA procedure. If 23 hours have not elapsed since the previous calibration and normalization, the SNC/IPA cassette is bypassed and this procedure is not performed. Ideally, the instrument Calibration, Normalization and Instrument Performance Assessment should be performed on this timed, 23-hour (~daily) cycle. If these procedures are performed using the timer, they should not interfere with sample counting, since they will occur overnight. Certain IPA parameters will need to be defined prior to the machine performing the assessment procedures. You may also choose to perform instrument calibration, normalization and IPA manually (not using the 23-hour timer) by “resetting” the protocol flag on the cassette.

An IPA report is generated after each IPA procedure is completed. To access the data generated from all IPA runs, select IPA Charts & Tables from the IPA menu.

Defining the IPA Parameters

Before performing any IPA procedures you must define the parameters that the instrument will use in the assessment process. To define these parameters, select IPA Definition from the IPA menu. The IPA Definition window is displayed:

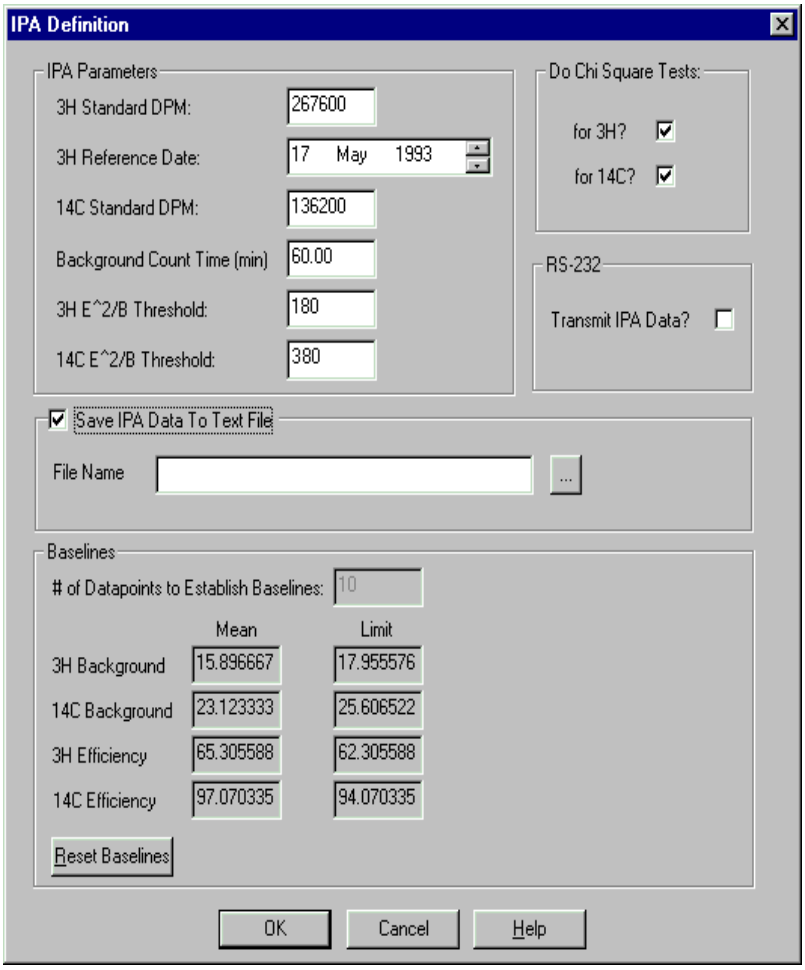

Figure 4-1The IPA Definition Window.

^{3}H (Tritium) Standard DPM

Enter the DPM value for the unquenched, sealed Tritium standard (supplied). The DPM values for standards purchased from PerkinElmer Life and Analytical Sciences are printed on the vial.

^{3}H (Tritium) Reference Date

Enter the reference (calibration) date for the unquenched Tritium standard. This is the date on which the standard has the specified amount of activity. You must enter this value for half-life correction to occur. The Reference Date for standards purchased from PerkinElmer Life and Analytical Sciences is printed on the vial.

^{14}C (Carbon-14) Standard DPM

Enter the DPM value for the unquenched, sealed Carbon-14 standard (supplied). The DPM values for standards purchased from PerkinElmer Life and Analytical Sciences are printed on the vial. No reference date is required due to the long half-life of Carbon-14.

Background Count Time

This is the length of time (in minutes) the instrument will measure the background counts. The background for both Carbon-14 and Tritium are collected simultaneously. Typically, a default 60 minute count time is used to assess background.

^{3}H (Tritium) E^2/B (Figure of Merit) Threshold

This is the lower limit for the calculated Tritium figure of merit value. If the figure of merit value falls below the defined threshold, a message is displayed in the main window. If this occurs, it indicates either an increase in background or a decrease in efficiency. Typically, the default threshold can be used until sufficient IPA data for this parameter is collected and an alternate threshold is established.

^{14}C (Carbon-14) E^2/B (Figure of Merit) Threshold

This is the lower limit for the calculated Carbon-14 figure of merit value. If the figure of merit value falls below the defined threshold, a message is displayed in the main window. If this occurs, it indicates either an increase in background or a decrease in efficiency. Typically, the default threshold can be used until sufficient IPA data for this parameter is collected and an alternate threshold is established.

Do Chi Square Tests: for ^{3}H (Tritium)?

Mark this box to enable a test that measures the degree of reproducibility for Tritium sample counting. If the Chi-Square value for a Tritium standard counted 20 times falls within an acceptable range of values, the variation in individual sample counts is a result of the count statistics of the sample, as opposed to an instrument problem.

Do Chi Square Tests: for ^{14}C (Carbon-14)?
Mark this box to enable a test that measures the degree of reproducibility for Carbon-14 sample counting. If the Chi-Square value for a Carbon-14 standard counted 20 times falls within an acceptable range of values, the variation in individual sample counts is a result of the count statistics of the sample, as opposed to an instrument problem.

RS-232 Transmit IPA Data?
Mark this box if you would like to transmit the IPA data to an external device, via the RS-232 communications port.

Save IPA Data To Text File
Clicking on this box enables the File Name field. You can then directly enter the path to where you want the IPA data saved as a text file.

# of Datapoints to Establish Baselines
Enter the number of IPA runs you would like to use to generate baselines for Tritium and Carbon-14 background and efficiency. The range for this value is between five and 99.

Tritium Background Mean and Limit
The instrument calculates the mean value for Tritium background from the number of IPA runs (datapoints) specified. This limit is calculated as 4SE (statistical error based on counts) above the baseline. When the limit is reached, a message is displayed in the main window.

^{14}C (Carbon-14) Background Mean and Limit
The instrument calculates the mean value for Carbon-14 background from the number of IPA runs (datapoints) specified. This limit is calculated as 4SE (statistical error based on counts) above the baseline. When the limit is reached, a message is displayed in the main window.

^{3}H (Tritium) Efficiency Mean and Limit
The instrument calculates the mean value for Tritium efficiency from the number of IPA runs (datapoints) specified. This limit is calculated as 3% below the baseline, or less than 58% efficiency. When the limit is exceeded, a message is displayed in the main window.

^{14}C (Carbon-14) Efficiency Mean and Limit
The instrument calculates the mean value for Carbon-14 efficiency from the number of IPA runs (datapoints) specified. This limit is calculated as 3% below the baseline. When the limit is exceeded, a message is displayed in the main window.

Reset Baselines

Click this button to delete the current baselines. The instrument uses the data from the number of IPA runs specified in the # of Datapoints to Establish Baselines field to establish new baselines. The range for this value is between five and 99.

Running the SNC Protocol for an Instrument without Super Low Level Counting Ability:

After defining the IPA parameters:

1. To run the SNC/IPA protocol, regardless of how long it has been since it last ran, reset the SNC protocol flag to the “reset position (the flag is all the way to the left when the flag is on the left end of the cassette). If the protocol flag is not “reset”, the SNC/IPA protocol will only run if 23 hours have elapsed since the last time that the protocol was run.

Note: The cassette must be loaded in the following order:

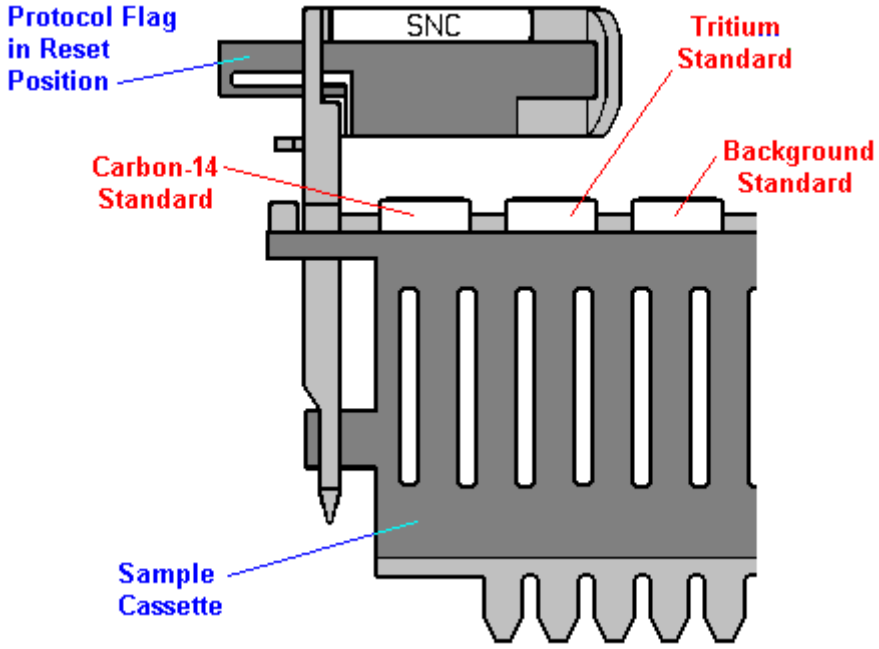

Figure 4-2 Standard SNC/IPA Cassette Loading.

2. Load the purged, unquenched Carbon-14 standard (supplied) into the first position of the cassette (this is at the same end as the protocol flag).

Caution: Do not use the unpurged, Low Level standards to calibrate the instrument, even if the instrument is to be used in Low Level, High Sensitivity or Super Low Level count mode.

3. Load the purged, unquenched Tritium standard (supplied) into the second cassette position.
4. Load the purged background standard (supplied) into the third cassette position.

If the instrument is IDLE (not counting):

5. Load the calibration cassette on the right-hand side of the sample changer deck such that you can read the protocol flag.

   Press the **Start** button to begin counting.

   If the instrument is currently counting a sample:

   Load the calibration cassette after the last cassette belonging to the current protocol. When the current protocol is completed, the calibration cassette will automatically move into the counting position. After the SNC flag is read by the instrument, the calibration, normalization and IPA procedure begins and the flag is automatically returned to the “non-reset” position.

To access the data generated from the IPA runs, select IPA Charts & Tables from the IPA menu.

Running the SNC Protocol for an Instrument with Super Low Level Counting Ability (with a BGO Detector Guard):
After defining the IPA parameters:

1. The SNC/IPA protocol will run every time that the protocol plug is recognized, regardless of the state of the protocol flag or how long it has been since it was last run.

Note: The cassette must be loaded in the following order:

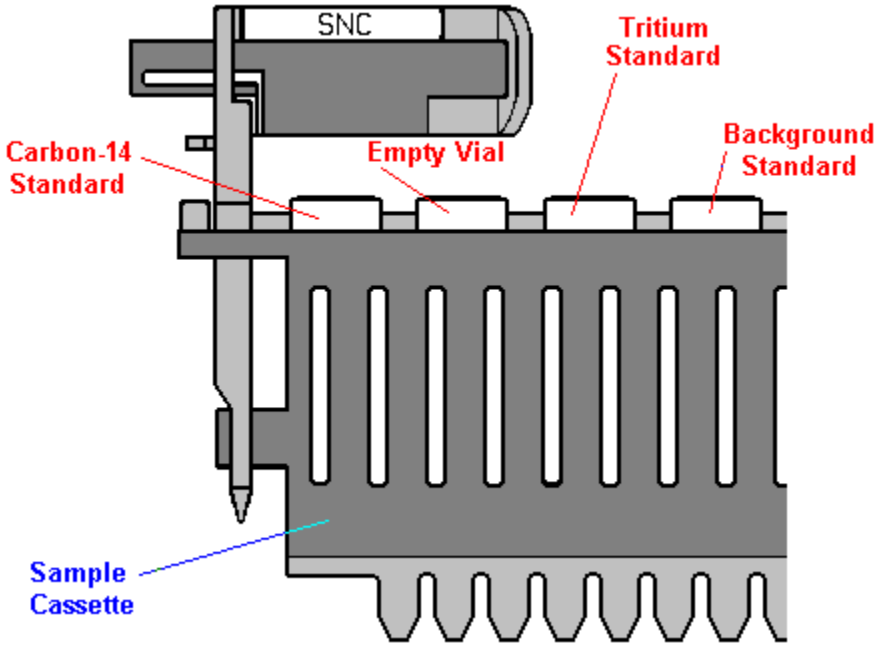

Figure 4-3 Super Low Level SNC/IPA Casette Loading.

2. Load the purged, unquenched Carbon-14 standard into the first position of the cassette (this is at the same end as the protocol flag).

Caution: Do not use the unpurged, Low Level standards to calibrate the instrument, even if the instrument is to be used in the High Sensitivity, Low Level, or Super Low Level count mode.

3. Load an empty vial into the second cassette position.
4. Load the purged, unquenched Tritium standard into the third cassette position.
5. Load the purged background standard into the fourth cassette position.
6. If the instrument is IDLE (not counting), load the calibration cassette on the right-hand side of the sample changer deck such that you can read the protocol flag and press the **Start** button to begin counting.

If the instrument is currently counting a sample, load the calibration cassette after the last cassette belonging to the current protocol. When the current protocol is completed, the calibration cassette will automatically move into the counting position. After the SNC flag is read by the instrument, the calibration, normalization and IPA procedure begins.

Once you have defined the IPA parameters and performed IPA, you can access the data generated from the IPA runs by selecting IPA Charts & Tables from the IPA menu.

Note: Calibration, Normalization and IPA on an instrument equipped with a BGO detector guard does not occur by virtue of the 23-hour timer. It occurs each time the SNC protocol flag is detected by the instrument.

The IPA Results

An IPA report is generated after each IPA procedure is completed. Data for all IPA parameters may be viewed, edited or printed via the IPA Charts & Tables menu option.

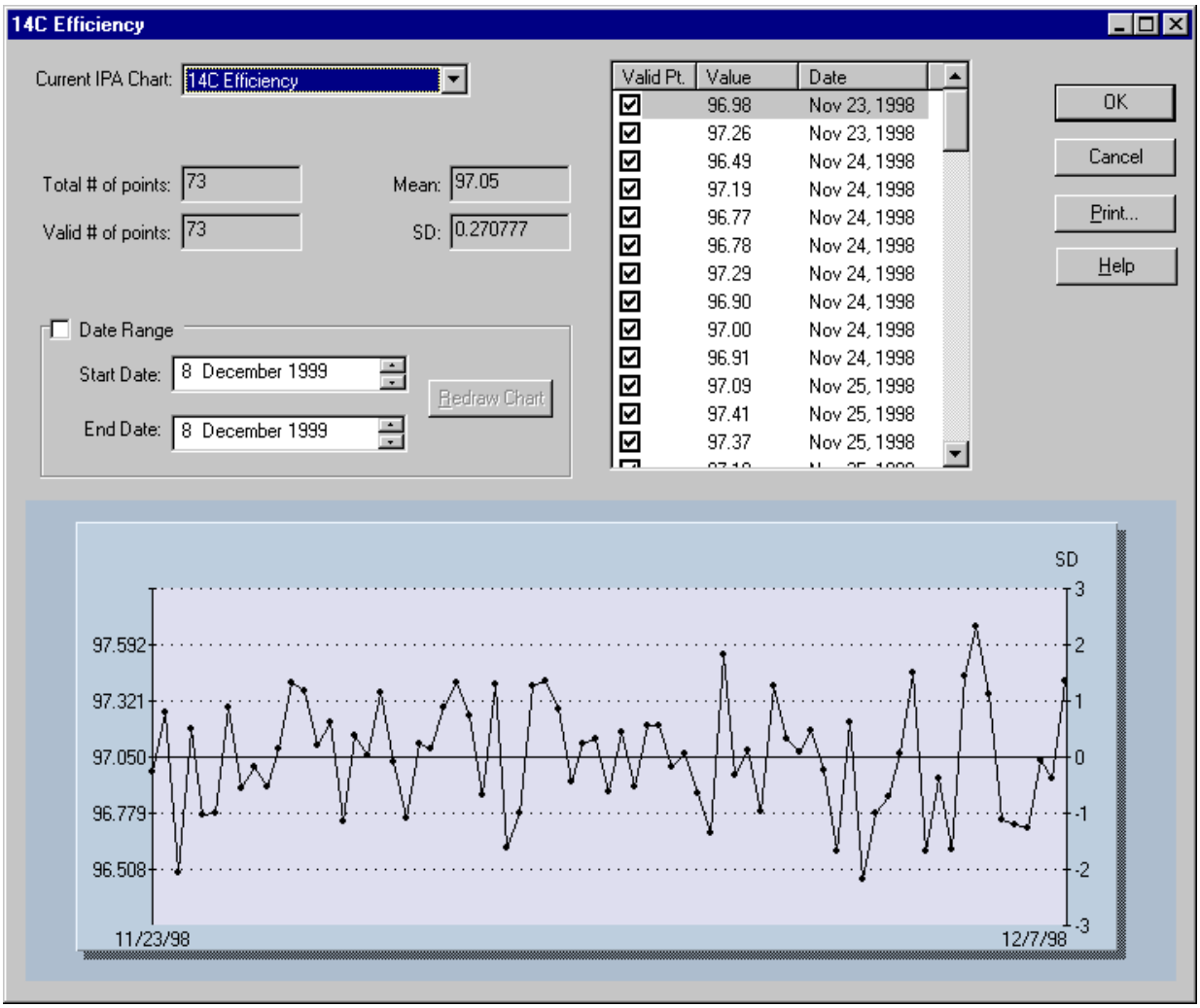

Figure 4-4 IPA Charts & Tables.

When the data is displayed as a table, points can be included or excluded from the data set. The right axis on the chart represents Standard Deviation, while the left axis represents the Mean value or baseline value for the selected IPA parameter depending on which type of chart is displayed. Using the print button in the IPA Charts & Tables window, you may print an individual chart or table, or you may print all the IPA charts and tables.

The following IPA charts are available:

^{14}C (Carbon-14) Background
This chart displays the results of the IPA test for Carbon-14 background counts. This test checks for detector contamination or light leaks. The limit for this parameter is > baseline + 4 Standard Deviations (SD). The mean and SD for this parameter are recalculated as new IPA data are generated.

^{14}C (Carbon-14) Background Baseline
This chart displays the Carbon-14 background data based on a fixed baseline value. The number of values used to generate the baseline is programmable and is defined in the IPA Definition window. The default for this setting is five.

^{14}C (Carbon-14) Chi-Square
This chart displays the results of the IPA test that measures the reproducibility of sample counting for Carbon-14. The test is performed by counting a single sample in the detector 20 consecutive times with a count time of 30 seconds for each repeat measurement. The normal range for this value is 7.63 to 36.19. A properly performing instrument may generate Chi-Square values outside this range 5% of the time, due to the statistical nature of the test. The mean and SD for this parameter are recalculated as new IPA data are generated.

^{14}C (Carbon-14) Efficiency
This chart displays the results of repeated Carbon-14 efficiency determinations. The mean and SD for this parameter are recalculated as new IPA data are generated.

^{14}C (Carbon-14) Efficiency Baseline
This chart displays the Carbon-14 efficiency data based on a fixed baseline value. The number of values used to generate the baseline is programmable and is defined in the IPA Definition window. The default for this setting is five.

^{14}C (Carbon-14) Figure of Merit
Figure of Merit (FOM) is a measure of the sensitivity of the instrument for Carbon-14 based on the instrument's counting efficiency and background. The mean and SD for this parameter are recalculated as new IPA data are generated.

^{3}H (Tritium) Background
This chart displays the results of the IPA test for Tritium background counts. This test checks for detector contamination or light leaks. The limit for this parameter is > baseline + 4 Standard Deviations (SD). The mean and SD for this parameter are recalculated as new IPA data are generated.

^{3}H (Tritium) Background Baseline

This chart displays the Tritium background data based on a fixed baseline value. The number of values used to generate the baseline is programmable and is defined in the IPA Definition window. The limit for this parameter is > baseline + 4 Standard Deviations (SD). The default for this setting is five.

^{3}H (Tritium) Chi-Square

This chart displays the results of the IPA test that measures the reproducibility of sample counting for Tritium. The test is performed by counting a single sample in the detector 20 consecutive times with a count time of 30 seconds for each repeat measurement. The normal range for this value is 7.63 to 36.19. A properly performing instrument may generate Chi-Square values outside this range 5% of the time, due to the statistical nature of the test. The mean and SD for this parameter are recalculated as new IPA data is generated.

^{3}H (Tritium) Efficiency

This chart displays the results of repeated Tritium efficiency determinations. The mean and SD for this parameter are recalculated as new IPA data is generated. The limit for this parameter is < baseline minus 3%.

^{3}H (Tritium) Efficiency Baseline

This chart displays the Tritium efficiency data based on a fixed baseline value. The number of values used to generate the baseline is programmable and is defined in the IPA Definition window. The default for this setting is five. The limit for this parameter is < baseline minus 3%.

^{3}H (Tritium) Figure of Merit

Figure of Merit (FOM) is a measure of the sensitivity of the instrument for Tritium based on the instrument's counting efficiency. The mean and SD for this parameter are recalculated as new IPA data are generated.

When the data is displayed as a table, points can be included or excluded from the data set. The right axis on the chart represents Standard Deviation, while the left axis represents the Mean value or baseline value for the selected IPA parameter depending on which chart is displayed. Using the print button in the IPA Charts & Tables window, you may print an individual chart or table, or you may print all the IPA charts and tables.

Chapter 5

Defining a CPM Assay

This chapter of the Getting Started manual describes the process for defining simple CPM assays. Information pertaining to Count Modes, Count Correction features and Quench Indicating Parameters is not addressed in this chapter. For detailed information regarding complex assays, please refer to the online help associated with the QuantaSmart program.

The CPM Assay

The CPM assay provides you with information regarding the total quantity of radioactivity within a sample, in one, two, or three defined counting regions, without regard to counting efficiency or sample interference, such as quench. The data generated from the assay is expressed in CPM (Counts Per Minute).

Prior to defining a CPM assay, the instrument should be properly calibrated. Refer to Chapter 4 of the Getting Started Manual, or the online help documentation for details regarding calibration.

Selecting a CPM Assay

Before defining a CPM assay, you must create a new assay by selecting New Assay from the File menu. The Select Assay Type window is displayed below.

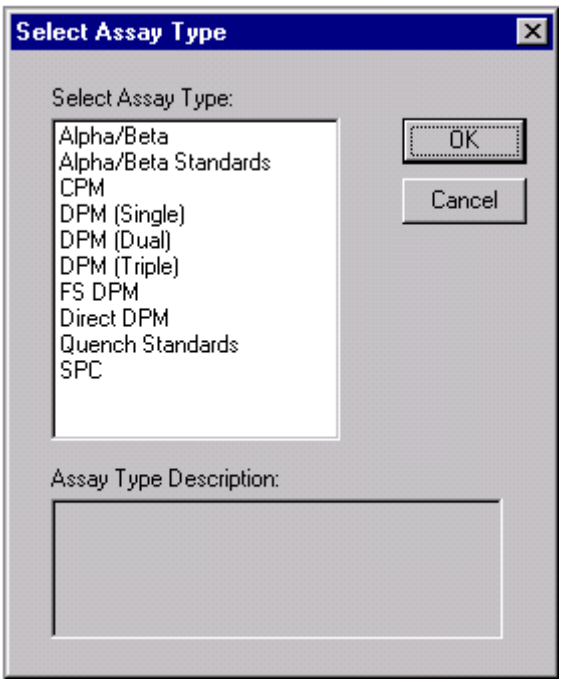

Figure 5-1 The Select Assay Type Window.

Select CPM from the Select Assay Type window and click OK. The Assay Definition window is displayed.

Note: For information regarding other assay types, please refer to the online help documentation for the QuantaSmart program.

The Assay Definition Window

Assays are defined by entering information into the seven Assay Definition tabs within the Assay Definition window: Assay Parameters, Count Conditions, Count Corrections, Report Definition, Report Output, Special Files, and Worklist. Using these windows for each CPM assay that you define, you will:

- Enter descriptive information about the nature of the assay and specify an author of the assay.
- Define a sample nuclide in the sample nuclides library if one does not already exist.
- Link the nuclide to the assay.
- Specify the appropriate count conditions and count correction factors that the instrument will use to analyze the samples.
- Define the reports you would like the system to generate.
- Define an optional worklist to designate Positive Identification numbers and sample names that correspond to sample numbers on a printout, if desired. Refer to the online help documentation for details regarding Worklists.

The parameters defined within the context of these tabs can be saved and used or edited at your discretion.

Assay Parameters

The Assay Parameters tab allows you to designate an author and provide descriptive information for an assay. You may also prohibit the editing of assay parameters using this window.

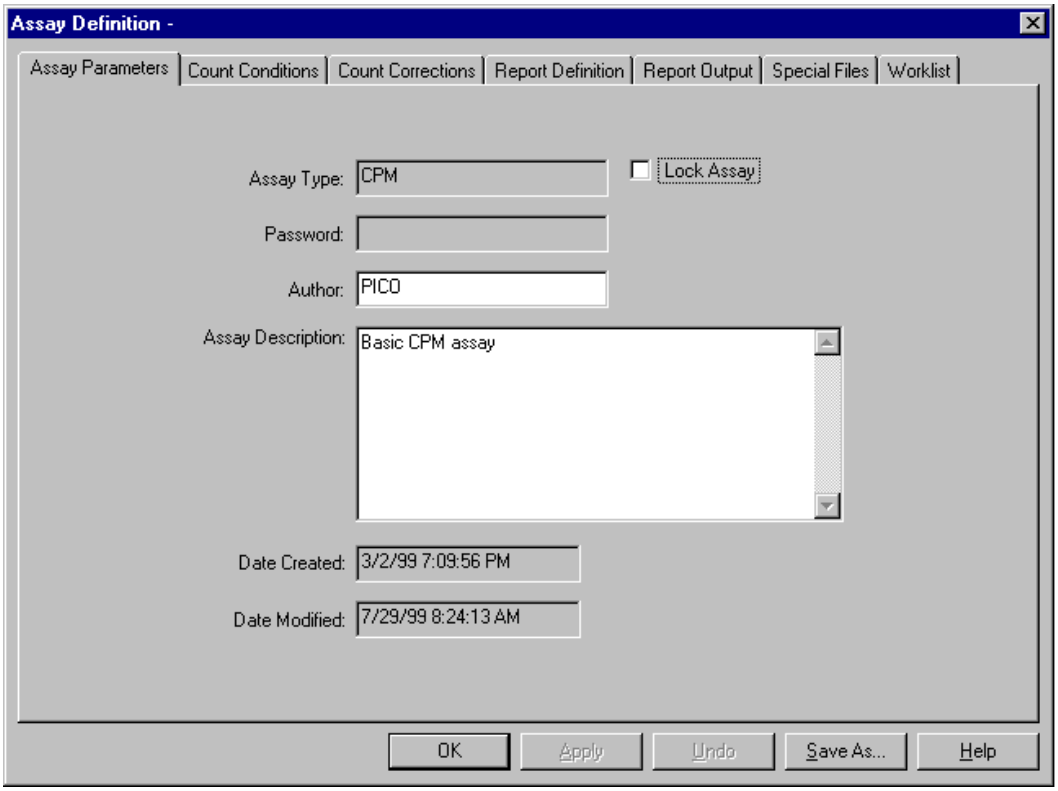

Figure 5-2 The Assay Parameters Tab.

Password

Enter a password (optional) to restrict editing functions for this assay. You must check the Lock Assay box before you can enter a password in this field.

Note: You cannot retrieve a lost or forgotten password.

Lock Assay

Mark this box if you would like to restrict editing functions for this assay. You must enter a password in the Password field if you would like to lock the assay.

Author

Enter your name or other identification as the author of the assay.

Assay Description

Enter descriptive information about the assay. This information is for future reference and is stored permanently with the assay. It does not appear in the reports.

Note: For information regarding the individual assay parameters, please refer to the “Assay Parameters” topic in the online help documentation.

Count Conditions

The Count Conditions tab allows you to define specific counting parameters for an assay.

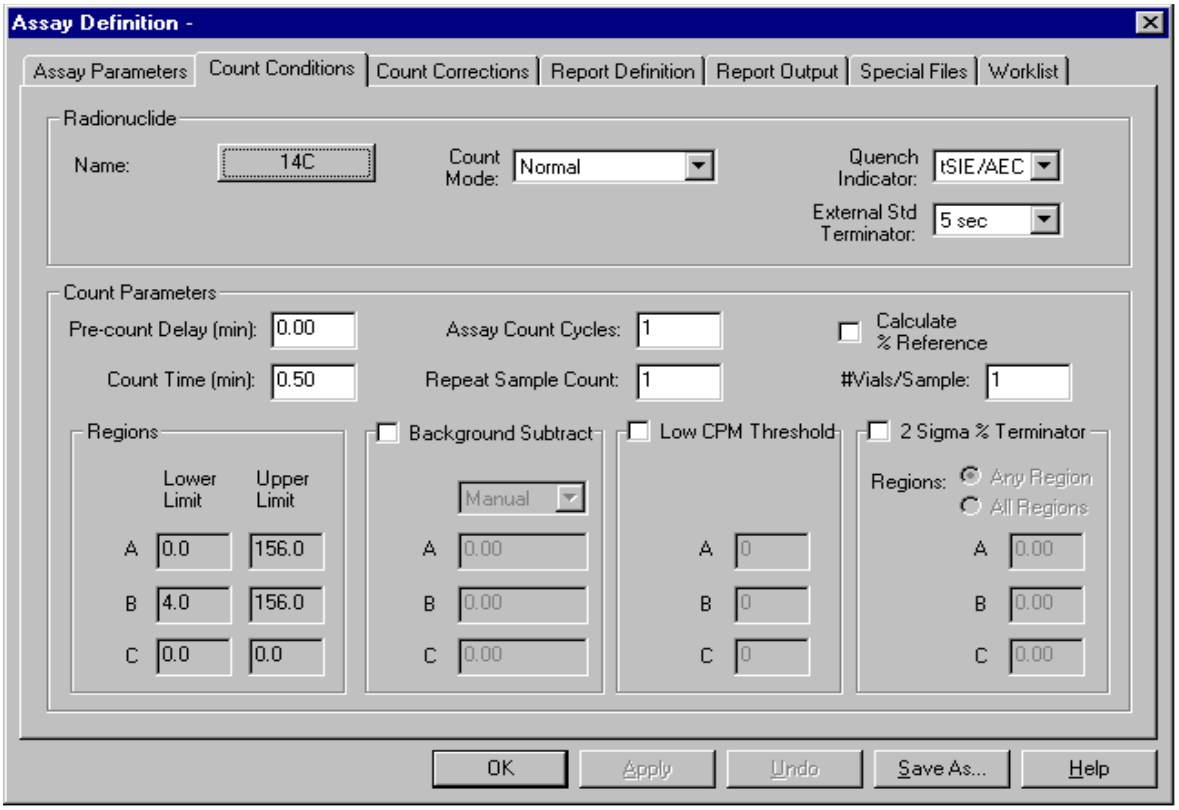

Figure 5-3 The Count Conditions Tab.

Name

Click this button to display the Sample Nuclides Library window.

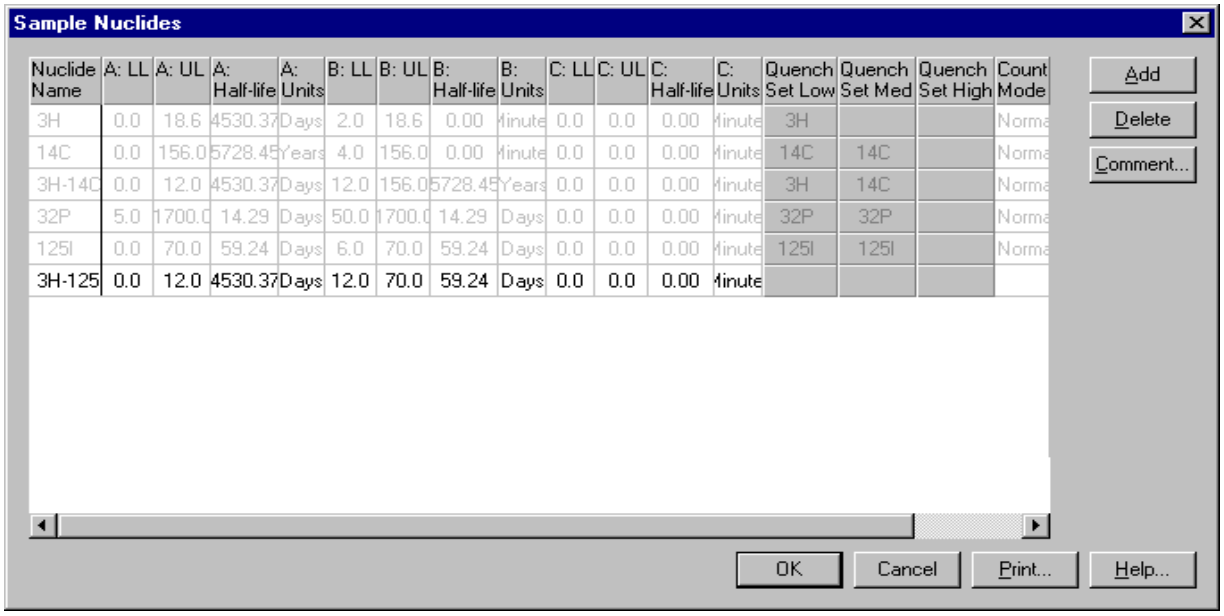

Figure 5-4 The Sample Nuclides Library Window.

This window allows you to enter information into and retrieve information from the Sample Nuclides Library. You can use the Sample Nuclides Library to define and save nuclide names and counting region limits for radionuclides in your samples. You can also link quench sets to nuclides for DPM assays (optional for the TriCarb 2800TR).

Select the appropriate nuclide(s) for your assay from the list provided and click OK.

Assay Count Cycles

Enter the number of times you would like the assay to count. The assay is recounted after it has moved one complete cycle around the sample changer deck. Any samples on the sample changer deck will be counted prior to your samples being recounted.

Count Time

Enter the maximum length of time that the samples will be counted (up to 9,999.99 minutes). Typically, a longer count time provides better count statistics. Two other count terminators, 2 Sigma% and Low Count Reject (LCR), allow you to terminate sample counting or either counting statistics or low activity.

Background Subtract

Mark this box to subtract background CPM from all samples. The background value is established in one of three ways. The method used is selected from the drop down list:

When the *1st Vial* background subtraction method is implemented, the instrument counts the first vial in an assay for either ten minutes or the defined assay count time (whichever is greater) and establishes a CPM value for each region; these are the background values subtracted from each sample within each region of the assay.

When the *IPA* background subtraction method is implemented, the instrument subtracts the background values established during the Instrument Performance Assessment procedures from the entire spectrum of each sample. The background spectra are stored during these procedures and are available for any counting region.

The *Manual* background subtraction feature allows you to enter the CPM values you would like the instrument to subtract from each counting region of the samples.

Note: For information regarding additional items in the Count Conditions tab, please refer to the "Count Conditions" topic in the online help documentation.

Count Corrections

The Count Corrections tab allows you to activate certain instrument devices or features and define count correction parameters.

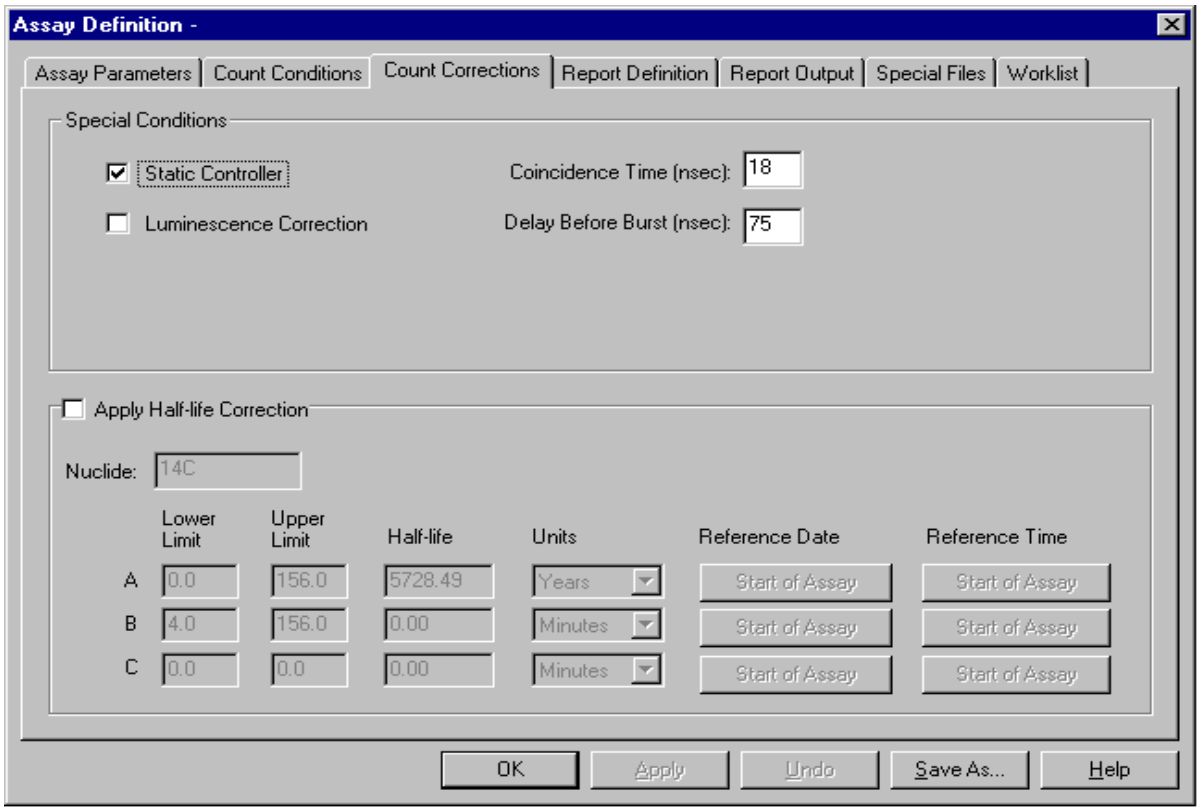

Figure 5-5 The Count Corrections Tab.

Static Controller

The instrument's static-controlling device, which is designed to reduce static originating on the sample vial, is automatically enabled. Static discharge can falsely elevate sample counts by producing non-beta pulses. This device should be activated in most cases. It is especially important in low humidity conditions, when using plastic vials and when handling vials with latex gloves. To further reduce the likelihood of generating static:

- Maintain a relative humidity level above 40%.
- Wipe latex gloves with anti-static wipes before handling vials.
- Use the "Pre-count delay" timer which delays the counting of each sample while static-induced pulses dissipate.

Luminescence Correction

Mark this box to activate luminescence correction. The instrument corrects the data for counts resulting from sample luminescence.

Apply Half-life Correction

Mark this box to activate half-life correction. This feature is typically used when counting short half-life nuclides. The instrument corrects the sample counts for half-life decay of the nuclide(s) being counted. The Half-life value for the nuclide is taken from the nuclide entry in the Sample Nuclide Library. The Reference Date and Time are used to perform the decay calculation. The default settings for the Reference Date and Time correspond to the start of an assay.

Note: For information regarding additional count correction features, please refer to the topic “Count Corrections” in the online help documentation.

Report Definition

The Report Definition tab allows you to specify the data items that are reported and the format for reporting. Multiple reports can be defined for each assay.

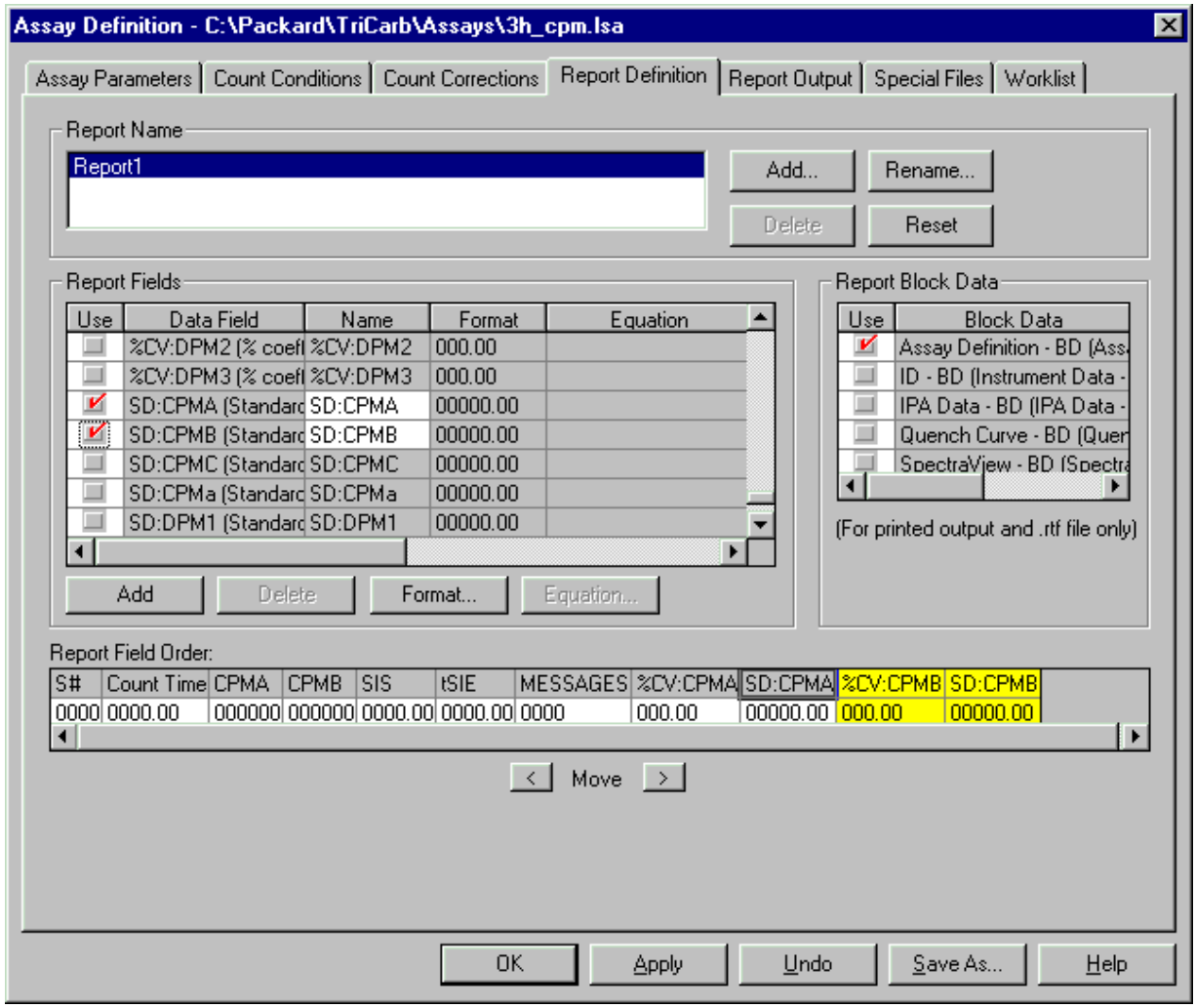

Figure 5-6 The Report Definition Tab.

Report Name

The Report Name field allows you to assign a descriptive name to a report. You can use the four buttons beside the Report Name list to add a new report, remove a named report, rename an existing report or reset the field selections to the original factory default.

Note: You cannot use special characters when naming reports.

Report Fields

You may define several printed or electronic reports for each assay, each containing different data items. The Report Fields box contains a comprehensive list of the available data items. To select the data items you would like to include in a report, double-click on those items in the Report Fields box.

Add Button

Click on this button to add a Custom report field to those already available in the list of fields. You can define these custom fields for name, content and format as desired.

Delete Button

Click on this button to delete a Custom report field from the currently selected report. A confirmation window will prompt you to confirm the deletion.

Note: You cannot delete a Custom field if it is referenced by another equation. The referencing equation must be deleted or modified first.

Format Button

Click on this button to bring up a window allowing the formatting of the selected field. Specify the total number of digits and the number of decimal places for the overall width of the field.

For fields that may result in very large or very small numbers, you may choose Scientific Notation as shown in the following examples:

Examples:3.123e+006 is equivalent to 3.123×10^{6} (3,123,000)
3.123e-003 is equivalent to 3.123×10^{-3} (0.003123)

Equation... Button

Click on this button to create an equation associated with the selected Custom field (see the note above under Delete Button). The following window will appear:

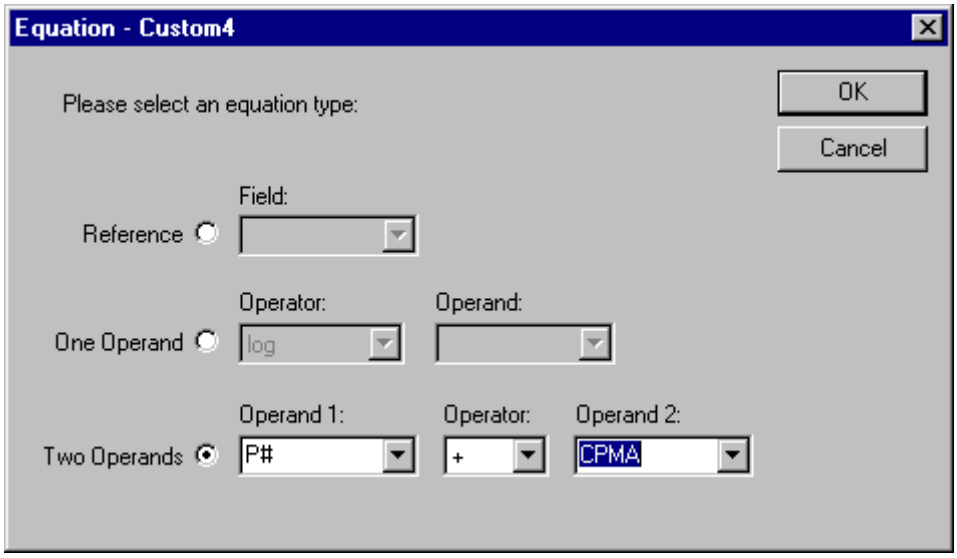

Figure 5-7 Equation Window

Reference: Reiterates the value of another field, either for convenience of repeating the value or custom naming of the field.

Operands: You can enter a constant value or choose any valid report field for these values.

Operators: You can choose any of the mathematical operations available on the drop down lists. These include common logarithm, natural anti-logarithm and square-root for the unary (single operand) operators and addition, subtraction, multiplication and division for the binary (two operands) operators.

Report Output

The Report Output tab offers options for how the report is output.

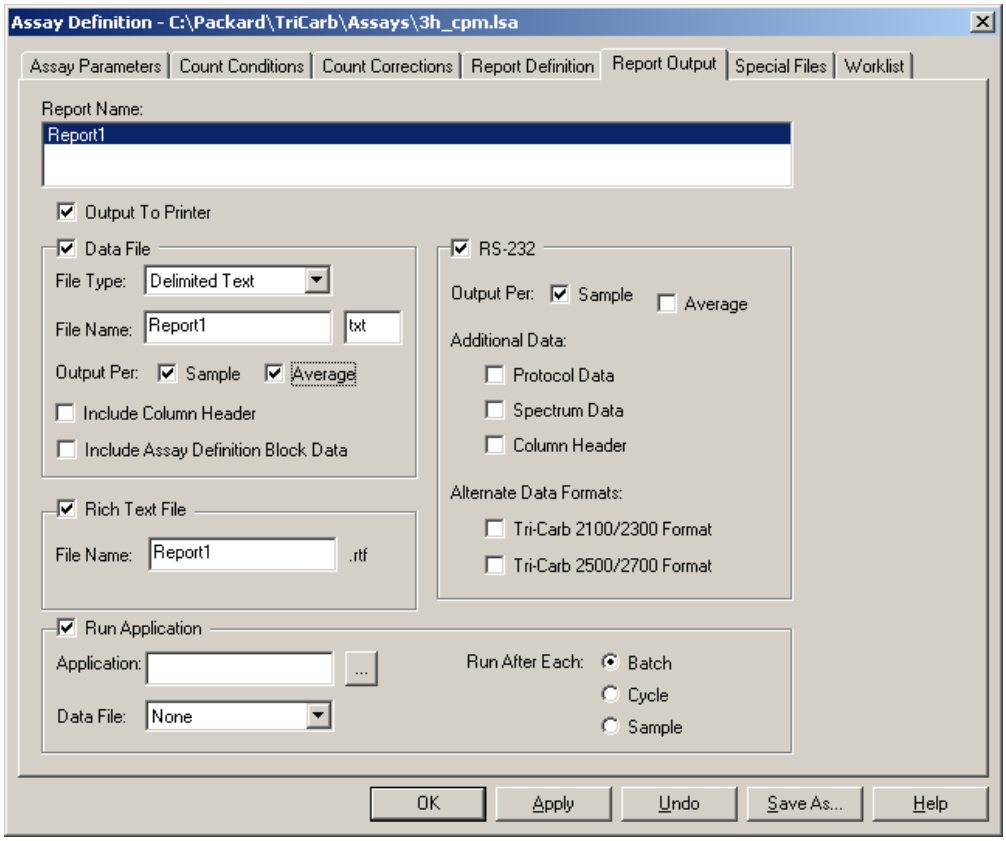

Figure 5-8 Report Output Window.

Major options offered in the Report Output window are printing the output to a printer, saving the output to a file, outputting the report to the RS-232 serial port, and tandem processing (running a printer, saving the output to a file, outputting the report to the RS-232 serial port, and tandem processing (running a program and a file after each batch, cycle, or sample).

Note:QuantaSmart automatically saves data as dated Results files for the optional Replay feature. However you can select other formats as reports, including Delimited Text (ASCII), Excel format, and Lotus 1-2-3 format.

Special Files

The Special Files window allows you to select and configure information regarding files pertinent to the assays.

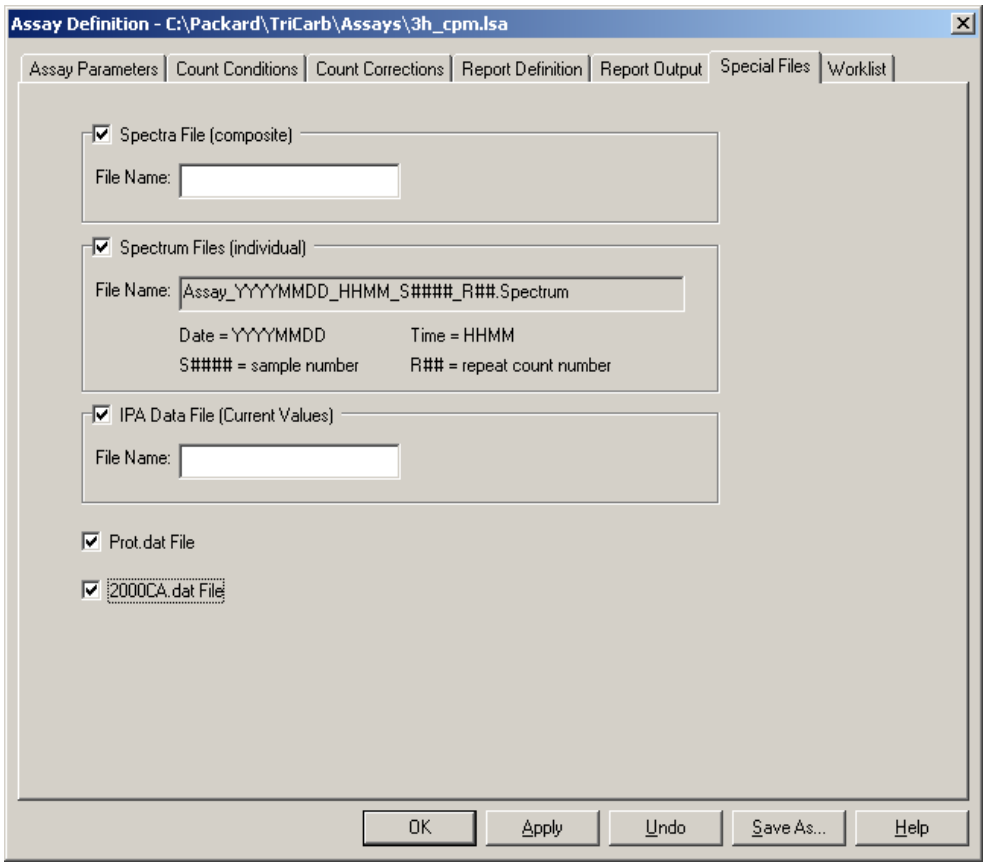

Figure 5-9 Special Files

Some of the major selections are making the following types of files:

- Composite file-all sample spectra are saved in a single file.
- Individual spectrum file - each file represents the spectrum of one sample
- IPA data file
- Prot.dat file
- 2000CA.dat file

Files are saved according to the path defined in the Data Output Path window when associating the assay to the protocol flag.

Once you have defined the assay parameters click the **OK** button in the Assay Definition window. Save the file to an appropriate folder, giving the file a descriptive name. Once you have saved the assay parameters, you must associate the assay to a protocol flag number, load the cassette with vials, load the instrument with cassettes, and begin counting the samples.

Chapter 6

Loading and Counting Samples

Before loading and analyzing samples, you must:

1. Calibrate the instrument. Refer to Chapter 4 of the Getting Started manual, or the online help documentation for details regarding calibration.
2. Define the assay using the seven tabs in the Assay Definition window.
3. Associate the assay to a protocol flag number.

Associating an Assay to a Protocol Flag Number

In the Protocols tab in the QuantaSmart main window, select a flag number that you would like to link to an assay. Right click on that selection. Select Associate Assay from the menu. You may also select Associate Assay from the File menu. menu.

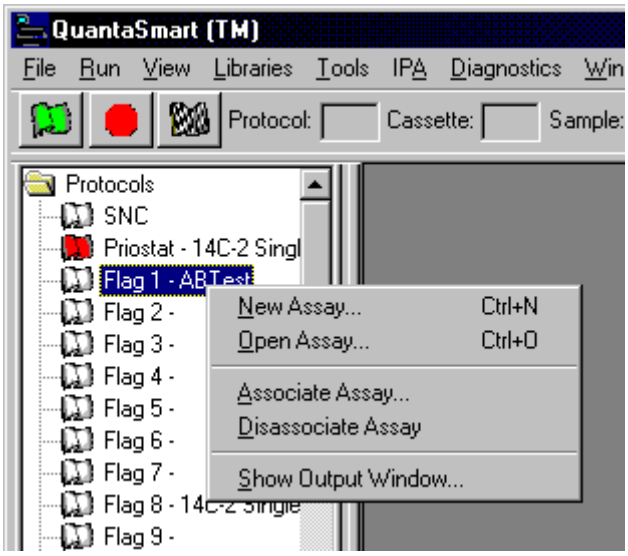

Figure 6-1 Associating an Assay to a Protocol Flag Number.

The Associate Assay window is displayed. Select an assay that you would like to link to the protocol. The Data Paths window is displayed. Enter a User ID and Additional Header (optional). Click OK. The file name of the assay you have linked should appear in the Protocols Tree with the flag number to which you have associated the assay.

Loading the Cassette with Vials

A cassette is a plastic device that moves sample vials on the instrument's sample changer deck. Load the vials into the cassette(s) as shown below:

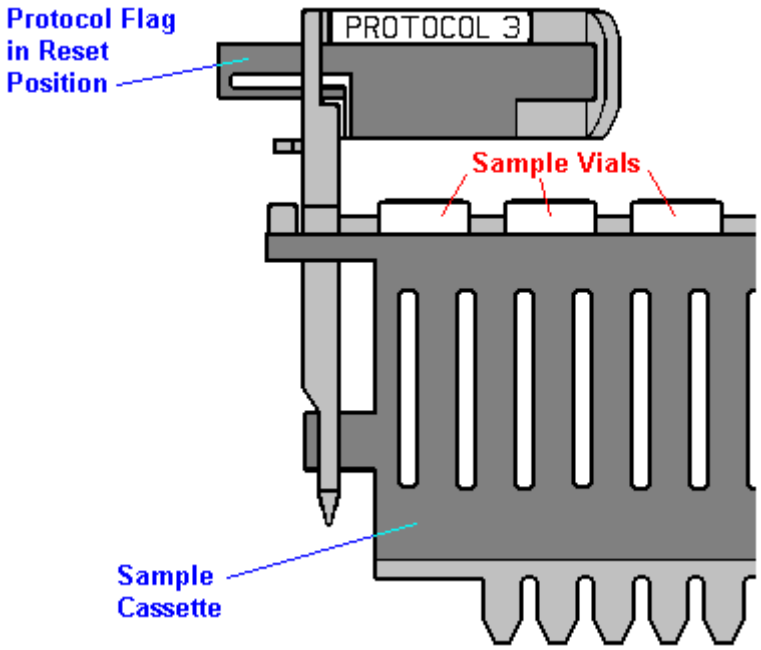

Figure 6-2 A Cassette Containing Sample Vials.

The first cassette in a protocol must contain the appropriate protocol flag number in the reset position (the flag is all the way to the left when the flag is on the left end of the cassette). The instrument moves the cassettes in a counterclockwise (forward) direction during sample analysis.

Loading the Instrument with Cassettes

To load the instrument, place the cassette(s) on the sample changer deck so that the protocol number on the flag is facing you. If the instrument is in the process of analyzing samples, place your cassettes after the last cassette in the currently counting assay. Your samples will be analyzed immediately after the current assay is completed. If the instrument is not in use, place your cassettes on the right side of the sample changer deck such that no other cassettes are between your samples and the far wall of the sample changer deck.

Counting Samples

Begin counting samples by selecting the Start button in the toolbar of the QuantaSmart main window. The instrument moves the first cassette into position, the first sample loads into the detection chamber and sample counting begins. Do not use the system's CD writer while the instrument is counting.

Printing Reports

A report symbol is displayed in the Protocols Tree of the main window for each currently counting assay. The printed report(s) you define for an assay will automatically print after the assay is completed if printout is chosen in the Report Output tab. To print additional reports, select the report symbol for the report you would like to print. The Output Window is displayed. Click the print button to print the report.

The Output Window

Output Window(s) display the named reports that you have defined on the Report Definition tab. A separate window will appear for each of the reports that you define and name in the assay. A typical Report Output window is shown in below:

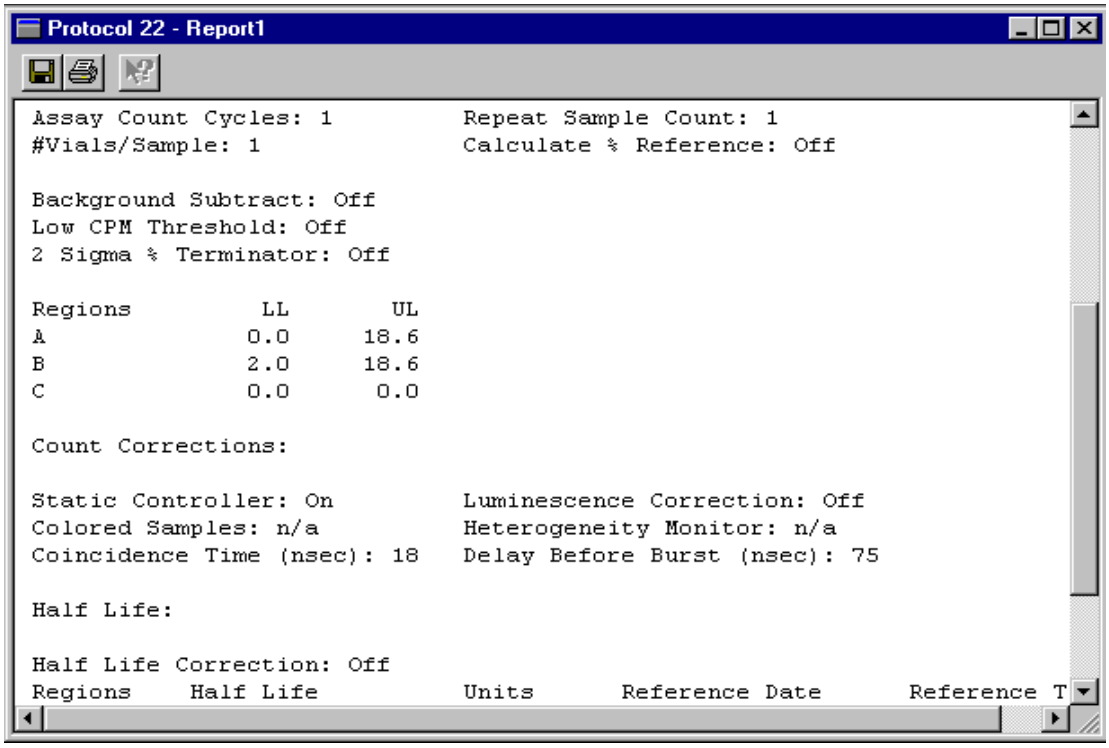

Figure 6-3 Report Output Window.

Chapter 7

Defining a Quench Standards Assay

This chapter of the Getting Started manual describes the process for defining simple Quench Standards assays. Information pertaining to Count Modes, Count Correction features and Quench Indicating Parameters is not addressed in this chapter. For detailed information regarding complex assays, please refer to the online help associated with the QuantaSmart program.

Quench

In a sample vial, the scintillation cocktail converts radioactive emissions from the sample nuclide into photons of light. The liquid scintillation analyzer detects this light when photons enter the photomultiplier tube (PMT) of the detector. Quenching occurs when something interferes with either the production or the detection of this light. Two types of quench can interfere with sample counting:

Chemical Quench

Chemical quenching occurs when a chemical agent interferes with the production of photons in the scintillator. As a result, the spectrum from a chemically quenched sample is compressed toward the low end of the (keV) energy scale.

Color Quench

Color quenching occurs when a colored agent interferes with the detection of photons. As a result, the height of the spectrum from a color-quenched sample is depressed. In cases of severe color quenching, the spectrum may also be compressed toward the low end of the (keV) energy scale.

In either case, quench affects sample counting efficiency since fewer photons are detected by the instrument.

Quench Curves

Quench Standards Assays are performed so that quench curves can be stored in the Quench Standards Library. A quench curve correlates sample counting efficiency to a Quench Indicating Parameter (QIP), SIS or tSIE. The quench indicator value for a sample is determined during sample counting. This value is used to interpolate the counting efficiency for a sample from the quench curve (where% Efficiency is plotted vs. the QIP). The interpolated efficiency value is used to calculate the DPM (Disintegrations Per Minute) for the sample, where DPM=CPM/Efficiency.

The system stores the spectrum of each standard in a quench standards set. The quench curve is constructed from the appropriate quench standards set as needed. The quench standards set needs to be counted one time only, as the quench data is available for use in any assay. You may establish a number of different quench standards sets for various nuclides in different sample matrices.

The Quench Standards Assay

The Quench Standards assay represents a comprehensive set of parameters that the system uses for the purpose of counting a quench standards set. A quench standards set is composed of a series of vials, each containing the same amount of nuclide with varying amounts of quenching agent. Using the data from the quench standards, a quench curve is generated to determine the counting efficiency and calculate DPM (Disintegrations Per Minute), where DPM=CPM/ Efficiency.

To accurately assess the level of quench within a sample, the chemical environment of the quench standards should reflect the chemical environment of the samples you would like to count.

Prior to defining a Quench Standards assay, the instrument should be properly calibrated.

Selecting a Quench Standards Assay

Before defining a Quench Standards assay, you must create a new assay by selecting New Assay from the File menu. The Select Assay Type window is displayed.

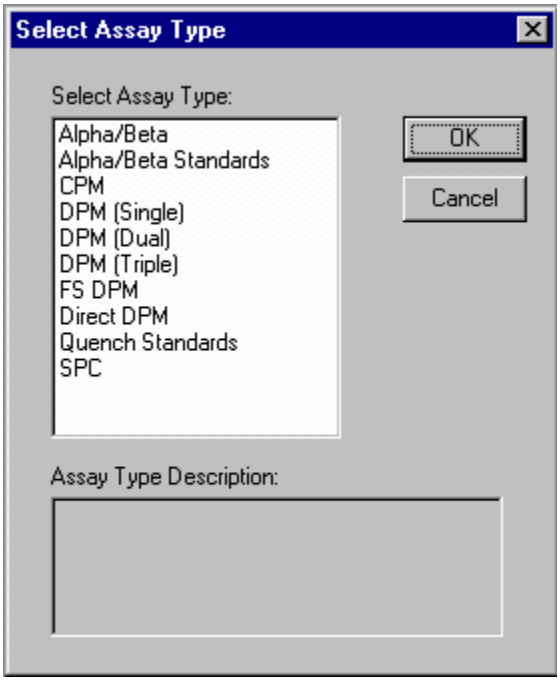

Figure 7-1 The Select Assay Type Window.

Select Quench Standards from the Select Assay Type window and click OK. The Assay Definition window is displayed.

Note: For information regarding other assay types, please refer to the online help documentation for the QuantaSmart program.

The Assay Definition Window

Assays are defined by entering information into the seven Assay Definition tabs within the Assay Definition window: Assay Parameters, Count Conditions, Count Corrections, Report Definition, Report Output, Special Files, and Worklist. Using these seven tabs, for each quench standards assay that you define, you will:

- Enter descriptive information about the nature of the assay and specify an author of the assay.
- Define a quench standard in the Quench Standards library if one does not already exist.
- Link the quench standard to the assay.
- Specify the appropriate count conditions and count correction factors that the instrument will use to analyze the standards.
- Define the reports you would like the system to generate.
- Define an optional worklist to designate Positive Identification numbers and sample names that correspond to sample numbers on a printout, if desired. Refer to the online help documentation for details regarding Worklists.

The parameters defined within the context of these seven tabs can be saved and used or edited at your discretion.

Assay Parameters

The Assay Parameters tab allows you to designate an author and provide descriptive information for an assay. You may also prohibit the editing of assay parameters using this window.

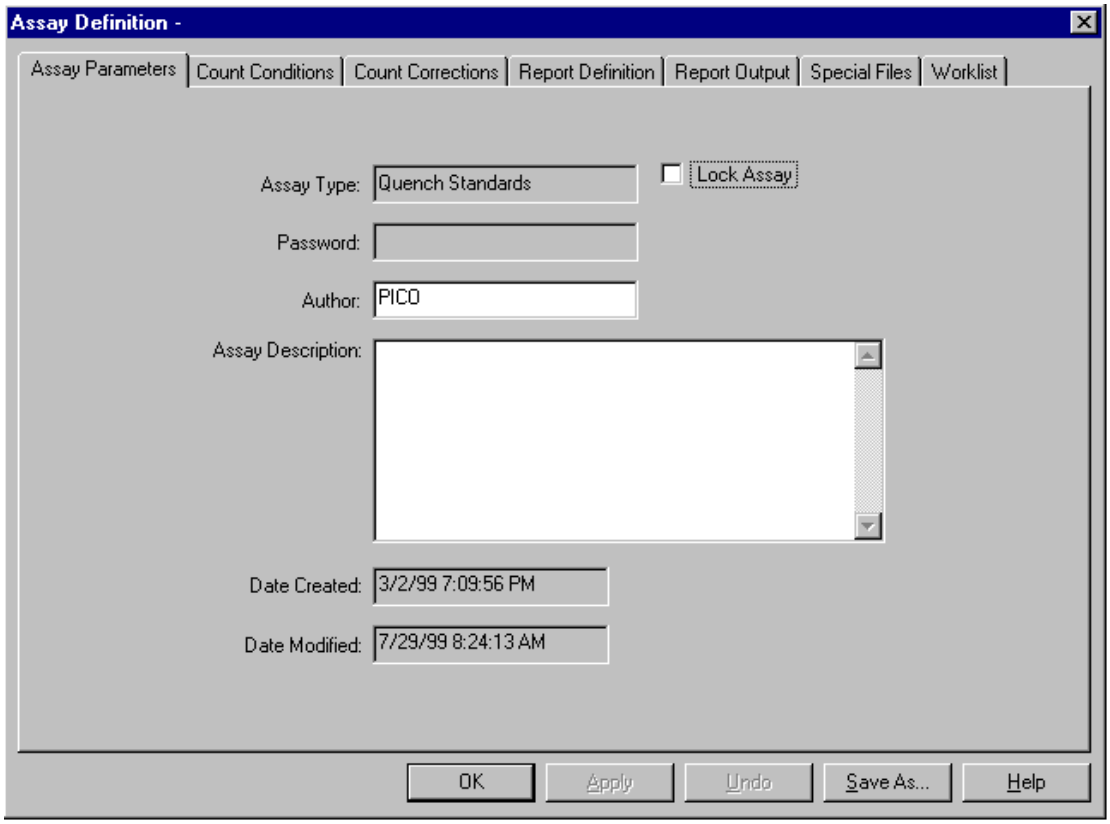

Figure 7-2 The Assay Parameters Tab.

Password

Enter a password (optional) to restrict editing functions for this assay. You must check the Lock Assay box before you can enter a password in this field.

Lock Assay

Mark this box if you would like to restrict editing functions for this assay. You must enter a password in the Password field if you would like to lock the assay.

Author

Enter your name or other identification as the author of the assay. This is an optional entry.

Assay Description

Enter descriptive information about the assay. This information is for future reference and is stored permanently with the assay.

Note: For information regarding the individual assay parameters, please refer to the “Assay Parameters” topic in the online help documentation.

Count Conditions

The Count Conditions tab allows you to define specific counting parameters for an assay.

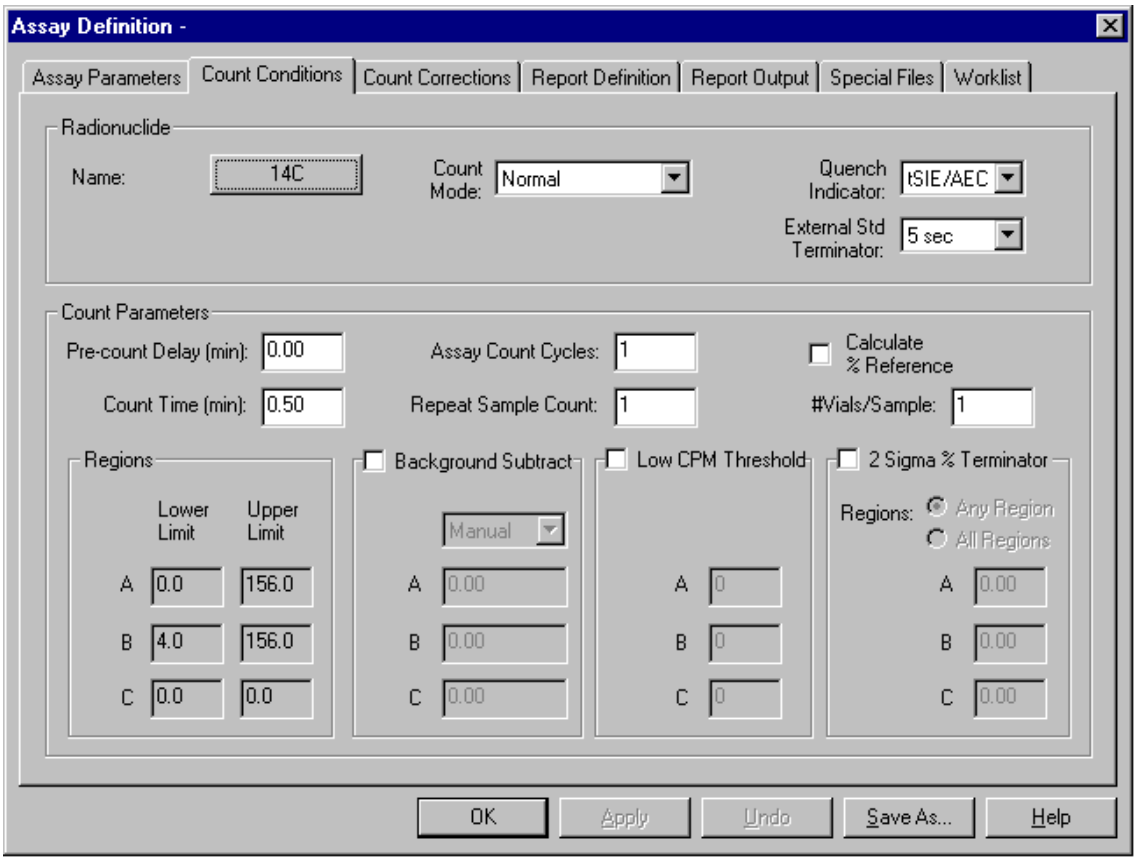

Figure 7-3 The Count Conditions Tab.

Name

Click this button to display the Quench Standards Library window.

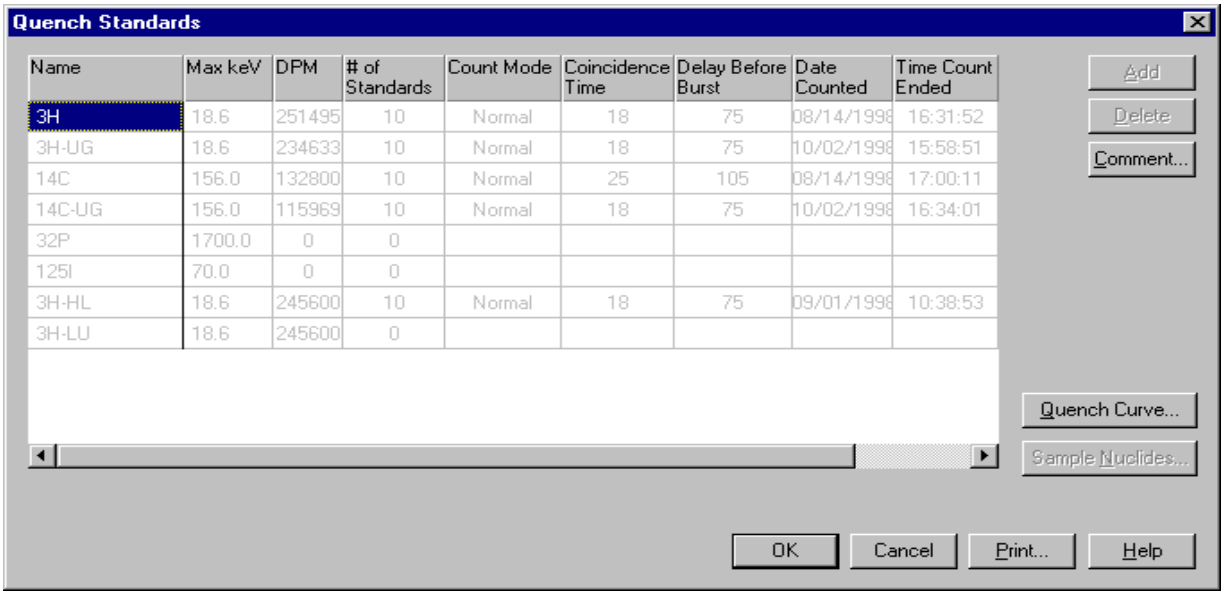

Figure 7-4 The Quench Standards Library Window.

The Quench Standards window allows you to enter information into and retrieve information from the Quench Standards Library. You can use the Quench Standards Library to define and save the name, maximum energy value and the number of standards for each quench set for Quench Standards assays. The data from these quench sets are used to construct quench curves for determining DPM (Disintegrations Per Minute) in DPM assays.

In the DPM field, enter the current DPM value of the quench standards you would like to count. If the quench standards set was purchased from PerkinElmer Life and Analytical Sciences, the DPM value and reference date are printed on the vial label. From this information, you can calculate the current DPM value using the Radionuclide Decay function of the QuantaSmart program. The Decay calculator is accessible via the Tools menu in the main window. Click Ok.

Note: The quench curve can be plotted after the quench standards are counted. To display the quench curve, click the Quench Curve button in the Quench Standards Library window. For additional information regarding quench curves, please refer to the “Quench Curve” topic in the online help documentation.

Count Time

Enter the maximum length of time that the samples will be counted. Typically, a longer count time provides better count statistics. Two other count terminators, 2 Sigma% and Low Count Reject (LCR), allow you to determine the minimum length of time that the sample will be counted. The default for this setting in a Quench Standards assay is 30 minutes.

Background Subtract

Mark this box to subtract background CPM from all samples. The background value is established in one of three ways. The method used is selected from the drop down list:

When the *1st Vial* background subtraction method is implemented, the instrument counts the first vial in the protocol for either ten minutes or the defined protocol count time (whichever is greater) and establishes a CPM value for each region; these are the background values subtracted from each sample within each region of the assay.

When the *IPA* background subtraction method is implemented, the instrument subtracts the background values established during the Instrument Performance Assessment (IPA) procedures from the entire spectrum of each sample. The background spectra are stored during these procedures and are available for any counting region.

The *Manual* background subtraction feature allows you to enter the CPM values you would like the instrument to subtract from each counting region of the samples.

Note: For information regarding additional items in the Count Conditions tab, please refer to the “Count Conditions” topic in the online help documentation.

Count Corrections

The Count Corrections tab allows you to activate certain instrument devices and define count correction parameters.

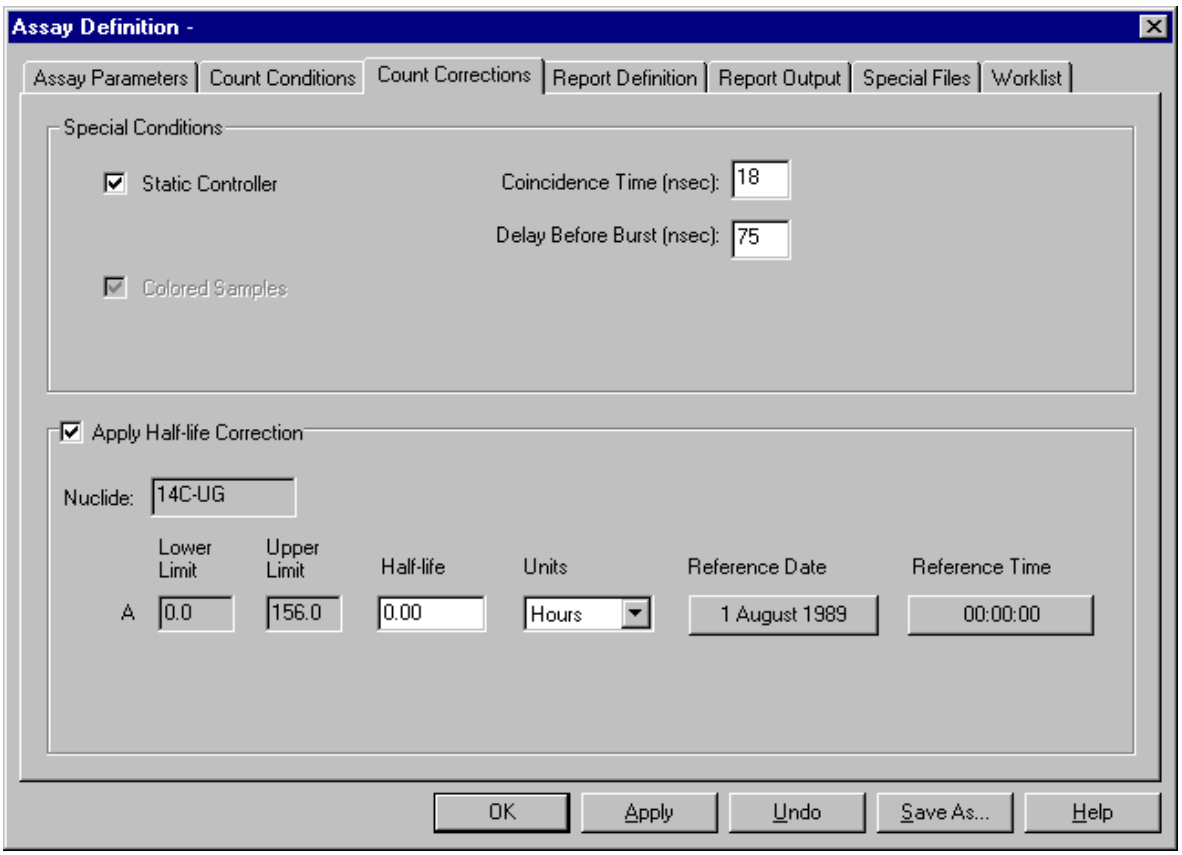

Figure 7-5 The Count Corrections Tab.

Static Controller

The instrument's static-controlling device, which is designed to reduce static originating on the sample vial, is automatically enabled. Static discharge can falsely elevate sample counts by producing non-beta pulses. This device should be activated in most cases. It is especially important in low humidity conditions, when using plastic vials and when handling vials with latex gloves. To further reduce the likelihood of generating static:

- Maintain a relative humidity level above 40%.
- Wipe latex gloves with anti-static wipes before handling vials.
- Use the "Pre-count delay" timer which delays the counting of each sample while static-induced pulses dissipate.

Apply Half-life Correction

Mark this box to activate half-life correction. This feature is typically used when counting short half-life nuclides. The instrument corrects the sample counts for half-life decay of the nuclide(s) being counted. The Half-life value for the nuclide is taken from the nuclide entry in the Quench Standards Library. The Reference Date and Time are used to make the decay calculation. The default settings for the Reference Date and Time correspond to the start of an assay. In Quench Standards assays, activate this feature only if the DPM value entered into the Quench Standards Library for the nuclide in the standards has not been corrected for decay. If the DPM value entered into the library for the standards has been corrected for decay of the nuclide, the Half-life Correction feature should not be activated.

Note: For information regarding additional count correction features, please refer to the topic “Count Corrections” in the online help documentation.

Report Definition

The Report Definition tab allows you to specify the data items that are reported and the format for reporting. Multiple reports can be defined for each assay.

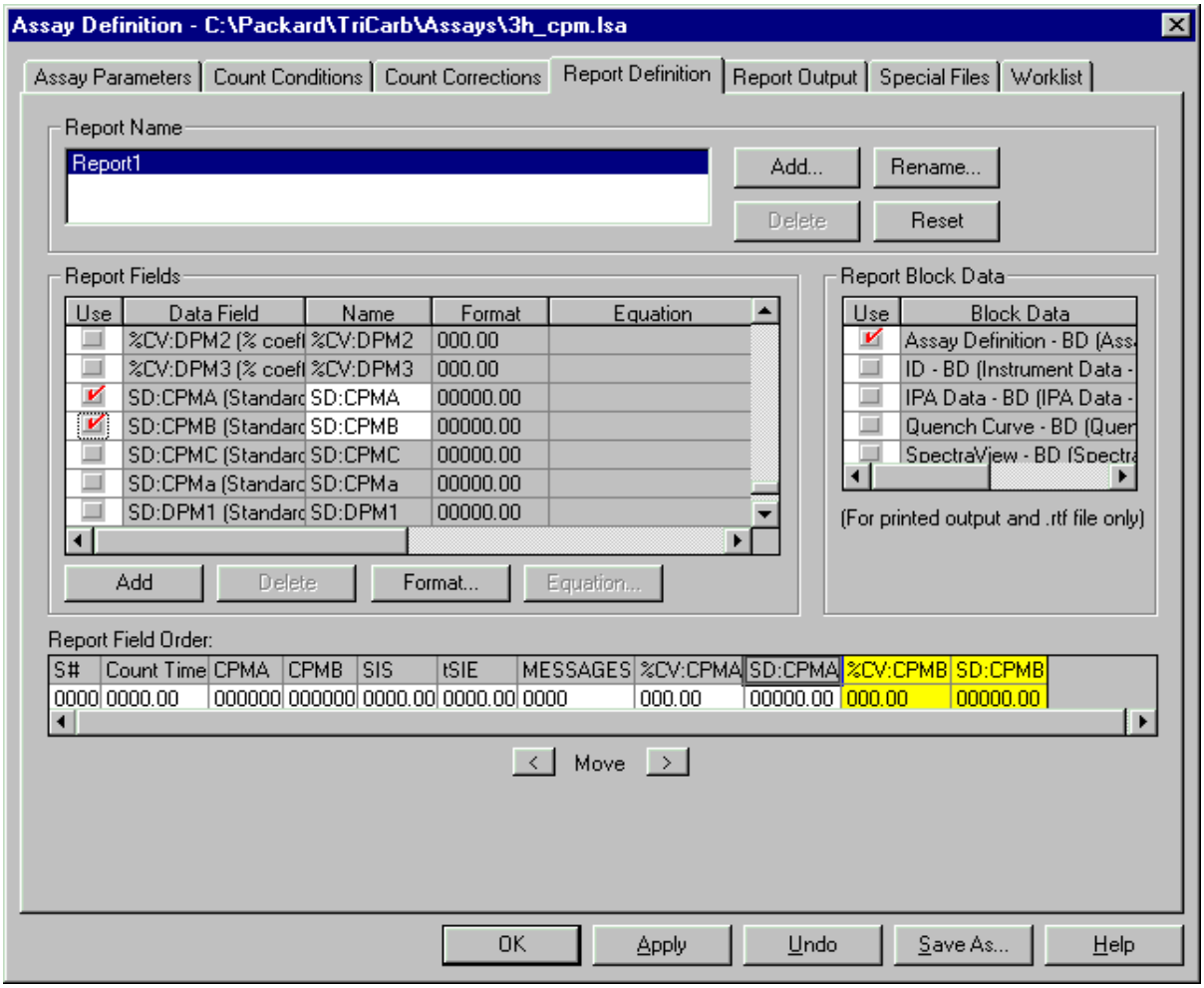

Figure 7-6 The Report Definition Tab.

Report Name

The Report Name field allows you to assign a descriptive name to a report. You can use the four buttons beside the Report Name list to add a new report, remove a named report, rename an existing report or reset the field selections to the original factory default.

Note: You cannot use special characters when naming reports.

Report Fields

You may define several printed or electronic reports for each assay, each containing different data items. The Report Fields box contains a comprehensive list of the available data items. To select the data items you would like to include in a report, double-click on those items in the Report Fields box.

Add Button

Click on this button to add a Custom report field to those already available in the list of fields. You can define these custom fields for name, content and format as desired.

Delete Button

Click on this button to delete a Custom report field from the currently selected report. A confirmation window will prompt you to confirm the deletion.

Note: You cannot delete a Custom field if it is referenced by another equation. The referencing equation must be deleted or modified first.

Format Button

Click on this button to bring up a window allowing the formatting of the selected field. Specify the total number of digits and decimal places for the overall width of the field.

For fields that may result in very large or very small numbers, you may choose Scientific Notation as shown in the following examples:

Examples: 3.123e+006 is equivalent to 3.123×10^{6} (3,123,000)
3.123e-003 is equivalent to 3.123×10^{-3} (0.003123)

Equation... Button

Click on this button to create an equation associated with the selected Custom field (see the note above under Delete Button). The following window will appear:

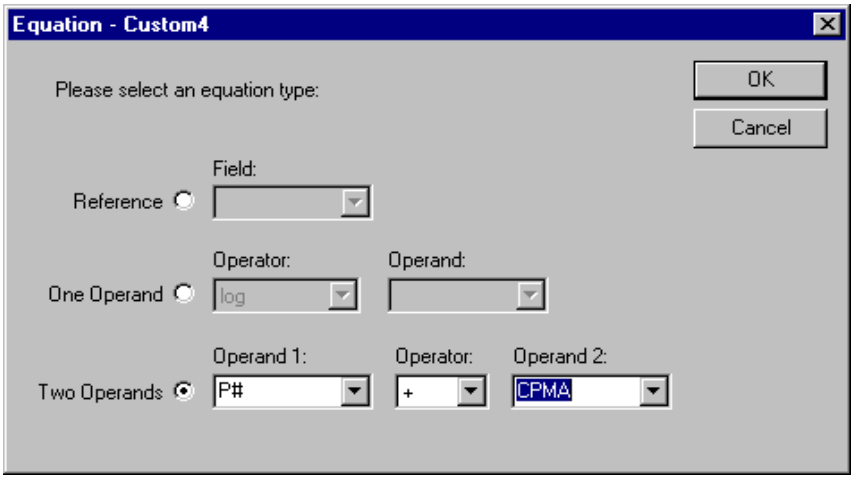

Figure 7-7 Equation Window

Reference: Reiterates the value of another field, either for convenience of repeating the value or custom naming of the field.

Operands: You can enter a constant value or choose any valid report field for these values.

Operators: You can choose any of the mathematical operations available on the drop down lists. These include common logarithm, natural anti-logarithm and square-root for the unary (single operand) operators and addition, subtraction, multiplication and division for the binary (two operands) operators.

Report Output

The Report Output tab offers options for how the report is output.

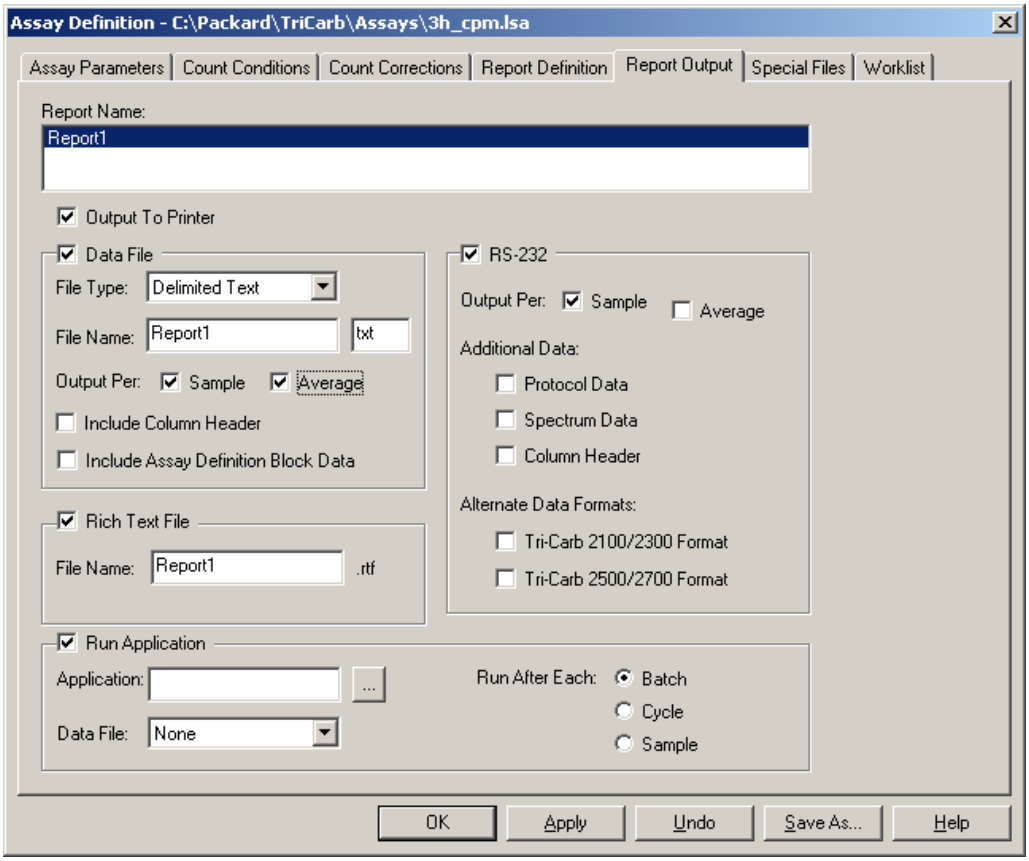

Figure 7-8 Report Output Window.

Major options offered in the Report Output window are printing the output to a printer, saving the output to a file, outputting the report to the RS-232 serial port, and tandem processing (running a program and a file after each batch, cycle, or sample).

Note:QuantaSmart automatically saves data as dated Results files for the optional Replay feature. However you can select other formats as reports, including Delimited Text (ASCII), Excel format, and Lotus 1-2-3 format.

Special Files

The Special Files window allows you to select and configure information regarding files pertinent to the assays.

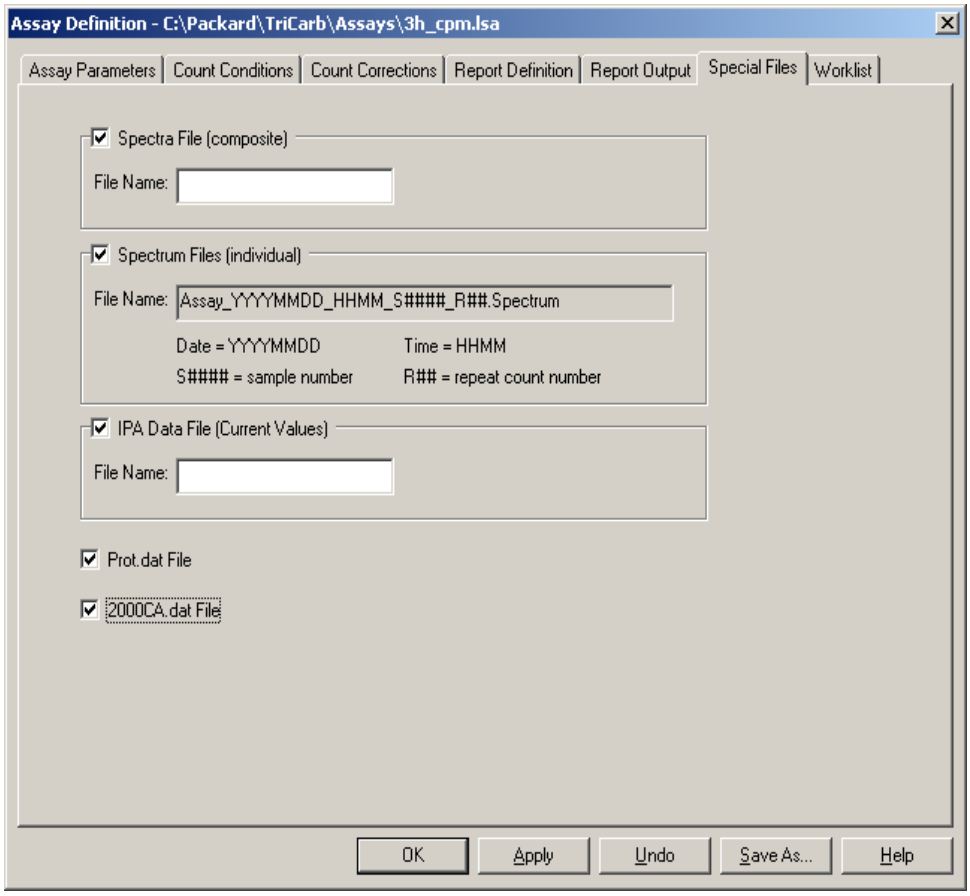

Figure 7-9 Special Files

Some of the major selections are making the following types of files:

- Composite spectra file
- Individual spectrum file
- IPA data file
- Prot.dat file
- 2000CA.dat file

Once you have defined the assay parameters click the OK button in the Assay Definition window. Save the file to an appropriate folder, giving the file a descriptive name. Once you have saved the assay parameters, you must associate the assay to a protocol flag number, load the cassette with vials, load the instrument with cassettes, and begin counting the samples.

Chapter 8

Defining a DPM Assay

This chapter of the Getting Started manual describes the process for defining a single-label DPM assay. Information pertaining to Count Modes and Count Correction features is not addressed in this chapter. For detailed information regarding these features, and dual or triple label DPM assays, please refer to the corresponding topics in the online help documentation.

Note: Single, dual, and triple label DPM assays are options on the TriCarb 2800TR.

The DPM Assay

The DPM assay allows you to quantitate a nuclide or nuclides within a sample in defined counting regions. The data generated from the assay is expressed as DPM (Disintegrations Per Minute). When DPM are calculated, the level of sample quench must be measured. If the sample data is not corrected for the effects of quench, erroneous DPM results may be reported.

For each sample in a DPM assay, the instrument:

- Measures the activity in a sample vial in Counts Per Minute (CPM).
- Determines the level of quench via one of the Quench Indicating Parameters (QIPs).
- Interpolates the counting efficiency from a quench curve (plots% Efficiency vs. QIP).
- Calculates DPM, where DPM=CPM/Efficiency.

Prior to defining a DPM assay:

1. The instrument should be calibrated.
2. A Quench Standards assay must be performed so that counting efficiency and DPM can be determined for the samples.

Selecting a DPM Assay

Before defining a DPM assay, you must create a new assay by selecting New Assay from the File menu. The Select Assay Type window is displayed.

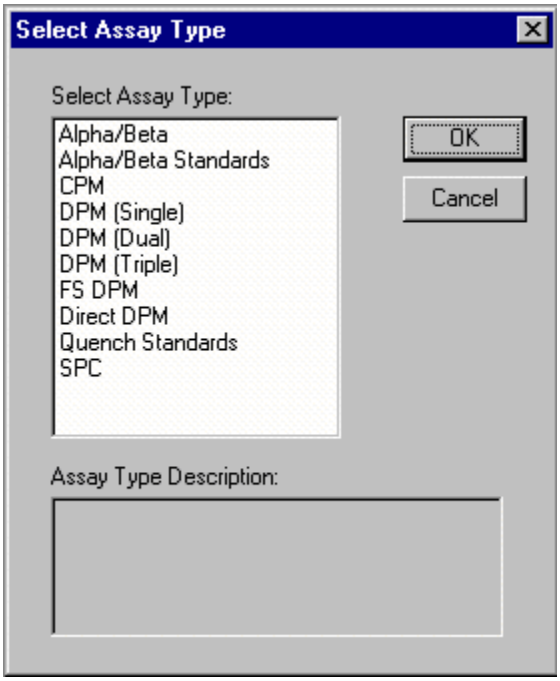

Figure 8-1The Select Assay Type Window.

Select DPM (Single) from the Select Assay Type window and click OK. The Assay Definition window is displayed.

Note: For information regarding other assay types, please refer to the online help documentation for the QuantaSmart program.

The Assay Definition Window

Assays are defined by entering information into the seven Assay Definition tabs within the Assay Definition window: Assay Parameters, Count Conditions, Count Corrections, Report Definition, Report Output, Special Files and Worklist. Using these seven tabs, for each DPM assay that you define, you will:

- Enter descriptive information about the nature of the assay and specify an author of the assay.
- Define a sample nuclide in the sample nuclides library if one does not already exist.
- Link the nuclide to the assay.
- Link quench standards to a sample nuclide name in the Sample Nuclides Library.
- Specify the appropriate count conditions and count correction factors that the instrument will use to analyze the samples.
- Define the reports you would like the system to generate.
- Define an optional worklist to designate Positive Identification numbers and sample names that correspond to sample numbers on a printout, if desired. Refer to the online help documentation for details regarding Worklists.

The parameters defined within the context of these seven tabs can be saved and used or edited at your discretion.

Assay Parameters

The Assay Parameters tab allows you to designate an author and provide descriptive information for an assay. You may also prohibit the editing of assay parameters using this window.

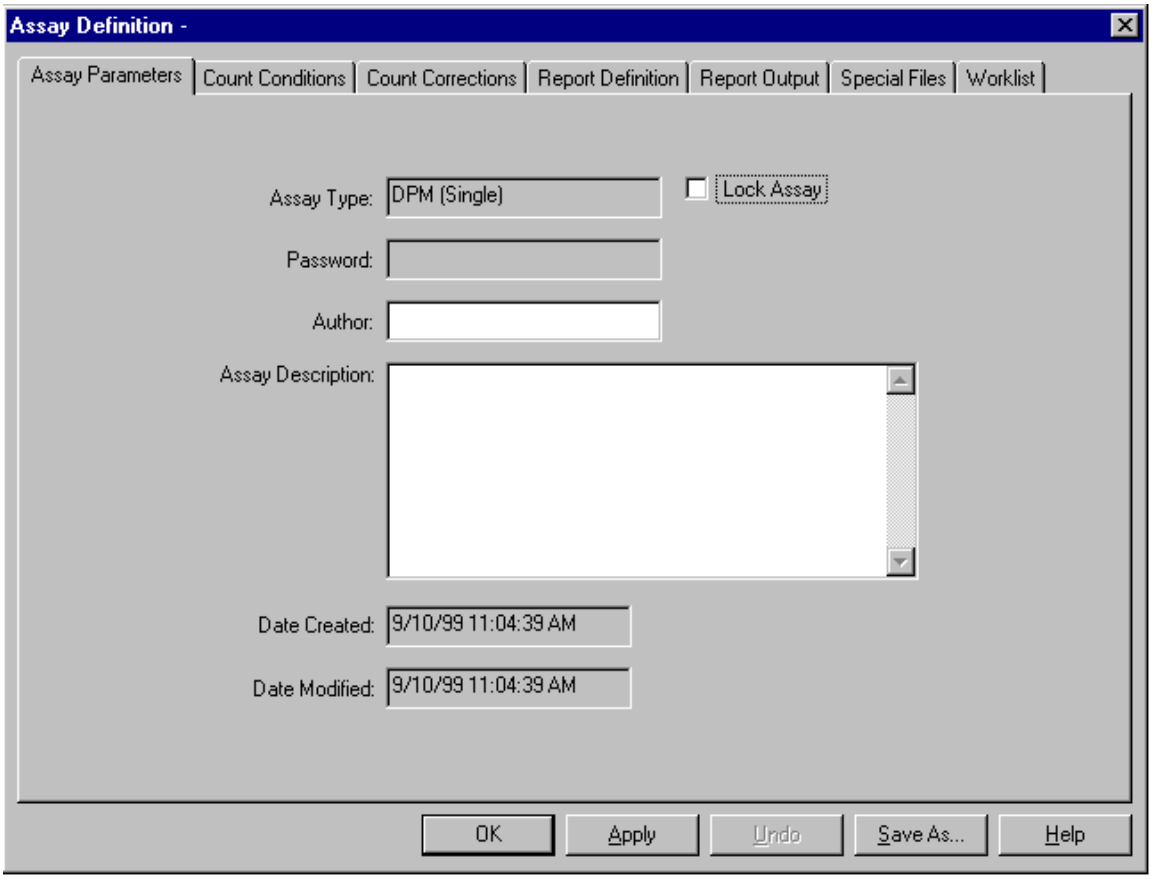

Figure 8-2 The Assay Parameters Tab.

Password

Enter a password (optional) to restrict editing functions for this assay. You must check the Lock Assay box before you can enter a password in this field.

Lock Assay

Mark this box if you would like to restrict editing functions for this assay. You must enter a password in the Password field if you would like to lock the assay.

Author

Enter your name or other identification as the author of the assay. This is an optional entry.

Assay Description

Enter descriptive information about the assay. This information is for future reference and is stored permanently with the assay.

Note: For information regarding the individual assay parameters, please refer to the “Assay Parameters” topic in the online help documentation.

Count Conditions

The Count Conditions tab allows you to define specific counting parameters for an assay.

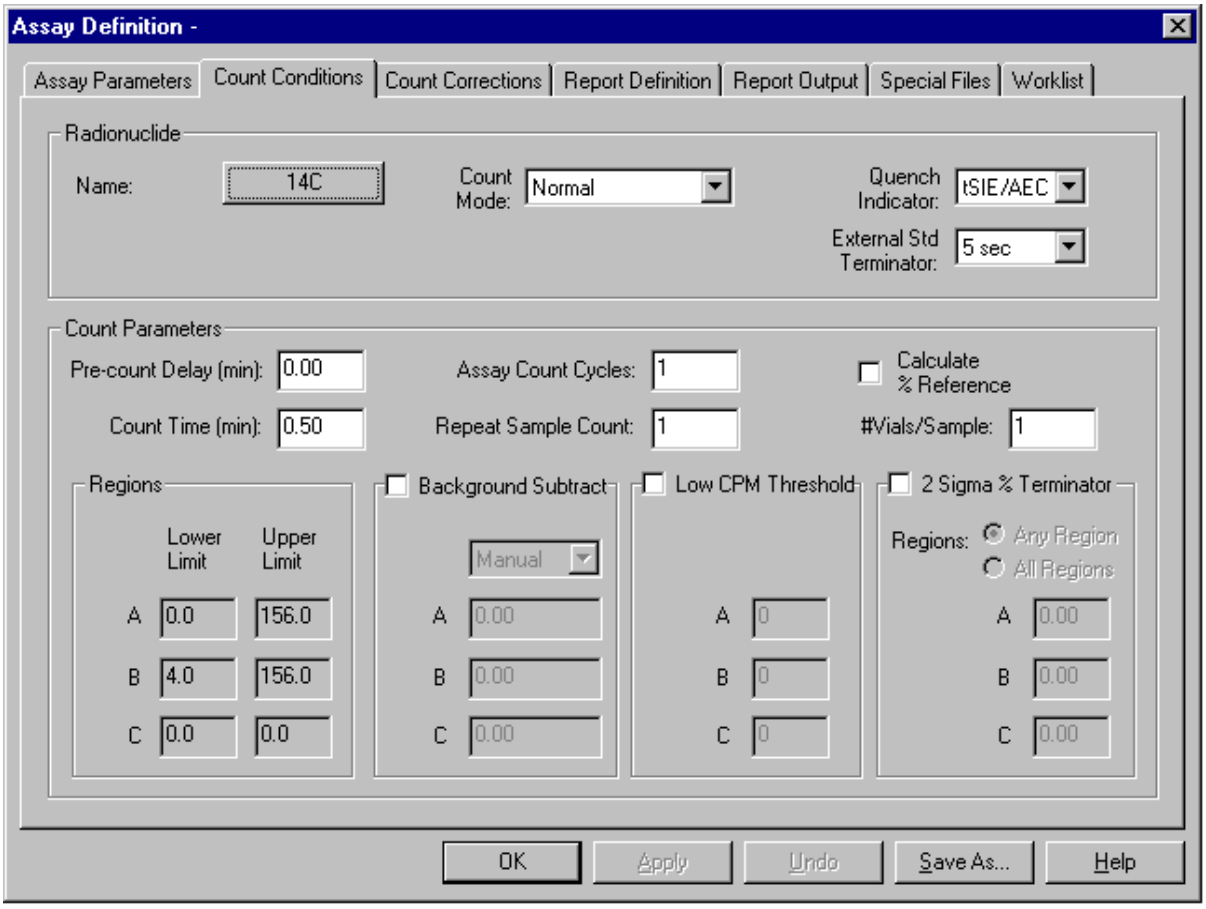

Figure 8-3 The Count Conditions Tab.

Name

Click this button to display the Sample Nuclides Library window.

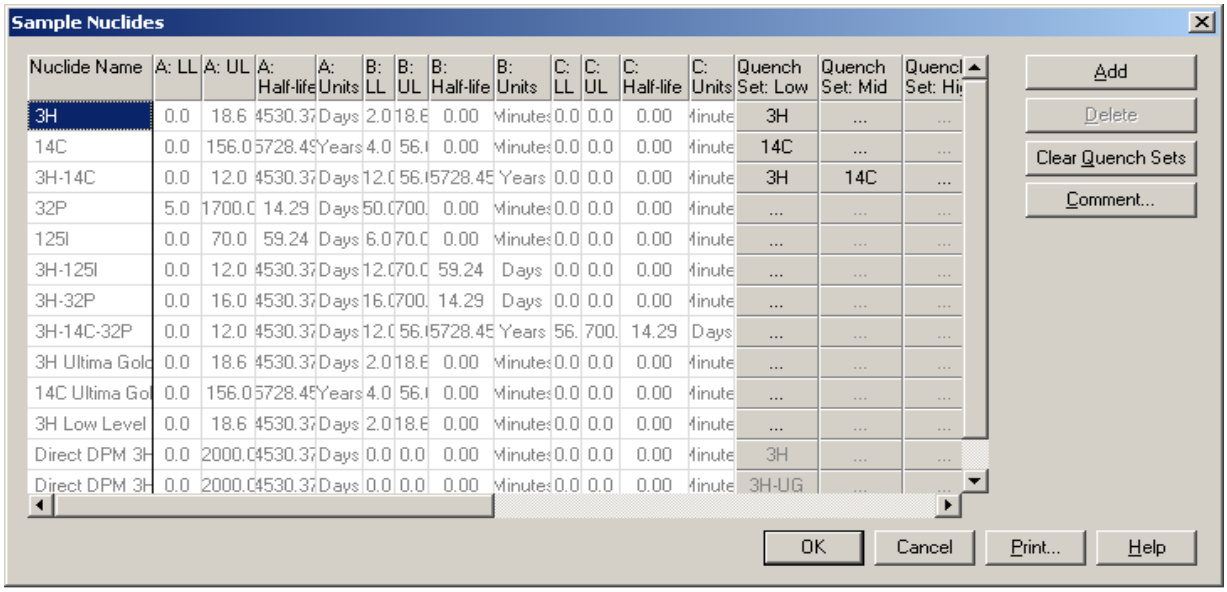

Figure 8-4 The Sample Nuclides Library Window.

Note: The window above has been compressed for display purposes.

This window allows you to enter information into and retrieve information from the Sample Nuclides Library. You can use the Sample Nuclides Library to define and save nuclide names and counting region limits for radionuclides in your samples. You can also select a quench set for each sample nuclide using the Quench Set buttons in this window.

Select a quench set by clicking one or more of the quench set buttons. Select the Low Quench to count one nuclide in one counting region. The medium set would be selected for counting two nuclides in two counting regions and the high set for counting three nuclides in three counting regions. The Quench Standards Library window is displayed.

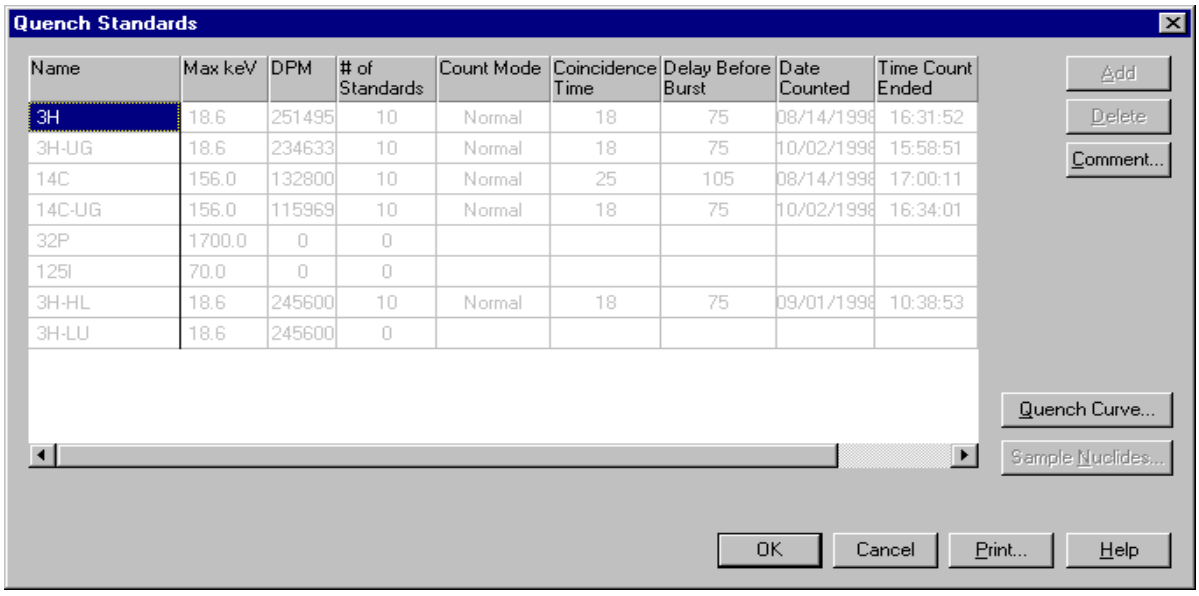

Figure 8-5 The Quench Standards Library Window.

Select the name of the quench standards you would like to use for calculating DPM values and click OK. The names of any quench sets selected should appear on the Quench Set buttons in the Sample Nuclides Library window. The Quench Set name also appears in the Quench Set field of the Count Conditions tab in the Assay Definition window.

Click OK in the Sample Nuclides Library Window.

Quench Indicator

Select a Quench Indicating Parameter from the drop-down list. There are three different Quench Indicating Parameters used by the system:

tSIE (transformed Spectral Index of External standards) uses an external Barium-133 standard source to assign a numeric value to sample quench. This determination is independent of the quantity of radioactivity in the sample and its count rate. The lower the tSIE value, the more the sample is being quenched. A tSIE value of 1000 represents a completely unquenched sample. Accurate DPM values can be determined for samples with tSIE values as low as 10. To ensure good count statistics, the external standard is typically counted to a 0.5% two sigma counting error, where the gross counts equal 160,000. tSIE is the most accurate of the quench indicator options and is typically used for low count rate and variable quench samples.

With tSIE/AEC(transformed Spectral Index of External standards coupled to Automatic Efficiency Correction), tSIE assigns a numeric value to sample quench. As quench varies, the AEC automatically monitors and adjusts the counting regions to exclude unwanted background. This setting is typically used for dual-label experiments and variable quench samples where optimal region settings are desired.

SIS (Spectral Index of the Sample) assigns a numeric value to sample quench. The SIS is determined from the spectral shape of the sample and is based on actual sample counts. The SIS setting is typically used to monitor the quench level in samples for CPM assays or in single label Cerenkov counting.

Assay Count Cycles

Enter the number of times you would like the assay to count. The assay is recounted after it has moved one complete cycle around the sample changer deck. Any other samples on the sample changer deck will be counted prior to your samples being recounted.

Count Time

Enter the maximum length of time that the samples will be counted. Typically, a longer count time provides better count statistics. Two other count terminators, 2 Sigma% and Low Count Reject (LCR), allow you to terminate counting based on a preset statistical accuracy or an activity level.

Background Subtract

Mark this box to subtract background CPM from all samples. The background value is established in one of three ways. The method used is selected from the drop down list:

When the *1st Vial* background subtraction method is implemented, the instrument counts the first vial in the protocol for either ten minutes or the defined protocol count time (whichever is greater) and establishes a CPM value for each region; these are the background values subtracted from each sample within each region of the assay.

When the *IPA* background subtraction method is implemented, the instrument subtracts the background values established during the Instrument Performance Assessment (IPA) procedures from the entire spectrum of each sample. The background spectra are stored during these procedures and are available for any counting region.

The *Manual* background subtraction feature allows you to enter the CPM values you would like the instrument to subtract from the entire spectrum of the samples.

Note: For information regarding additional items in the Count Conditions tab, please refer to the “Count Conditions” topic in the online help documentation.

Count Corrections

The Count Corrections tab allows you to activate certain instrument devices and define count correction parameters.

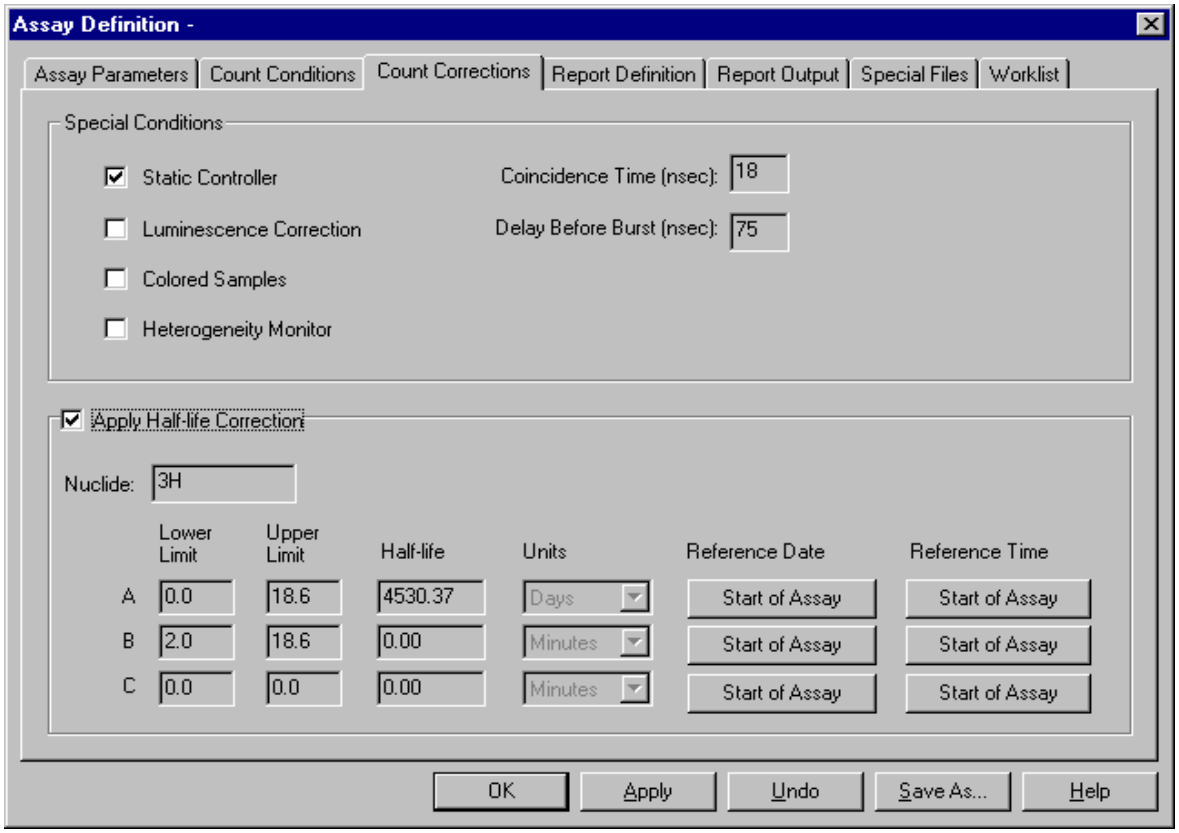

Figure 8-6 The Count Corrections Tab.

Static Controller

The instrument's static-controlling device, which is designed to reduce static originating on the sample vial, is automatically enabled. Static discharge can falsely elevate sample counts by producing non-beta pulses. This device should be activated in most cases. It is especially important in low humidity conditions, when using plastic vials and when handling vials with latex gloves. To further reduce the likelihood of generating static:

- Maintain a relative humidity level above 40%.
- Wipe latex gloves with anti-static wipes before handling vials.
- Use the "Pre-count delay" timer which delays the counting of each sample while static-induced pulses dissipate.

Luminescence Correction

Mark this box to activate luminescence correction. The instrument corrects the data for counts resulting from sample luminescence.

Apply Half-life Correction

Mark this box to activate half-life correction. This feature is typically used when counting short half-life nuclides. The instrument corrects the sample counts for half-life decay of the nuclide(s) being counted. The Half-life value for the nuclide is taken from the nuclide entry in the Sample Nuclide Library. The Reference Date and Time are used to make the decay calculation. The default settings for the Reference Date and Time correspond to the start of an assay.

Note: For information regarding additional count correction features, please refer to the topic “Count Corrections” in the online help documentation.

Report Definition

The Report Definition tab allows you to specify the data items that are reported and the format for reporting. Multiple reports can be defined for each assay.

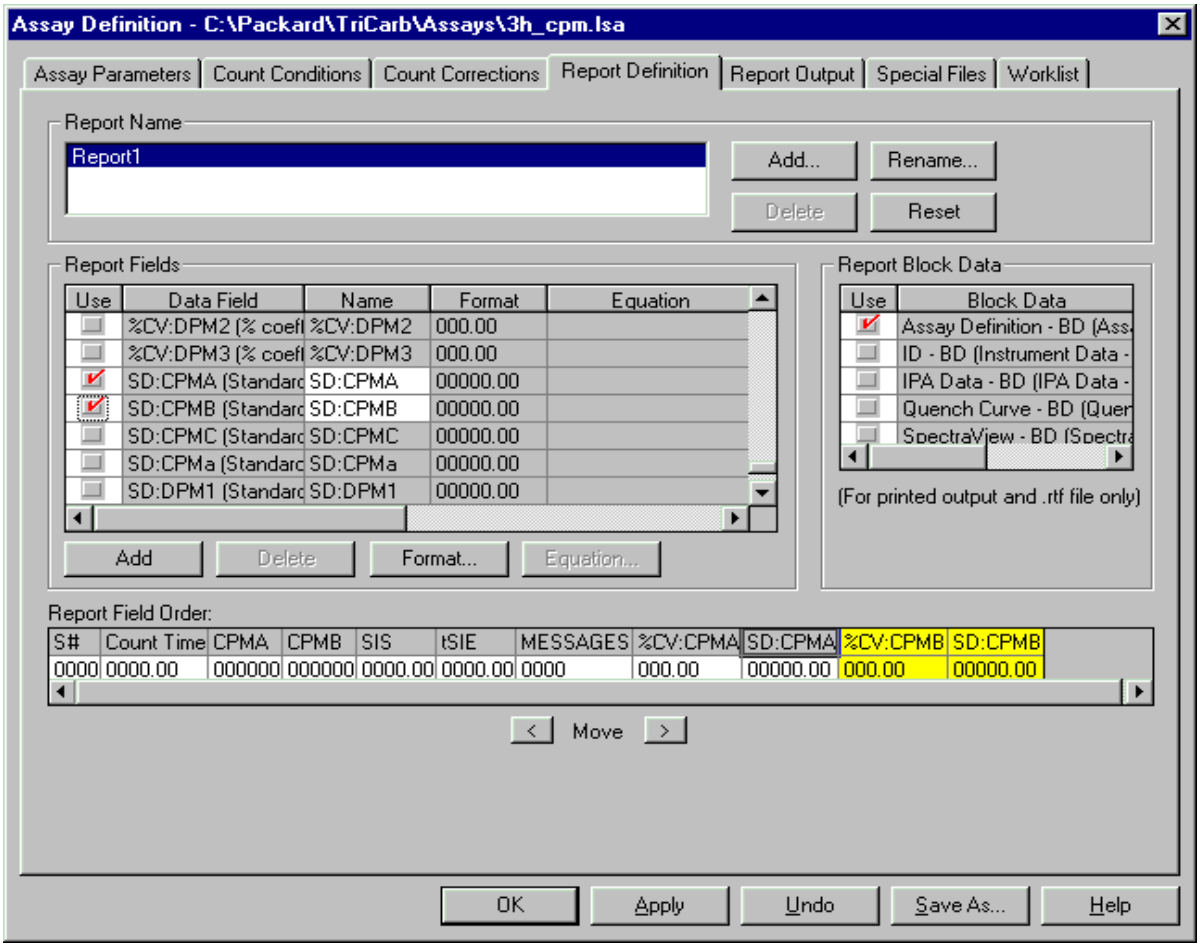

Figure 8-7 The Report Definition Tab.

Report Name

The Report Name field allows you to assign a descriptive name to a report. You can use the four buttons beside the Report Name list to add a new report, remove a named report, rename an existing report or reset the field selections to the original factory default.

Note: You cannot use special characters when naming reports.

Report Fields

You may define several printed or electronic reports for each assay, each containing different data items. The Report Fields box contains a comprehensive list of the available data items. To select the data items you would like to include in a report, double-click on those items in the Report Fields box.

Add Button

Click on this button to add a Custom report field to those already available in the list of fields. You can define these custom fields for name, content and format as desired.

Delete Button

Click on this button to delete a Custom report field from the currently selected report. A confirmation window will prompt you to confirm the deletion.

Note: You cannot delete a Custom field if it is referenced by another equation. The referencing equation must be deleted or modified first.

Format Button

Click on this button to bring up a window allowing the formatting of the selected field. Specify the total number of digits for the overall width of the field, including decimal space, integer space and the padding (spaces inserted in front of the value) necessary to fill any unused space. The decimal point (if appropriate) is NOT counted as a digit for this purpose.

The number of digits to the right of the decimal point can also be defined in the same manner. Click OK to save any changes.

For fields that may result in very large or very small numbers, you may choose Scientific Notation as shown in the following examples:

Examples:3.123e+006 is equivalent to 3.123×10^{6} (3,123,000)
3.123e-003 is equivalent to 3.123×10^{-3} (0.003123)

Equation... Button

Click on this button to create an equation associated with the selected Custom field (see the note above under Delete Button). The following window will appear:

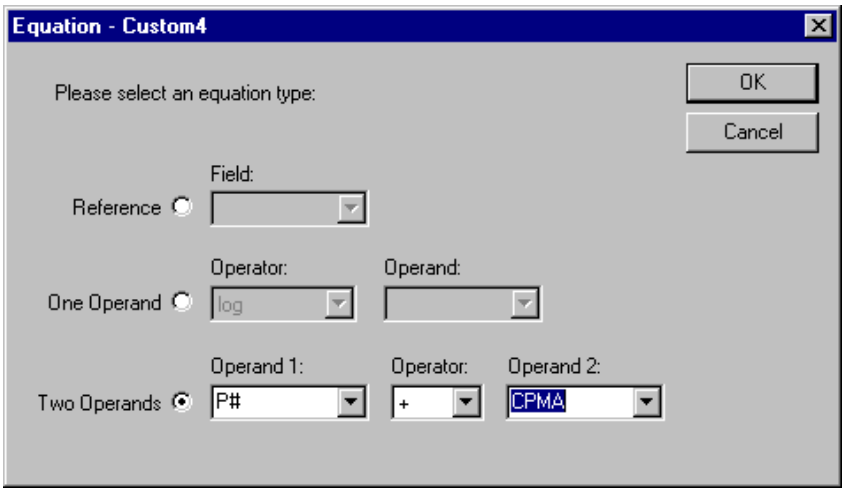

Figure 8-8 Equation Window

Reference: Reiterates the value of another field, either for convenience of repeating the value or custom naming of the field.

Operands: You can enter a constant value or choose any valid report field for these values.

Operators: You can choose any of the mathematical operations available on the drop down lists. These include common logarithm, natural anti-logarithm and square-root for the unary (single operand) operators and addition, subtraction, multiplication and division for the binary (two operands) operators.

Note: For additional information regarding reports, please refer to the online help documentation.

Report Output

The Report Output tab offers options for how the report is output.

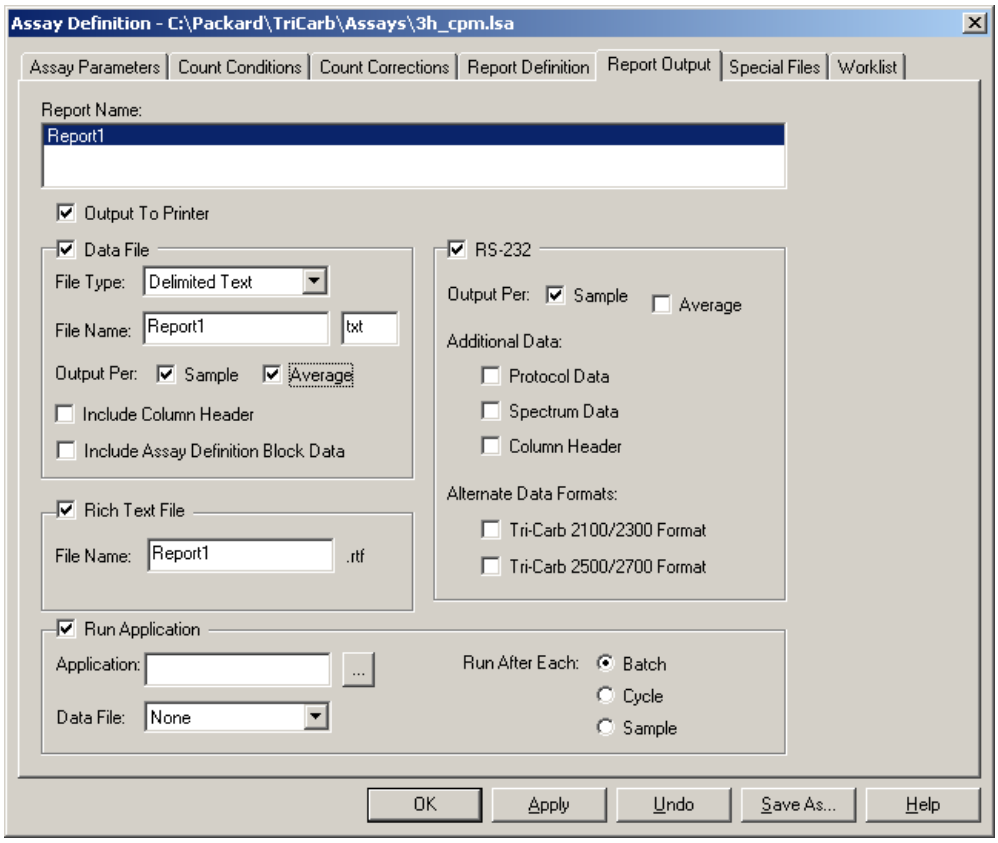

Figure 8-9 Report Output Window.

Major options offered in the Report Output window are printing the output to a printer, saving the output to a file, outputting the report to the RS-232 serial port, and tandem processing (running a program and a file after each batch, cycle, or sample).

Note:QuantaSmart automatically saves data as dated Results files. However you can select other formats as reports, including Delimited Text (ASCII), Excel format, and Lotus 1-2-3 format.

Special Files

The Special Files window allows you to select and configure information regarding files pertinent to the assays.

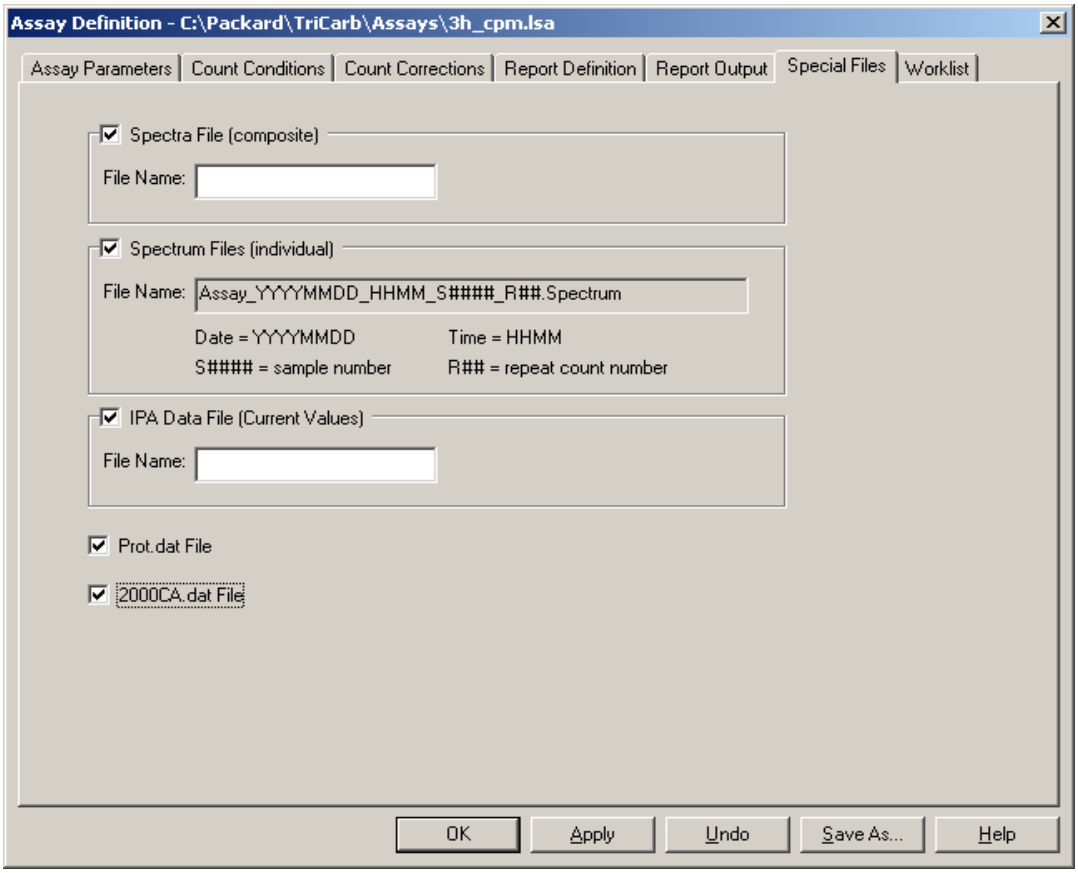

Figure 8-10 Special Files

Some of the major selections are making the following types of files:

- Composite spectra file
- individual spectrum file
- IPA data file
- Prot.dat file
- 2000CA.dat file

Once you have defined the assay parameters click the **OK** button in the Assay Definition window. Save the file to an appropriate folder, giving the file a descriptive name. Once you have saved the assay parameters, you must associate the assay to a protocol flag number, load the cassette with vials, load the instrument with cassettes, and begin counting the samples.