

User Manual for

ACTUARIAL AUDITOR

"Be Sure Now!"

By

SALT Solutions, Inc.

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ACTUARIAL AUDITOR

"Be Sure Now!"

Table of Contents

Overview	4
SAVE Life Windows Software	5
Calculating a XXX reserve	5
Contact Us	5
CRVM and Unitary Reserves	5
Deficiency Reserves	7
Toolbar Documentation	8
Global Variables	9
Two Life Policies	9
Values that vary by duration	10
Methods and Dates	13
General	14
Policy Input	14
Benefits and Premiums.....	16
Interest Rate Input	18
Factors Input - Only available for XXX	
Calculations.....	18
Mortality rates and Select Factors	19
Mortality Calculations.....	20
Segment.....	21
Cash Values	21

**Minimum Assumptions and Miscellaneous
XXX..... 22**

**Comparison of values using XXX
methodology 23**

Mid Year..... 24

Return of Premiums 25

Smoothness 26

Report Type..... 27

**Report Documentation (Commutation
Reports) 28**

Report Documentation (Detail Reports)..... 29

Report Documentation (Summary Reports)30

Overview

Have you ever calculated reserves and cash values with large software packages only to find out too late that you calculated them incorrectly because you didn't input all of your data correctly? If it hasn't happened to you yet, you are probably younger than I. It has happened to me.

What is needed to solve this problem is an easy-to-use online tool that doesn't have all of the "bells and whistles" but just performs the basic calculations. This is the goal for Actuarial Auditor.

There are three editions of the Actuarial Auditor: Premium, Standard, and Free. This manual will focus on the Premium edition but will also document differences in all three versions. Our web site has a document that shows the differences between these three editions.

I have personally found this tool helpful in performing audits for insurance departments as well as validating calculations that I perform for our clients. I hope that you find it useful as well.

David L. Kester, FSA, MAAA
President of SALT Solutions, Inc.

For more information about SALT Solutions, go to our website www.saltsolutions.com.

SAVE Life Windows Software

The Actuarial Auditor replaces the Windows based SAVE Life. SAVE Life will no longer be supported. Generally, all of the functionality that existed in SAVE Life exists in the Actuarial Auditor. The traditional life and universal life components of SAVE Life have been split into separate online tools in Actuarial Auditor. This allows the user to only purchase the tool that they need as well as simplifying each module. This manual documents the traditional life component.

Calculating a XXX reserve

On the input page, choose a reserve value calculation type. Choose one of the XXX reserve methods (see [Methods and Dates](#)). All of the XXX input will now be enabled (See [Segment](#), [Cash Values](#), [Minimum Assumptions and XXX Miscellaneous](#)).

Several XXX specific reports will be available for the user to choose as well. These will be found in the [Report List Box](#) at the bottom of the input page.

See [Mortality Calculations](#) and [Report Documentation \(Summary Reports\)](#)

Although many of the features and formulas for XXX are incorporated into the Actuarial Auditor program, *the user must be familiar enough with the regulation to make correct input decisions that are not automated*. For example, all of the mortality tables are available if the user chooses a XXX method. However, only the 1980 and 2001 CSO tables are appropriate.

Calculating Return of Premium Cash Values

There is a special document created that provides details on how to calculate return of premium cash values.

Contact Us

You may contact us for technical support or inquiries. [Contact Us](#) (Click on the link). No support provided for the Free edition.

CRVM and Unitary Reserves

Regulation XXX redefines the Commissioners' Reserve Valuation Method (CRVM) as the reserve resulting from using the XXX methodology (Section 1B). Further, it defines

Unitary Reserves (Section 4K1) as the reserves resulting from a traditional modified net premium calculation. Actuarial Auditor has adopted this terminology and will avoid using the term CRVM wherever possible to avoid confusion.

Deficiency Reserves

Deficiency reserves are calculated using the Minimum mortality assumptions. The user must choose a XXX method. The deficiency reserves are a separate output item in the XXX Summary Report. Unlike previous definitions, the XXX regulation defines deficiency reserves in terms of the difference between two reserves (Minimum and Basic) rather in terms of the difference between two premiums. See section 4C of the XXX regulation.

For more information on the output from Actuarial Auditor for deficiency reserves, see [Report Documentation \(Summary Reports\)](#) and [Report Documentation \(Detail Reports\)](#).

Toolbar Documentation

Case ID

This will allow the user to quickly navigate to a saved case. It also provides the user a convenient method for viewing the saved cases.

Run

This button processes all of the input items, and displays an output file that contains either Reserve or Cash Value information. The system will validate the input before processing. The output format will depend upon which output format the user chose on the input page.

Save

This button will save the information currently displayed on the form for that case.

New

This button will create a new saved case. The default values for the new case will be the values that are showing on the input form when the Add button is clicked.

Delete

This button will delete the entire input data from the database for the current case.

Cancel

This button will cancel the changed data on the form for that case and reset the data on the form to the previously stored data. It will cancel ALL changes to the current case since it was last modified.

Formulae

Loads a PDF file that documents the formulae that are utilized in Actuarial Auditor

Rounding Definitions

Opens a form for the user to define the rounding that will be used for all cases for a given user.

Help

Loads this PDF file that provides assistance on how to properly operate Actuarial Auditor

Global Variables

The global variable input items remain constant for all cases. Variables that have been added to this section tend to remain constant for all cases and thus minimizing user input.


The rounding input has two steps. The first step is to define the rounding on a per unit basis. The second step is to define the rounding when the number of units is multiplied by the per unit values. The first step should produce values that match per unit values often printed in manuals or tables. The second step should match a specific policy once the number of units have been applied.


Note that the summary reports show the values AFTER the number of units have been applied and the rounding of those values. The detail reports show the per unit values BEFORE the per unit rounding. This allows the user to see the values the system generates before any rounding or unit multiplication occurs.

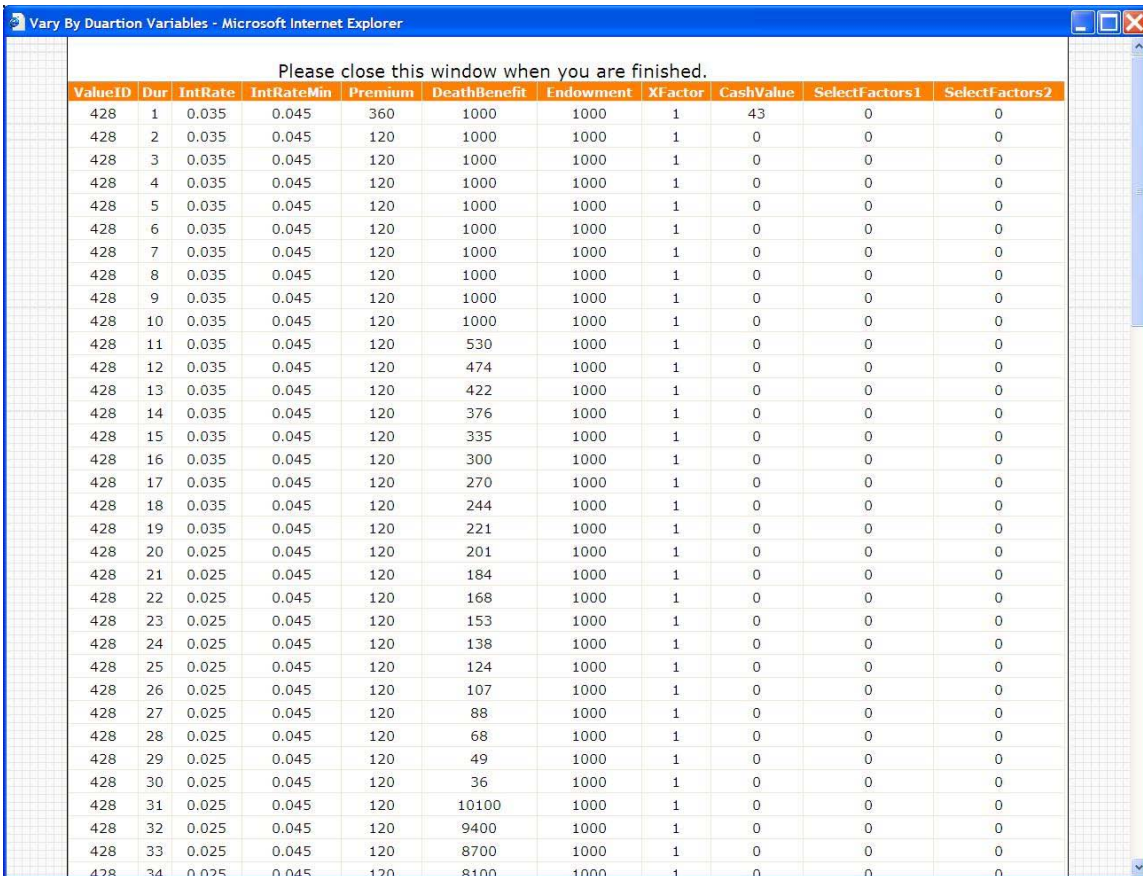
Two Life Policies

SAVE Life calculates reserves and cash values for policies insuring two lives on a last survivor basis. The user can input a mortality table and select table for each life. Actuarial Auditor will "frasierize" the two mortality rates into one on an exact issue age basis. This process was introduced by W. M. Frasier in the article "*Second to Die Joint Life Cash Values and Reserves*" in *The Actuary*, XII, (1978). In more modern literature, this process is documented in the "*Products and Finance*" textbook by David B. Atkinson, FSA and James W. Dallas, FSA.

Values that vary by duration

The Actuarial Auditor application allows the user to input varying data with the help of a grid. If the user selects “Vary by Duration” from the drop down list a button  will appear.

When this  button is clicked a new form (as shown below) with the information regarding the all input variables that may vary by duration will appear.



Please close this window when you are finished.											
ValueID	Dur	IntRate	IntRateMin	Premium	DeathBenefit	Endowment	XFactor	CashValue	SelectFactors1	SelectFactors2	
428	1	0.035	0.045	360	1000	1000	1	43	0	0	
428	2	0.035	0.045	120	1000	1000	1	0	0	0	
428	3	0.035	0.045	120	1000	1000	1	0	0	0	
428	4	0.035	0.045	120	1000	1000	1	0	0	0	
428	5	0.035	0.045	120	1000	1000	1	0	0	0	
428	6	0.035	0.045	120	1000	1000	1	0	0	0	
428	7	0.035	0.045	120	1000	1000	1	0	0	0	
428	8	0.035	0.045	120	1000	1000	1	0	0	0	
428	9	0.035	0.045	120	1000	1000	1	0	0	0	
428	10	0.035	0.045	120	1000	1000	1	0	0	0	
428	11	0.035	0.045	120	530	1000	1	0	0	0	
428	12	0.035	0.045	120	474	1000	1	0	0	0	
428	13	0.035	0.045	120	422	1000	1	0	0	0	
428	14	0.035	0.045	120	376	1000	1	0	0	0	
428	15	0.035	0.045	120	335	1000	1	0	0	0	
428	16	0.035	0.045	120	300	1000	1	0	0	0	
428	17	0.035	0.045	120	270	1000	1	0	0	0	
428	18	0.035	0.045	120	244	1000	1	0	0	0	
428	19	0.035	0.045	120	221	1000	1	0	0	0	
428	20	0.025	0.045	120	201	1000	1	0	0	0	
428	21	0.025	0.045	120	184	1000	1	0	0	0	
428	22	0.025	0.045	120	168	1000	1	0	0	0	
428	23	0.025	0.045	120	153	1000	1	0	0	0	
428	24	0.025	0.045	120	138	1000	1	0	0	0	
428	25	0.025	0.045	120	124	1000	1	0	0	0	
428	26	0.025	0.045	120	107	1000	1	0	0	0	
428	27	0.025	0.045	120	88	1000	1	0	0	0	
428	28	0.025	0.045	120	68	1000	1	0	0	0	
428	29	0.025	0.045	120	49	1000	1	0	0	0	
428	30	0.025	0.045	120	36	1000	1	0	0	0	
428	31	0.025	0.045	120	10100	1000	1	0	0	0	
428	32	0.025	0.045	120	9400	1000	1	0	0	0	
428	33	0.025	0.045	120	8700	1000	1	0	0	0	
428	34	0.025	0.045	120	8100	1000	1	0	0	0	

428	69	0	0	120	45276	0	0	0	0	0	0
428	70	0	0	120	46967	0	0	0	0	0	0
428	71	0	0	120	48726	0	0	0	0	0	0
428	72	0	0	120	50555	0	0	0	0	0	0
428	73	0	0	120	52457	0	0	0	0	0	0
428	74	0	0	120	54435	0	0	0	0	0	0
428	75	0	0	120	56493	0	0	0	0	0	0
428	76	0	0	120	58633	0	0	0	0	0	0
428	77	0	0	120	60858	0	0	0	0	0	0
428	78	0	0	120	63172	0	0	0	0	0	0
428	79	0	0	0	65579	0	0	0	0	0	0
428	80	0	0	0	172154	0	0	0	0	0	0

Export to spreadsheet

Paste values from spreadsheet here:
(Please copy the column headings also)

Save values

Click the export to spreadsheet button to export the values in the grid to a csv spreadsheet. The values cannot be modified within this window, but can be within the spreadsheet (shown below.)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ValueID	Dur	IntRate	IntRateMi	Premium	DeathBen	Endowme	XFactor	CashValue	SelectFact	SelectFactors2		
2	448	1	0.04	0.04	25	1000	0	1	0	1	1		
3	448	2	0.04	0.04	25	1000	0	1	0	1	1		
4	448	3	0.04	0.04	25	1000	0	1	0	1	1		
5	448	4	0.04	0.04	25	1000	0	1	0	1	1		
6	448	5	0.04	0.04	25	1000	0	1	0	1	1		
7	448	6	0.04	0.04	25	1000	0	1	0	1	1		
8	448	7	0.04	0.04	25	1000	0	1	0	1	1		
9	448	8	0.04	0.04	25	1000	0	1	0	1	1		
10	448	9	0.04	0.04	25	1000	0	1	0	1	1		
11	448	10	0.04	0.04	25	1000	0	1	0	1	1		
12	448	11	0.04	0.04	25	1000	0	1	0	1	1		
13	448	12	0.04	0.04	25	1000	0	1	0	1	1		
14	448	13	0.04	0.04	25	1000	0	1	0	1	1		
15	448	14	0.04	0.04	25	1000	0	1	0	1	1		
16	448	15	0.04	0.04	25	1000	0	1	0	1	1		
17	448	16	0.04	0.04	25	1000	0	1	0	1	1		
18	448	17	0.04	0.04	25	1000	0	1	0	1	1		
19	448	18	0.04	0.04	25	1000	0	1	0	1	1		
20	448	19	0.04	0.04	25	1000	0	1	0	1	1		
21	448	20	0.04	0.04	25	1000	550	1	0	1	1		
22	448	21	0.04	0.04	27.5	1000	0	1	0	1	1		
23	448	22	0.04	0.04	30.25	1000	0	1	0	1	1		
24	448	23	0.04	0.04	33.275	1000	0	1	0	1	1		
25	448	24	0.04	0.04	36.6025	1000	0	1	0	1	1		
26	448	25	0.04	0.04	40.26275	1000	0	1	0	1	1		
27													
28													
29													
30													

The first column “ValueID” is a the case number, and it should be constant for each individual case. DO NOT CHANGE THIS NUMBER. The second column “Dur” is the duration. It should start at one and be incremented by 1 until the last duration. Every other column is an input variable that may vary by duration, depending on the options selected on the input page.

When the user is done updating the vary by duration data, copy all the values from the spreadsheet (make sure to DO NOT include the column headings), return to the vary by duration window and paste the data in the large blank field below the table. After pasting the data, click the save values button, and close the window.

Methods and Dates

The unitary method is the traditional CRVM (see [CRVM and Unitary Reserves](#)) calculation with a possible first year expense allowance. If benefits or premiums vary by duration, Actuarial Auditor can use the Menge or Traditional Interpretation in how to determine the death benefit in the expense allowance calculation. This method is explained in detail in the Bowers, Gerber, Hickman, Jones, and Nesbitt "*Actuarial Mathematics*" Textbook.

The Tabular COI method calculates the reserve on a tabular cost of insurance basis. This will result in zero terminal reserves and a mean reserve equal to the interpolated net premium.

Actuarial Auditor supports 3 XXX Methods. XXX 1999 method is the 1999 version of the XXX regulation. XXX YRT/ART (Section 6E or 6F) and XXX Unitary Exemption (Section 6G or 6H) are optional XXX calculation options. All of the other methods are independent of XXX regulation. See [Calculating a XXX reserve](#).

Actuarial Auditor currently supports the 1941 Minimum Cash Value method if the premiums and death benefits are level for all durations.

All reserve and cash value methods allow the user to choose whether they compare the mid year reserve (mean or mid terminal) to a $\frac{1}{2}$ Cx calculation. This option is available in the [Mid Year](#) Section of the input page.

The issue and valuation dates are used to determine the current reserves. Although reserves are calculated and displayed for all durations, the summary reports will show the terminal and mean reserves for the current duration. If the user chooses to define the mid year interpolation other than "Half Year", these dates will also be used to define the interpolation for the mean reserve calculation.

General

Report for Client: An input item is to provided for the user to document which client / company this case is associated. It is only used for documentation. It will be displayed in many of the reports.

Client Notes: An unlimited capacity for the user to document necessary details regarding this case.

Issue Date: Enter the issue date for the policy. Only used to determine the final reserve to print in the heading of the summary report.

Valuation Date: Enter the valuation date. Must be after the issue date. Only used to determine the final reserve to print in the heading of the summary report. See Methods and Dates for more details.

Policy Input

Case Documentation {Premium edition} / Policy Number {Standard edition}: This is a text field that allows the user to enter the case documentation or policy number. It is only used for documentation purposes. It will be included in the output reports. It is also what is used to populate the list box that shows all of the case ID's at the top of the form.

Number of lives: If two lives are chosen, the user will need to input the issue ages and mortality rates for both insureds. The user will also have the option to input select factors for both insureds if needed. Actuarial Auditor will frasierize the two mortality tables into one table on an exact age basis. See also [Mortality rates and Select Factors](#), [Mortality Calculations](#). The formulae documentation details this calculation.

Values: Choose whether to calculate reserves or cash values.

Method: Choose the reserve or cash value method. See Methods and Dates for more details.

Issue Age: If two lives are chosen, input the exact issue age for both insureds. Actuarial Auditor will frasierize the mortality based upon the issue ages input. You must input the younger insured as the first insured.

Ending Issue Age: The last issue age to calculate. Only available in the premium edition.

Step: The definition for how to define the issue ages to calculate between the beginning and ending issue ages. For example, if you want to calculate values for issue ages 25, 35, and 45, enter a value of 10 for the steop. Only available in the premium edition.

Gender: This is only enabled if the user chooses a XXX method. It will be used to determine the correct select factors after the first segment.

Number of Years of Unitary and Grading to Net Level: To reproduce the New Jersey Method, enter 1 year of Unitary CRVM and then 19 years of grading to the Net Level reserve. This would produce a Net Level reserve after 20 years.

Benefits and Premiums

Benefit and premium timing: The timing for the expense allowance is a separate input item. A continuous benefit assumption uses the uniform distribution of death (UDD) approximation. This results in the traditional δ factor to apply to the curtate death benefit values. A continuous premium assumption also assumes a uniform distribution of deaths (UDD). This assumption can be summarized by an α and β parameters as defined in the Life Annuity chapter of the Bowers, Gerber, Hickman, Jones, and Nesbitt "*Actuarial Mathematics*" Textbook. This is similar to but not exactly equal to a traditional approximation of assuming a linear function D_x . The UDD premium assumption can be shown to provide more consistent approximations than the linear D_x function.

A continuous discounted mean option is provided. The discounted continuous mean premium represents the approximation of the premium to be refunded in the event of death. For that reason it is more appropriate to use in a Mid Year Reserve formula. The displayed net premium in the summary output reports will be the unadjusted net premium. However, if this option is chosen, it will affect the mean reserve in the output.

See the TRANSACTIONS OF SOCIETY OF ACTUARIES 1995 VOL. 47 "Equivalence of Reserve Methodologies" pages 455-478 By Keith P. Sharp and references mentioned within this publication for more detail discussion on discounted continuous premiums.

Curtate Expense Allowance: If selected, the expense allowance will assumed to be curtate. If not selected, the expense allowance will be consistent with the timing assumption. Thus, if the timing assumption is semi continuous and the curtate expense allowance is not checked, then the expense allowance will be semi continuous.

Benefit cease age: Enter the age that the benefit and the policy will cease. The user may enter 999 for the system to assume that the benefit will cease at the end of the mortality table.


Premium cease age: Enter the age that the premium will cease. The user may enter 999 for the system to assume that the premium will be paid for the entire policy.

Policy Fee: Will only be used to determine deficiency reserves. The user has an option whether to include the policy fee in the segmentation calculation. See [Segment](#). Actuarial Auditor does not support policy fees that vary by duration as a separate input item.


Number of Units: All values are calculated in two stages. The first is on a per unit basis. After the per unit calculations are performed, the values are rounded. The second stage is to multiply the rounded per unit value by the number of units and rounded again. This methodology allows users to replicate the majority of methods systems utilize to derive the final values. The summary reports display values after the number of units have been applied and all rounding performed. The detail reports display values after the per unit values have been calculated but before any rounding. This allows the user to identify the calculated values before any rounding has been applied.

Full Preliminary Term Criteria: User can choose between the Menge or Traditional Interpretation in how to determine the death benefit in the expense allowance calculation


19 Pay Death Benefit: This option is not needed if the benefits are constant, the method is net level, or if a minimum cash value method is chosen. ELRA (Equivalent Level Renewal Amount) follows Menge's interpretation for how to define the expense allowance death benefit. Actuarial students will be familiar with this method as it is described in the Bowers, Gerber, Hickman, Jones, and Nesbitt "*Actuarial Mathematics*" Textbook. Average death benefit will calculate the arithmetic average of the death benefits in years 2-10. This methodology has been the more consistent methodology since the introduction of the 1980 CSO tables.

Death Benefit: If the death benefit varies by duration, the user will need to enter the death benefits by clicking the  button. The user may also modify all of the variables that vary by duration by clicking this button. See [values that vary by duration](#).

Constant Death Benefit: If the user chooses the death benefit pattern to be constant, then the user will need to enter the constant death benefit in this input box.

Gross Premium: If the gross premium varies by duration, the user will need to enter the death benefits by clicking the  button. The user may also modify all of the variables that vary by duration by clicking this button. See [values that vary by duration](#).

Constant Gross Premium: Choosing a constant gross premium will result in a constant net premium. The gross premium will be used to determine segmentation and deficiency reserves for a XXX calculation. Enter the gross premium without policy fee.

Endowment: The likely option will be the One Payment choice. This will pay an endowment at the time that the benefit ceases. For example, an endowment at 65 policy would choose this option and the system would pay an endowment at age 65. Choosing an endowment that varies by duration, it can be used to calculate values for retirement income policies. If the endowment varies by duration, the user will need to enter the death benefits by clicking the  button. The user may also modify all of the variables that vary by duration by clicking this button. See [values that vary by duration](#).

Single Endowment: Only used if the One Payment endowment type is chosen and if the mortality rate is less than one at the benefit cease age.

Interest Rate Input

Interest rate type: The user has the option to choose the interest rates that vary by duration. See [values that vary by duration](#). It is assumed that if either the basic or minimum interest rate varies by duration, then both of them will vary by duration.

Interest Rate: Enter the interest rate as a decimal (e.g. 0.045). The basic interest rate is used in all of the calculations. For a XXX calculation, it is used to calculate the Basic values. The minimum interest rate is only used for XXX calculation to determine deficiency (minimum) reserves.

Factors Input - Only available for XXX Calculations

X Factor type: The user has the option to choose the X Factor to be constant for all durations or vary by duration. See [values that vary by duration](#). Generally, the X Factor will be between 0.20 and 1.00. The X factor will only be used in the first segment.

10 Year Factor after 1st Segment: If none is chosen, then there will not be a select factor after the first segment in a XXX calculation. The user is presented with other options to include the 10 year factor after the 1st segment. The system uses the gender that the user entered to determine which 10 year selection factor to use. The system will use either the male or the female 10 year factors or a combination of the two.

Mortality rates and Select Factors

Regulation XXX has guidelines on which mortality rates and select factors are allowed. The user is responsible for choosing the mortality rates and factors that are consistent with the regulation. The select factors chosen are only used in the first segment. If the user chooses "10 Year Factor After 1st Segment", then the system will choose the select factors in the renewal segments based upon the gender that was entered. This option should only be used if the user chooses a 1980 CSO mortality table.

Basic Mortality Tables and Select Factors: These rates will be used for all of the calculation methods. If the user chooses a 2001 CSO select and ultimate table, the system will convert to the ultimate part of this table after the first segment. If the user chooses a 2001 CSO table and a XXX method, then the user should not choose a select table. For a XXX method, if the user chooses the one year term comparison, then it will use the Tabular COI mortality and Select factors. For a non XXX method and the user chooses the one year term comparison, then the system will use the Basic Mortality and Select factors.

Tabular COI Mortality Tables and Select Factors: These rates will only be used for a one year term comparison for a XXX method. If the user chooses a 2001 CSO table, then the user should not choose a select table. For a XXX method, if the user chooses the one year term comparison, then it will use the Tabular COI mortality and Select factors. The only select factors that will be displayed will be the ones that are allowed for XXX for the purposes of comparing to a one year term calculation.

Minimum Mortality Tables and Select Factors: These rates will be used to calculate minimum and deficiency reserves for XXX. If the user chooses a 2001 CSO select and ultimate table, the system will convert to the ultimate part of this table after the first segment. If the user chooses a 2001 CSO table, then the user should not choose a select table.

Mortality Calculations

The individual mortality rates are calculated considering these factors: the base mortality rate, the select factor, and the X factor (Minimum assumptions only). Which value to use for each of these variables depends on several variables: which segment (1st or renewal), and the user input of the various mortality tables and select factors.

Generally, the select factors are not used in the renewal segments. There are two exceptions. 1. If the user selects the "10 year factor after the first segment" option. 2. For the tabular cost of insurance calculation, the select factors will be used up to 10 years.

For a 2001 CSO XXX calculation, the base mortality uses the ultimate scale after the first segment. No separate select factors should be used for a 2001 CSO XXX calculations. The select mortality can be utilized by choosing a 2001 select and ultimate mortality table.

If the policy insures two lives, then the individual mortality rates are frasierized to produce a final mortality rate. For two lives, this rate is on a last to die basis.

Actuarial Auditor provides some (but not all!) limitations regarding which mortality options are available for a XXX calculation. However, the user must make the final decisions. See the formulae documentation for more details.

See [Calculating a XXX reserve](#).

Segment


Segment Ratio Definition: Allows the user to be able to select how the segmentation is defined for "close" mortality ratios based upon the "contract segmentation method" defined in section 4B of XXX. The regulation defines that R_t may be increased or decreased by 1% but does not state whether this is additive or multiplicative. The system allows the user to choose either option.

Use Policy Fee in Segmentation: Regulation XXX (Section 4B) does not require policy fees to be included in the segment calculation if they are level.

Segment Endowment Option: Section 6A of the XXX regulation allows the insurer to choose these endowment options.

Segment Endowment Rule: Determines which set of calculations to apply the segment endowment option.

Cash Values

Cash Value Input: Regulation XXX (Section 6D) requires an additional floor comparison to make sure that any unusual pattern of cash values are reserved or the user may want to compare to the cash values. If the user wants to ignore these comparisons, chose "Zero". To make the comparisons, choose "Vary by duration". The user may manually enter the cash values by clicking the  button.

Compare to Basic Mid Year: If the user wants to compare the cash values to the basic mid year reserve, check this option. The system will convert the terminal cash values that the user entered into mid year cash values for the purpose of this comparison.

Unusual Cash Values Test: Choose this option to enforce the Section 6D of the XXX regulation.

1st Year Surrender Charge: This is used in the unusual cash value test. Enter the total amount of the first year surrender charge.

Nonforfeiture interest rate: This is used in the unusual cash value test. Enter as a decimal value.

Minimum Assumptions and Miscellaneous XXX

Mean Reserve Definition: This option is used only if the user chooses the mid year definition to be the mean reserve (see Mid Year). For the mean reserve calculation, this allows the system to use the gross premium if it is less than the net premium. Choosing the "Calculated Net Premium" option will always use the net premium in the mean reserve.

Net Premium Definition: This option affects how the net premium is defined in the output. This option is used for all XXX calculations. The "Mean Reserve Definition" defined how the net premium is used in the mean reserve calculation. It is recommended that these two input items to be consistent.

Policy Fee Per Unit: Since the net premium is a function of the gross premium, the policy fee potentially affects the net premium. Also, for minimum reserves, the policy fee may impact the deficiency reserves.

Unitary, Segment Choice: This option is used when the system is comparing the unitary and segmented reserves to determine the largest value for the net premium, terminal, and mean reserves. For example, if the mid year basic segmented reserve is larger than the mid year basic unitary reserve, then the basic segmented net premium is defined as the net premium to output.

Comparison of values using XXX methodology

After all of the reserves and net premiums have been calculated for different mortality assumptions, XXX requires a comparison of these values to determine which is to be considered the final value. Actuarial Auditor calculates a final Basic value and a final Minimum value.

How the system determines the final value for a given reserve or net premium depends upon many factors. One factor is the reserve method chosen. If the reserve method chosen is XXX Unitary Exemption, then the unitary values will be disregarded.

A second key factor is whether there is a comparison to the one year term comparison (see output tab). If that option is selected, then the one year term reserve will affect the mid year comparison.

A third key factor is which option the user chose for the “unitary, segment choice” input. If the user chooses “compare terminals”, then the terminal values will be compared. If the user chooses “compare mid year”, then the mid year values will be compared.

For example, if the user chooses “compare terminals” then the final minimum net premium will be the unitary net premium if the Basic unitary terminal is greater than the Basic segmented terminal. Likewise, the final net premium will be the segmented net premium if the Basic segmented terminal is greater than or equal to the Basic unitary terminal. Note that based upon section 6B1 of the XXX regulation, this comparison is made at *each* duration. See the Formulae documentation for details regarding the comparison procedures.

Mid Year

Reserve Definition: Choosing the mean will result in all of the mid year reserve values to include the net premium.

One Year Term Comparison: Choosing this option will result in the mid year reserve to be compared to the net premium for a one year term insurance ("one half Cx"). This net premium will equal $\frac{1}{2} Cx$ if the interpolation is half year. Other interpolated values will result in different values used in this comparison. For a XXX calculation, this comparison will use the mortality defined by the "Tabular COI" input. All other calculations will use the mortality defined by the "Basic" input.

Interpolation: This determines how to calculate the mid year reserve values as well as the "one half Cx" comparison if that option is chosen. Exact day considers all days in the year, including leap days. Next month will interpolate to the next monthaversary day if the valuation date is not on a monthaversary. This interpolation only considers the months in a year.

Rounding Order: Choosing to round the terminals and net premium first will result in those values to be rounded when the mid year reserve is calculated.

Return of Premiums

Return of Premium: “None” chooses that there is no return of premiums. This is not a valid option if the method is AG_CCC. “ROP – CV Only” provides a return of premiums in the form of cash values (and possibly endowment) but not included in the death benefit. “ROP – DB & CV” provides a return of premiums in the form of cash values and death benefit. For both of these options, the user can also include an endowment option by the option below “Endow Period (Duration). If the returned premiums are included in the death benefit (“ROP – DB & CV”), do NOT input these returned premiums in the death benefit section.

If you have selected a return of premium option, then you will need to enter the percentages of accumulated premiums by duration that will be returned. You enter these percentages, as a decimal, by clicking on any of the boxes that have three dots (...) to open the form that allows you to enter values that vary by duration (See [Values that vary by duration](#)). Enter 1 at the duration of the endowment period if 100% of the premiums are returned at that duration. The percentages before the endowment duration will be interpreted as cash values and also death benefits if the “ROP – DB & CV” option is selected.

Endow Period (Duration): If the user selects one of the Return of Premium options, then they have an option to choose an Endowment. Enter the duration of the endowment in this text box. For example, 20 will result in the premiums to be returned as an endowment in duration 20. Note that there is also an endowment entry option (See [Benefits and Premiums](#)). The final endowment that will be used will be the maximum endowment from that endowment and the endowment entered in this section. If the endowment is a return of premium, it is recommended that the user enters that information in this section and not in the “Benefits and Premiums” section.

Policy Fee included in ROP: If the policy fee is included in the premium that is returned, select this option. If the policy fee is not included, then do not select this option.

Test Current Premium: Actuarial Guideline CCC states that if there exist a current premium scale that is returned that is different than the guaranteed scale, then the minimum cash values are the ones that produce the greatest cash values testing both premium scales. To test the current premiums, select this option. You will need to enter the current premiums on a per unit basis, similar to the method that the guaranteed premiums were entered by clicking on any of the three dots button “...” to open the values that vary by duration form (See [Values that vary by duration](#)).

Smoothness

Test for Smoothness: Selecting this option will test to determine if the cash values pass the smoothness test based upon the language of the 1980 SNFL. Actuarial Guideline did not add additional language to the test other than it must be performed to satisfy this guideline. See the discussion forum (<http://actuarialauditor.saltsolutions.com/Forum/Topics.aspx>) to see more details regarding this test.

1st Segment Definition: The segments for the smoothness test generally are 5 years duration. The user can extend the first segment to be longer by selecting “Variable”. The system will begin with a first segment of 5 years. If a set of Non Forfeiture Factors (NFF) can be found that meet the smoothness criteria, then the system will use those NFF’s. If a set of NFF’s cannot be found, then the first segment will be extended to 6 years. The process will continue until a set of NFF’s can be found that meet the smoothness test or the maximum first segment duration is reached. See the formula documentation for more details on this maximum definition.

Report Type

The user may choose which reports to produce by selecting any of the output report choices in the Report section of the input page. Actuarial Auditor will save the user's report selection when they choose to save the data. The reports that are available for a given case will depend upon the policy type, values calculated, and the methodology chosen.

Actuarial Auditor supports 2 output formats:

PDF: This is the quickest and simplest format. The reports will be opened as a pdf file in the user's browser.

Excel: This format is useful if the user wants to view the data in a spreadsheet. Most spreadsheets will easily read these files with each column being imported into a separate column in the spreadsheet. All the reports are shown on one worksheet of an excel workbook.

See [Report Documentation](#)

Report Documentation (Commutation Reports)

The commutation reports are listed below. The policy type, the values calculated (reserve or cash value), and the method determine which reports are available.

Basic Commutation Functions 1: Calculates the final mortality after all of the select factors have been applied using Basic assumptions. It also displays the commutation functions

$$M_x, \bar{M}_x, N_x, \bar{N}_x$$

Basic Commutation Functions 2: Uses the final mortality after all of the select factors have been applied using Basic assumptions. It displays the commutation functions

$$l_x, C_x, \bar{C}_x, D_x, \bar{D}_x$$

Tabular COI Commutation Functions 1: Similar to the Basic Commutation functions except the Tabular COI mortality is used.

Tabular COI Commutation Functions 2: Similar to the Basic Commutation functions except the Tabular COI mortality is used.

Minimum Commutation Functions 1: Similar to the Basic Commutation functions except the Minimum mortality and interest rates are used.

Minimum Commutation Functions 2: Similar to the Basic Commutation functions except the Minimum mortality and interest rates are used.

See [Report Documentation \(Summary Reports\)](#) and [Report Documentation \(Detail Reports\)](#)

Report Documentation (Detail Reports)

The detail reports are listed below. The policy type, the values calculated (reserve or cash value), and the method determine which reports are available. All values in the detail reports are on a per unit basis before any rounding has been applied. This allows the user to review the calculations before any rounding has been performed or number of units have been applied.

Basic Unitary Detail: Calculates \ddot{a}_x , Present Value of Future Benefits, Present Value of Future Gross Premiums, Net Annual Premium, Net Level Reserves, Modified Net Premiums, and Modified Reserves. If the reserve method is net level, then the modified values will be the same as the net level. In addition, the header provides results for the 19 Pay Premium, Expense Allowance Death Benefit (See [Benefits and Premium](#)), Definition as to the expense allowance type (high premium or low premium), and the r factor using full preliminary term assumptions.

Basic Segmented Detail: Similar to the Basic Unitary Detail except the present values are based upon the segmentation results.

Minimum Unitary Detail: Similar to the Basic Unitary Detail except the Minimum mortality assumption is used. This report does NOT include any deficiency reserves.

Minimum Segmented Detail: Similar to the Basic Segmented Detail except the Minimum mortality assumption is used. This report does NOT include any deficiency reserves.

Deficiency Detail: The values are provided for 3 different deficiency calculations. The ART calculations result from the Tabular COI mortality assumptions and comparing to an ART mean premium. The minimum unitary and minimum segmented calculations result from using the minimum mortality assumptions. Traditional reserve methodology is used in the calculation of the deficiency reserves where the reserve is simply the present value of future "benefits". This methodology assumes that the "Benefit" is the difference of the net and gross premium (or zero if the gross is greater). There are no "premiums". The first column (Premium Deficiency) is the difference between the net and the gross premium (or zero if the gross is greater). The second column (Present Value of the Premium Deficiency) takes the present value. Note that the "benefit" timing is at the beginning of the year for curtate or semi-continuous assumptions. The third column (Deficiency Reserve) is the deficiency reserve calculated using the methodology previously described.

Segment Details (Reserve Calculation): Provides the user with documentation on the gross premium, gross premium ratio, mortality, and the mortality ratio that were used in the segmentation process. The result of the calculations produces the definition of the segments. That is found in the End of Year Attained Age Segment column. For example, if the first segment for an issue age 25 policy is 35, then the first segment is 10 years.

Segment Details (Cash Value Calculation): Provides the user with documentation on the segments that are used in the smoothness test. These segments are used in the basic cash value calculation.

Minimum Endow Period (Cash Value Calculation): If the AG_CCC method is chosen, then a test to determine the minimum cash values is performed during the endowment period only. This report provides the per unit details for that calculation.

Minimum Unitary – Curr Premium (Cash Value Calculation): If the AG_CCC method is chosen, then a test to determine the minimum cash values is performed assuming that the current premium scale is paid and those premiums are returned. This report provides the per unit details for that calculation for the entire benefit period.

Minimum Endow Period – Curr Premium (Cash Value Calculation): If the AG_CCC method is chosen, then a test to determine the minimum cash values is performed assuming that the current premium scale is paid and those premiums are returned. This report provides the per unit details for that calculation for the endowment period.

Cash Value Compare (Cash Value Calculation): If the AG_CCC method is chosen, then the minimum cash values are the maximum cash values based upon two (or more) tests as mentioned above. This report provides the per unit details for each of these test and shows the final (maximum) minimum cash value by duration.

See [Report Documentation \(Summary Reports\)](#) and [Report Documentation \(Commutation Reports\)](#)

Report Documentation (Summary Reports)

All of the summary reports provide the terminal and mid year reserves for all durations as well as the terminal and mid year reserves for the current duration based upon the issue date and valuation date.

The reports are listed below. The policy type, the values calculated (reserve or cash value), and the method determine which reports are available.

All of the summary reports are after the per unit values have been calculated, rounded by the per unit definitions, multiplied by the number of units, and rounded based upon the total rounding definitions. For more information on rounding definitions, see [Global Variables](#).

Reserve Summary: Calculates net premiums, terminal and mid year reserves.

Minimum Cash Value Summary: Calculates adjusted premiums, terminal, and mid year cash values. If the user chose a return of premium option, the actual cash values are provided.

Reserve Summary XXX: Same as the reserve summary except the minimum and deficiency results are provided as well. These values are the net premium, terminal and mid year reserve using the minimum assumptions (deficiency reserves are included in these values). Because of the need to report the deficiency reserves separate, they are also included as a separate output value. The terminal and mean deficiency reserves are provided. The Terminal Reserve and Mid-Year Reserve at the top of the report are the final reserves based upon the issue date and the valuation date. These two values are the larger of the values calculated using the Basic and Minimum assumptions.

See [Report Documentation \(Commutation Reports\)](#) and [Report Documentation \(Detail Reports\)](#)