ONLINE RISK CALCULATOR TUTORIALS

RadRAT 4.3

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Example Case 1 – Excess Lifetime Risk from a Single Exposure of a Single Organ

Estimate the excess lifetime risk (chances in 100,000) of developing colon cancer as a result of a single exposure to radiation at age 10.

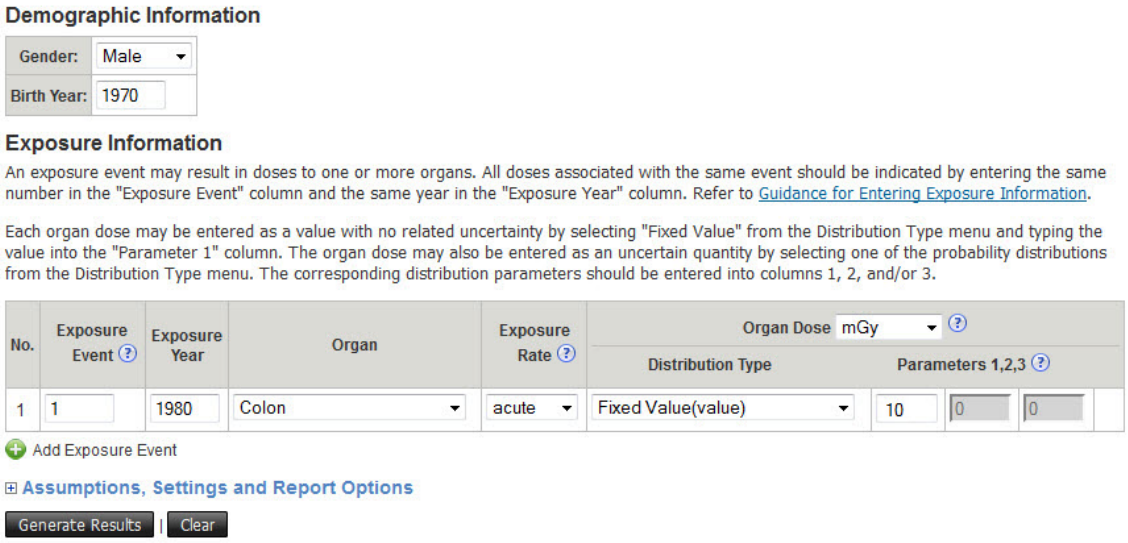
Gender – Male or Female
Birth year – 1970
Exposure year – 1980
Age at time of exposure – 10 yrs
Exposure scenario – Single exposure to high-energy gamma radiation
Exposure Rate – acute (i.e., dose was delivered in a matter of seconds)
Organ exposed – Colon
Organ dose – 10 mGy

Step-by-Step Solution

- On the calculator home page, click **Get Started**.
- On the main input page, set **Gender** to *Male* and **Birth Year** to *1970* and set **Organ Dose** to *mGy*.

Enter exposure information

- Key *1* into the **Exposure Event** field, to indicate that this case has a single exposure
- Key *1980* into the **Exposure Year** field.
- Select *Colon* from the **Organ** drop-down menu.
- Select *acute* from the **Exposure Rate** drop-down menu.
- Select *Fixed Value* from the **Distribution Type** drop-down menu.
- Key *10* into the **Parameter 1** field to indicate that the radiation dose received by the colon is equal to 10 mGy.



Click **Generate Results**.

Results

The estimated excess lifetime risk for males is displayed in the **Summary Report** page.

Risk Estimates

Lifetime Risk of Developing Colon Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	0.0	0.0	0.0

* Risk from the time of exposure to the end of the expected lifetime

To estimate the excess lifetime risk for females

- Click the **Back** button of the browser or the **Information** link in the top left of the **Summary Report** page to return to the main data input page.
- Change **Gender** to *Female*.

Click **Generate Results**.

The **Summary Report** page displays the excess lifetime risk for females.

Risk Estimates

Lifetime Risk of Developing Colon Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	0.0	0.0	0.0

* Risk from the time of exposure to the end of the expected lifetime

Example Case 2 – Excess Lifetime Risk from a Single Exposure of Multiple Organs

Estimate the excess lifetime risk of developing cancer (summed across cancer sites) as a result of a single exposure at age 10 to radiation affecting multiple organs.

Gender – Female
Birth year – 1990
Exposure year – 2000
Age at time of exposure – 10 yrs
Exposure scenario – single exposure of multiple organs to high-energy gamma radiation
Exposure Rate – acute (i.e., dose was delivered in a matter of seconds)
Organ exposed – multiple organs (see table below)
Organ dose – See table below

Example doses (mGy) to multiple organs from a single exposure

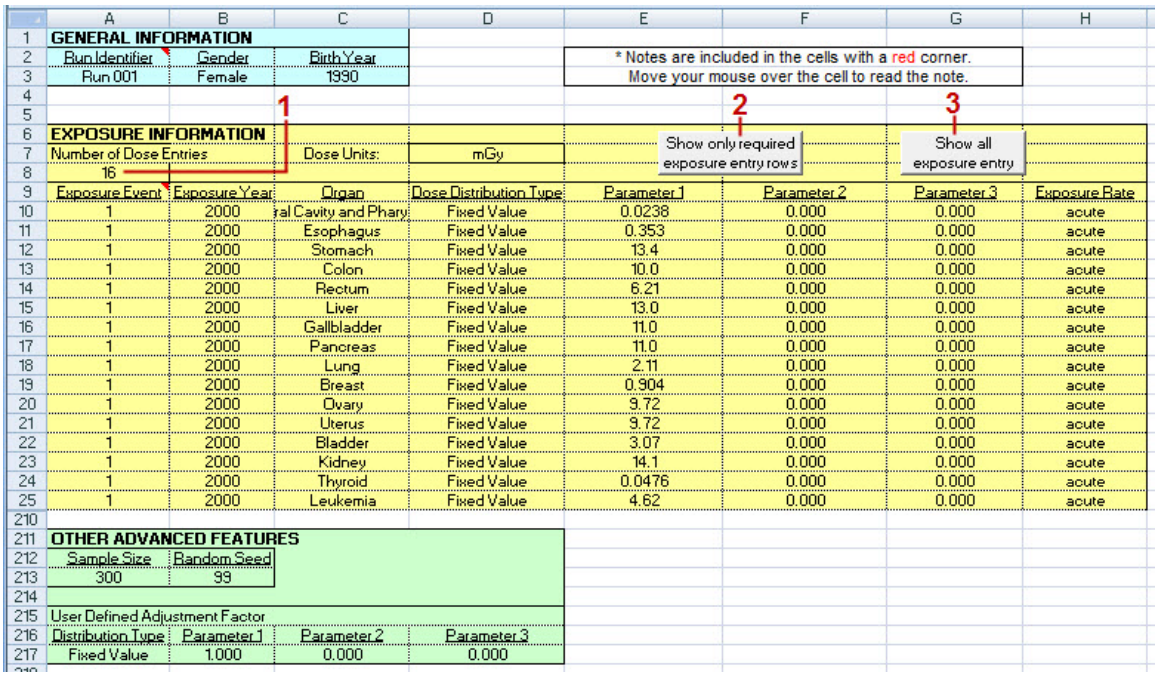
Organ	**Organ Dose (mGy)**
Oral Cavity and Pharynx	0.0238
Esophagus	0.353
Stomach	13.4
Colon	10.0
Rectum	6.21
Liver	13.0
Gallbladder	11.0
Pancreas	11.0
Lung	2.11
Breast	0.904
Ovary	9.72
Uterus	9.72
Bladder	3.07
Kidney	14.1
Thyroid	0.0476
Leukemia	4.62

Step-by-Step Solution

The input data can be entered by keying the information directly into the main input page. However, in this example, we will use an Excel template file to store the input data for future use. The Excel file can be uploaded to populate the input fields on the main input page. To accomplish this, follow these steps:

- From the calculator home page, click **Get Started**.
- On the main input page, click **Upload an input file.** link in the upper left corner. The page for downloading the template and uploading the file will open.
- Click **Download a template version of the Excel input file** and save the template Excel file on your computer. If you already have an Excel template file on your computer, skip this step.

- Prepare the Excel file (see the directions below).
- From the upload page of the calculator, click **Browse**, select the saved Excel file and upload it. The data in the upload file will populate all the fields in the main input screen.
- Click **Generate Results**. The **Results** page will open.



	A	B	C	D	E	F	G	H
1	GENERAL INFORMATION							
2	Run Identifier	Gender	Birth Year		* Notes are included in the cells with a red corner.			
3	Run 001	Female	1990		Move your mouse over the cell to read the note.			
4								
5			1			2	3	
6	EXPOSURE INFORMATION							
7	Number of Dose Entries		Dose Units:	mGy		Show only required exposure entry rows	Show all exposure entry	
8	16							
9	Exposure Event	Exposure Year	Organ	Dose Distribution Type	Parameter 1	Parameter 2	Parameter 3	Exposure Rate
10	1	2000	al Cavity and Phary	Fixed Value	0.0238	0.000	0.000	acute
11	1	2000	Esophagus	Fixed Value	0.353	0.000	0.000	acute
12	1	2000	Stomach	Fixed Value	13.4	0.000	0.000	acute
13	1	2000	Colon	Fixed Value	10.0	0.000	0.000	acute
14	1	2000	Rectum	Fixed Value	6.21	0.000	0.000	acute
15	1	2000	Liver	Fixed Value	13.0	0.000	0.000	acute
16	1	2000	Gallbladder	Fixed Value	11.0	0.000	0.000	acute
17	1	2000	Pancreas	Fixed Value	11.0	0.000	0.000	acute
18	1	2000	Lung	Fixed Value	2.11	0.000	0.000	acute
19	1	2000	Breast	Fixed Value	0.904	0.000	0.000	acute
20	1	2000	Ovary	Fixed Value	9.72	0.000	0.000	acute
21	1	2000	Uterus	Fixed Value	9.72	0.000	0.000	acute
22	1	2000	Bladder	Fixed Value	3.07	0.000	0.000	acute
23	1	2000	Kidney	Fixed Value	14.1	0.000	0.000	acute
24	1	2000	Thyroid	Fixed Value	0.0476	0.000	0.000	acute
25	1	2000	Leukemia	Fixed Value	4.62	0.000	0.000	acute
210								
211	OTHER ADVANCED FEATURES							
212	Sample Size	Random Seed						
213	300	99						
214								
215	User Defined Adjustment Factor							
216	Distribution Type	Parameter 1	Parameter 2	Parameter 3				
217	Fixed Value	1.000	0.000	0.000				

Preparing the Excel file

- In the **General Information** section, set **Gender** to *Female* using the drop-down list, and key *1990* in the **Birth Year** field.
- At the top of the **Exposure Information** section, key in the **Number of Dose Entries** (1) as *16*, because there are 16 doses measured, each to a different organ. **Note:** The number on this line will be the number of lines that are uploaded.
- The **Show only required exposure entry rows** (2) and **Show all exposure entry** (3) buttons can be used to hide or show the lines that *don't have data*. This feature only works if you have macros enabled. If you don't have macros enabled, you can use the **Hide**/**Unhide** function of Excel or delete the extra rows. However, only the number of rows indicated in **Number of Dose Entries** are uploaded into the application, so it is not necessary to delete or hide them.
- Leave **Dose Units** at the default setting (*mGy*). There is a drop-down menu for other settings.
- In the **Exposure Event** column, key *1* in as the exposure number in all 16 rows of the table, to indicate that there was only *one* event that irradiated all 16 organs.
- Enter *2000* in the **Exposure year** column for all 16 rows.
- Select the exposed organ from the drop-down menus in the **Organ** column for each of the 16 rows.

- Leave the **Dose Distribution Type** set to the default, *Fixed Value* in all 16 rows.
- Key in the respective dose values in the **Parameter 1** column for each selected organ, and leave the values set to zero, the default settings, in the **Parameter 2** and **Parameter 3** columns.
- Leave the **Exposure Rate** column set to the default, *acute* for all 16 rows of dose entries.
- Save the Excel file with any desired name.

Results

The total excess lifetime risk (summed across cancer sites) is displayed in the **Summary Report** page.

Risk Estimates

Lifetime Risk of Developing Cancer of the Exposed Organs (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	50.6	101	187

* Risk from the time of exposure to the end of the expected lifetime

To inspect the risks estimated for each cancer site, click on the link labeled:

⊞ **Excess Lifetime Risk per Cancer Site with a 90% Uncertainty Range**

Risk Estimates

Lifetime Risk of Developing Cancer of the Exposed Organs (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	50.6	101	187

* Risk from the time of exposure to the end of the expected lifetime

⊟ Excess Lifetime Risk per Cancer Site* with a 90% Uncertainty Range

Cancer Site	Lower Bound	Mean	Upper Bound
Oral Cavity & Pharynx	0.00238	0.00982	0.0209
Esophagus	< 0	0.0778	0.225
Stomach	2.84	21.1	83
Colon	7.32	18.1	35.9
Rectum	< 0	1.48	4.35
Liver	0.589	6.22	23.5
Gallbladder	< 0	< 0	0.896
Pancreas	0.487	5.22	11.7
Lung	5.11	12.7	25.4
Breast	3.88	7.09	12.4
Ovary	1.73	8.03	18.5
Uterus	< 0	4.7	17.1
Bladder	1.82	5.82	12.5
Kidney	0.618	5.46	14.3
Thyroid	0.0573	0.249	0.61
Leukemia	1.25	4.58	11.1

* Risk from the time of exposure to the end of the expected lifetime

Example Case 3 – Excess Lifetime Risk from Multiple Exposures of a Single Organ

Estimate the total excess lifetime risk of developing breast cancer as a result of annual exposures between ages 40 and 49.

Gender – Female
Birth year – 1950
Exposure years – 1990-1999
Age at time of exposure – 40-49 yrs
Exposure scenario – single dose each year for 10 years
Exposure Rate – acute (i.e., dose was delivered in a matter of seconds)
Organ exposed – Breast
Each organ dose – Lognormal probability distribution with a geometric mean (GM) of 1.73 mGy and a geometric standard deviation (GSD) of 1.15

Step-by-Step Solution

- From the calculator home page, click **Get Started**.
- On the main input page, set **Gender** to *Female* and **Birth Year** to *1950* and set **Organ Dose** to *mGy*.

For the first exposure event in 1990

- Key *1* into the **Exposure Event** field, because this is the first exposure.
- Key *1990* into the **Exposure Year** field.
- Select *Breast* from the **Organ** drop-down menu.
- Select *acute* from the **Exposure Rate** drop-down menu.
- Select *Lognormal* from the **Distribution Type** drop-down menu.
- Key *1.73* in the **Parameter 1** field to indicate that the lognormal distribution describing the uncertain dose has a geometric mean equal to 1.73 mGy.
- Key 1.*15* in the **Parameter 2** field to indicate that the lognormal distribution describing the uncertain dose has a geometric standard deviation equal to 1.15 mGy.

For the second exposure event in 1991

- Click **Add** to insert another line of input information.
- Key *2* into the **Exposure Event** field, because this is the second exposure received by the breast tissue.
- Populate the fields labeled **Exposure Year**, **Organ**, **Exposure Rate**, Distribution **Key**, **Parameters 1**, **2**, **3** with the same values as above.

Repeat this process by adding eight additional lines of exposures (events 3 to 10), representing exposures in years 1992 to 1999, and enter the same dose information for each of them, as described above.

Demographic Information

Gender:	Female
Birth Year:	1950

Exposure Information

An exposure event may result in doses to one or more organs. All doses associated with the same event should be indicated by entering the same number in the "Exposure Event" column and the same year in the "Exposure Year" column. Refer to Guidance for Entering Exposure Information.

Each organ dose may be entered as a value with no related uncertainty by selecting "Fixed Value" from the Distribution Type menu and typing the value into the "Parameter 1" column. The organ dose may also be entered as an uncertain quantity by selecting one of the probability distributions from the Distribution Type menu. The corresponding distribution parameters should be entered into columns 1, 2, and/or 3.

No.	Exposure Event	Exposure Year	Organ	Exposure Rate	Organ Dose mGy				
					Distribution Type	Parameters 1,2,3			
1	1	1990	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
2	2	1991	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
3	3	1992	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
4	4	1993	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
5	5	1994	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
6	6	1995	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
7	7	1996	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
8	8	1997	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
9	9	1998	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	
10	10	1999	Breast	acute	Lognormal(median,gsd)	1.73	1.15	0	

Add Exposure Event

Click **Generate Results**.

Results

The estimated excess lifetime risk is displayed in the **Summary Report** page.

Risk Estimates

Lifetime Risk of Developing Breast Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	10	19.4	33.7

* Risk from the time of exposure to the end of the expected lifetime

The calculation above was performed using a simulation sample size of 300 Monte-Carlo iterations and a random number seed equal to 99 (default settings). In some situations, it may be necessary to estimate risk with a different Monte-Carlo sample size and/or a different Monte-Carlo random seed.

Changing the Sample Size

To change the simulation sample size to 1,000 and the random seed to 123

- Click the **Back** button of the browser or the **Information** link in the top left of the **Summary Report** page to return to the main data input page.
- Click on the link labeled:

⊞ **Assumption, Settings and Report Options**.

- Key *1000* the **Simulation Sample Size** field.
- Key *123* in the **Random Seed** field.

Click **Generate Results**.

The **Summary Report** page displays the estimated excess lifetime risk obtained using a Monte-Carlo simulation sample size of 1,000 iterations and a random number seed equal to 123.

Example Case 4 – Excess Lifetime Risk from Multiple Exposures of Multiple Organs

Estimate the excess lifetime risk of developing cancer (summed across cancer sites) as a result of exposure to radiation at ages 30, 31 and 35.

Gender – Male
Birth year – 1960
Exposure years – 1990, 1991, 1995
Age at time of exposure – 30, 31, and 35 years of age
Exposure scenario –
    Exposure Event 1 in 1990 – single acute doses to colon, bladder and kidneys
    Exposure Event 2 in 1991 – single acute doses to oral cavity, esophagus and thyroid
    Exposure Event 3 in 1995 – single chronic dose to the thyroid gland
Organ dose – Listed in table below

Example doses (mGy) to multiple organs from multiple exposures

Exposure No.	Exposure Year	Organ	Organ Dose (mGy)
1	1990	Colon	Normal (Mean=4.0, Standard Deviation=0.35)
1	1990	Bladder	Triangular (Min=2.5, Mode=3.5, Max=4.0)
1	1990	Kidneys	Lognormal (GM=5.0, GSD=1.5)
2	1991	Oral Cavity and Pharynx	Uniform (Min=0.3, Max=0.8)
2	1991	Esophagus	Log-Triangular (Min=0.2, Mode=0.7, Max=1.4)
2	1991	Thyroid	Log-Uniform (Min=0.1, Max=1.0)
3	1995	Thyroid	Fixed Value=10.0

Step-by-Step Solution:

- On the calculator home page, click **Get Started**.
- On the main input page, set **Gender** to *Male* and **Birth Year** to *1960* and set **Organ Dose** to *mGy*.

For the first exposure event

- Click **Add Exposure Event** to generate a total of three lines in the **Dose Exposure Information** table.
- In each of the three lines, key *1* into the **Exposure Event** column to indicate that this is the first event that resulted in an exposure.
- In each of the three lines, key *1990* into the **Exposure Year** column

- In each of the three lines, select *acute* from the drop-down menus in the **Exposure Rate** column.
- In the **Organ** column, use the drop-down menus to select *Colon* in the first line, *Bladder* in the second line and *Kidney* in the third line.
- In the **Organ Dose** (*mGy)* fields enter the doses listed in the table above.
    - In the first line, the dose to colon is set by selecting *Normal* from the drop-down menu in the **Distribution Type** field, keying *4.0* into the **Parameter 1** field as the mean of the distribution, and *0.35* in the **Parameter 2** field as the standard deviation.
    - Doses provided in the table above for bladder (second line) and for kidneys (third line) can be entered in a similar way.

For the second exposure event

- Click **Add Exposure Event** to generate a total of three lines in the **Dose Exposure Information** table.
- In each of the three lines, key *2* into the **Exposure Event** column to indicate that this is the second event that resulted in an exposure.
- In each of the three lines, key *1991* into the **Exposure Year** column.
- In each of the three lines, select *acute* from the drop-down menus in the **Exposure Rate** column.
- In the **Organ** column, the drop-down menus to select *Oral Cavity and Pharynx* in the first of the newly added lines, *Esophagus* in the second added line and *Thyroid* in the third added line.
- In the **Organ Dose** fields, enter the doses listed in the table above by selecting the desired type of probability distribution (i.e., *Uniform*, *Logtriangular*, and *Loguniform*) from the **Distribution Type** drop-down menus, and by setting parameters 1, 2, and 3 to the listed values..

For the third exposure event

- Click **Add Exposure Event** to generate one more line in the **Dose Exposure Information** table.
- Key *3* into the **Exposure Event** column to indicate that this is the third event that resulted in an exposure.
- Key *1995* into the **Exposure Year** column.
- Select *chronic* from the drop-down menus in the **Exposure Rate** column.
- Select *Thyroid* in the **Organ** column drop-down menu.
- In the **Organ Dose** field, enter the dose listed in the table above for the thyroid gland by selecting *Fixed Value* from the **Distribution Type** drop-down menu, and keying *10* into the **Parameter 1** field.

Click **Generate Results**.

Demographic Information

Gender:	Male
Birth Year:	1960

Exposure Information

An exposure event may result in doses to one or more organs. All doses associated with the same event should be indicated by entering the same number in the "Exposure Event" column and the same year in the "Exposure Year" column. Refer to Guidance for Entering Exposure Information.

Each organ dose may be entered as a value with no related uncertainty by selecting "Fixed Value" from the Distribution Type menu and typing the value into the "Parameter 1" column. The organ dose may also be entered as an uncertain quantity by selecting one of the probability distributions from the Distribution Type menu. The corresponding distribution parameters should be entered into columns 1, 2, and/or 3.

No.	Exposure Event	Exposure Year	Organ	Exposure Rate	Organ Dose mGy — Distribution Type	Parameters 1,2,3		
1	1	1990	Colon	acute	Normal(mean,sd)	4.0	0.35	0
2	1	1990	Bladder	acute	Triangular(min,mode,max)	2.5	3.5	4.0
3	1	1990	Kidney	acute	Lognormal(median,gsd)	5.0	1.5	0
4	2	1991	Oral Cavity and Pharynx	acute	Uniform(min,max)	0.3	0.8	0
5	2	1991	Esophagus	acute	Logtriangular(min,mode,max)	0.2	0.7	1.4
6	2	1991	Thyroid	acute	Loguniform(min,max)	0.1	0.1	0
7	3	1995	Thyroid	chronic	Fixed Value(value)	10.0	0	0

Add Exposure Event

Results

The estimated excess lifetime risk is displayed in the **Summary Report** page.

Risk Estimates

Lifetime Risk of Developing Cancer of the Exposed Organs (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	5.1	11.9	22.3

* Risk from the time of exposure to the end of the expected lifetime

To inspect the risks estimated for each cancer site, click on the link labeled:

⊞ **Excess Lifetime Risk per Cancer Site* with a 90% Uncertainty Range**.

Risk Estimates

Lifetime Risk of Developing Cancer of the Exposed Organs (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	5.1	11.9	22.3

* Risk from the time of exposure to the end of the expected lifetime

⊟ Excess Lifetime Risk per Cancer Site* with a 90% Uncertainty Range

Cancer Site	Lower Bound	Mean	Upper Bound
Oral Cavity & Pharynx	0.00618	0.111	0.278
Esophagus	0.0341	0.165	0.426
Colon	2.49	5.53	10.1
Bladder	0.961	3.36	8.15
Kidney	0.106	1.64	4.67
Thyroid	0.231	1.04	3.02

* Risk from the time of exposure to the end of the expected lifetime

Example Case 5 – Excess Lifetime Risk from Long-Term Exposure of All Organs

Calculate the excess lifetime risk from external exposure to high-energy gamma radiation in areas contaminated with radionuclides.

Gender – Male
Birth year – 1991
Years of exposure: 2011 – 2040
Age at time of exposure: 20 – 50 years of age
Organ exposed – All organs
Organ dose – Each organ receives a dose ranging from 1 to 5 mGy in the first year, after which annual doses are assumed to decrease with an effective half-life of 1100 days (approximately 3 years). To account for uncertainty, doses are expressed as uniform probability distributions between the minimum and the maximum values listed in the table below.
Exposure Rate – chronic (i.e., annual doses are delivered chronically over the entire year)

Example external exposure doses (mGy)

Year	Possible range of doses-Minimum	Possible range of doses-Maximum		Year	Possible range of doses-Minimum	Possible range of doses-Maximum
2011	1.0000	5.000		2026	0.0317	0.159
2012	0.7945	3.973		2027	0.0252	0.126
2013	0.6313	3.156		2028	0.0200	0.100
2014	0.5016	2.508		2029	0.0159	0.080
2015	0.3985	1.993		2030	0.0127	0.063
2016	0.3166	1.583		2031	0.0101	0.050
2017	0.2516	1.258		2032	0.0080	0.040
2018	0.1999	0.999		2033	0.0063	0.032
2019	0.1588	0.794		2034	0.0050	0.025
2020	0.1262	0.631		2035	0.0040	0.020
2021	0.1003	0.501		2036	0.0032	0.016
2022	0.0797	0.398		2037	0.0025	0.013
2023	0.0633	0.316		2038	0.0020	0.010
2024	0.0503	0.251		2039	0.0016	0.0080
2025	0.0400	0.200		2040	0.0013	0.0063

Step-by Step Solution

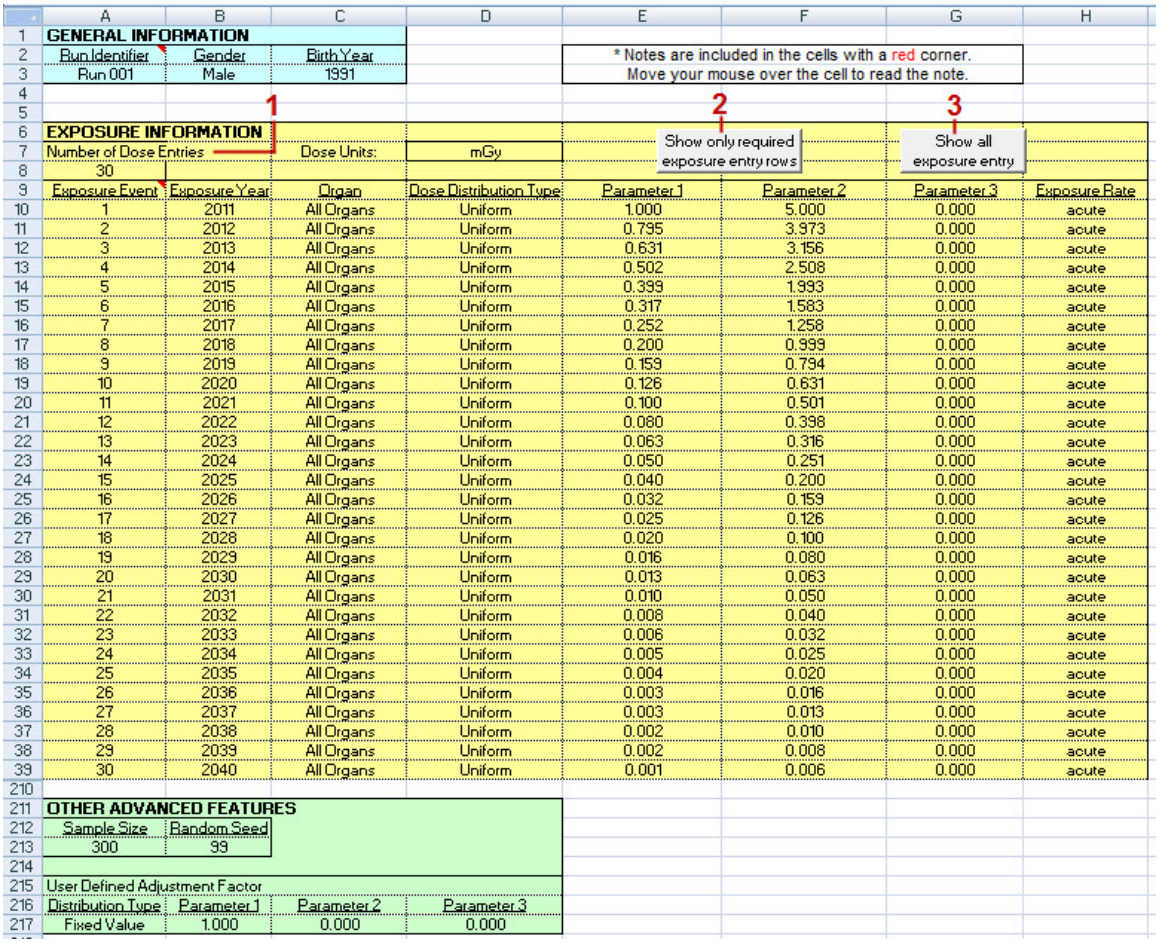
The input data can be entered by keying the information directly into the main input page. However, in this example, we will use an Excel template file to store the input data for future use. The Excel file can be uploaded to populate the input fields on the main input page. To accomplish this, follow these steps:

- From the calculator home page, click **Get Started**.
- On the main input page, click **Upload an input file.** link in the upper left corner. The page for downloading the template and uploading the file will open.
- Click **Download a template version of the Excel input file** and save the template Excel file on your computer. If you already have an Excel template file on your computer, skip this step.
- Prepare the Excel file (see the directions below).
- From the upload page of the calculator, click **Browse**, select the saved Excel file and upload it. The data in the upload file will populate all the fields in the main input screen.
- Click **Generate Results**. The **Results** page will open

Prepare an Excel file

- Edit the Excel template file.
- Set **Gende**r to *Male* and key *1991* in as the **Birth Year**.
- Set the **Number of Dose Entries** at the top left side of the template to *30*, the number of rows of data. In this example there are 30 doses, each to be applied to all organs of the body. **Note:** The number you key into this field will be the number of lines that are uploaded from your file.
- In the **Exposure Event** column, enter the exposure numbers in increasing order from *1* to *30*, since there are 30 years of exposure.
- In the **Exposure Year** column, key in the consecutive years of exposure starting with *2011* and ending with *2040*.
- In the **Organ** column, use the drop-down menus to select *All organs* for each of the 30 years of exposure.
- For the dose received in any given year, select *Uniform* from the **Distribution Type** drop-down menu, and key the minimum and the maximum doses from the table above into the **Parameter 1** and **Parameter 2** fields, respectively.
- Leave the default value of *0* in **Parameter 3** field for all years of exposure.
- Select *chronic* from the drop-down menus in the **Exposure Rate** column, for all years of exposure.
- The **Show only required exposure entry rows** (2) and **Show all exposure entry** (3) buttons can be used to hide or show the lines that *don't have data*. This feature only works if you have macros enabled. If you don't have macros enabled, you can use the **Hide**/**Unhide** function of Excel or delete the extra rows. However, only the number of rows indicated in **Number of Dose Entries** are uploaded into the application, so it is not necessary to delete or hide them.
- Save the template Excel file with a desired name.

- The **Show only required exposure entry rows** (2) and **Show all exposure entry** (3) buttons can be used to hide or show the lines that *don't have data*. This feature only works if you have macros enabled. If you don't have macros enabled, you can use the **Hide**/**Unhide** function of Excel or delete the extra rows. However, only the number of rows indicated in **Number of Dose Entries** are uploaded into the application, so it is not necessary to delete or hide them.



	A	B	C	D	E	F	G	H
1	**GENERAL INFORMATION**							
2	Run Identifier	Gender	Birth Year		* Notes are included in the cells with a red corner.			
3	Run 001	Male	1991		Move your mouse over the cell to read the note.			
4								
5			1		2		3	
6	**EXPOSURE INFORMATION**							
7	Number of Dose Entries		Dose Units:	mGy	Show only required exposure entry rows		Show all exposure entry	
8	30							
9	Exposure Event	Exposure Year	Organ	Dose Distribution Type	Parameter 1	Parameter 2	Parameter 3	Exposure Rate
10	1	2011	All Organs	Uniform	1.000	5.000	0.000	acute
11	2	2012	All Organs	Uniform	0.795	3.973	0.000	acute
12	3	2013	All Organs	Uniform	0.631	3.156	0.000	acute
13	4	2014	All Organs	Uniform	0.502	2.508	0.000	acute
14	5	2015	All Organs	Uniform	0.399	1.993	0.000	acute
15	6	2016	All Organs	Uniform	0.317	1.583	0.000	acute
16	7	2017	All Organs	Uniform	0.252	1.258	0.000	acute
17	8	2018	All Organs	Uniform	0.200	0.999	0.000	acute
18	9	2019	All Organs	Uniform	0.159	0.794	0.000	acute
19	10	2020	All Organs	Uniform	0.126	0.631	0.000	acute
20	11	2021	All Organs	Uniform	0.100	0.501	0.000	acute
21	12	2022	All Organs	Uniform	0.080	0.398	0.000	acute
22	13	2023	All Organs	Uniform	0.063	0.316	0.000	acute
23	14	2024	All Organs	Uniform	0.050	0.251	0.000	acute
24	15	2025	All Organs	Uniform	0.040	0.200	0.000	acute
25	16	2026	All Organs	Uniform	0.032	0.159	0.000	acute
26	17	2027	All Organs	Uniform	0.025	0.126	0.000	acute
27	18	2028	All Organs	Uniform	0.020	0.100	0.000	acute
28	19	2029	All Organs	Uniform	0.016	0.080	0.000	acute
29	20	2030	All Organs	Uniform	0.013	0.063	0.000	acute
30	21	2031	All Organs	Uniform	0.010	0.050	0.000	acute
31	22	2032	All Organs	Uniform	0.008	0.040	0.000	acute
32	23	2033	All Organs	Uniform	0.006	0.032	0.000	acute
33	24	2034	All Organs	Uniform	0.005	0.025	0.000	acute
34	25	2035	All Organs	Uniform	0.004	0.020	0.000	acute
35	26	2036	All Organs	Uniform	0.003	0.016	0.000	acute
36	27	2037	All Organs	Uniform	0.003	0.013	0.000	acute
37	28	2038	All Organs	Uniform	0.002	0.010	0.000	acute
38	29	2039	All Organs	Uniform	0.002	0.008	0.000	acute
39	30	2040	All Organs	Uniform	0.001	0.006	0.000	acute
210								
211	**OTHER ADVANCED FEATURES**							
212	Sample Size	Random Seed						
213	300	99						
214								
215	User Defined Adjustment Factor							
216	Distribution Type	Parameter 1	Parameter 2	Parameter 3				
217	Fixed Value	1.000	0.000	0.000				

Results

The estimated excess lifetime risk is displayed in the **Summary Report** page.

Risk Estimates

Lifetime Risk of Developing Cancer of the Exposed Organs (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	95.9	181	328

* Risk from the time of exposure to the end of the expected lifetime

⊞ Excess Lifetime Risk per Cancer Site* with a 90% Uncertainty Range

Example Case 6 – Excess Future Risk from Multiple Exposures of a Single Organ

Estimate the excess future risk of developing thyroid cancer as a result of childhood exposure to radiation.

Gender – Female
Birth year – 1950
Exposure year – 1951, 1952, 1953, 1955, and 1957
Age at time of exposure – 1, 2, 3, 5, and 7 yrs
Exposure scenario – ingestion and inhalation of ^{131}I
Exposure Rate – chronic (i.e., dose was delivered in a matter of seconds)
Organ exposed – thyroid gland
Organ dose – See table below

Example doses (mGy) to the thyroid gland

Year of exposure (age)	Organ Dose (mGy)
1951 (age 1)	0.047
1952 (age 2)	12.0
1953 (age 3)	3.3
1955 (age 5)	4.9
1957 (age 7)	42.0

Step-by-Step Solution:

- On the calculator home page, click **Get Started**.
- On the main input page, set **Gender** to *Female* and **Birth Year** to *1950* and set **Organ Dose** to *mGy*.

For the exposure in 1951

- Set **Exposure Event** to *1*, because this is the first exposure.
- Key *1951* into the **Exposure Year** field.
- Select *Thyroid* from the **Organ** drop-down menu.
- Select *chronic* from the **Exposure Rate** drop-down menu.
- Select *Fixed Value* from the **Distribution Type** drop-down menu.
- Key *0.047* into the **Parameter 1** field to represent a dose of 0.047 mGy.

For the second exposure in 1952

- Click **Add Exposure Event** to insert another line of input information.
- Set **Exposure Event** to *2*, because this is the second exposure.
- Key *1952* into the **Exposure Year** field.
- Select *Thyroid* from the **Organ** drop-down menu.
- Select *chronic* from the **Exposure Rate** drop-down menu.
- Select *Fixed Value* from the **Distribution Type** drop-down menu.
- Key *12.0* into the **Parameter 1** field to represent a dose of 12.0 mGy.

Repeat the steps above by adding three additional lines of exposures (events 3, 4 and 5)

- Enter doses equal to *3.3*, *4.9*, and *42* mGy, for exposures in years *1953*, *1955*, and *1957*, respectively.

Demographic Information

Gender:	Female
Birth Year:	1950

Exposure Information

An exposure event may result in doses to one or more organs. All doses associated with the same event should be indicated by entering the same number in the "Exposure Event" column and the same year in the "Exposure Year" column. Refer to Guidance for Entering Exposure Information.

Each organ dose may be entered as a value with no related uncertainty by selecting "Fixed Value" from the Distribution Type menu and typing the value into the "Parameter 1" column. The organ dose may also be entered as an uncertain quantity by selecting one of the probability distributions from the Distribution Type menu. The corresponding distribution parameters should be entered into columns 1, 2, and/or 3.

No.	Exposure Event	Exposure Year	Organ	Exposure Rate	Organ Dose mGy — Distribution Type	Parameters 1,2,3		
1	1	1951	Thyroid	chronic	Fixed Value(value)	0.047	0	0
2	2	1952	Thyroid	chronic	Fixed Value(value)	12.0	0	0
3	3	1953	Thyroid	chronic	Fixed Value(value)	3.3	0	0
4	4	1955	Thyroid	chronic	Fixed Value(value)	4.9	0	0
5	5	1957	Thyroid	chronic	Fixed Value(value)	42.0	0	0

Add Exposure Event

Click **Generate Results**.

Results

The **Summary Report** page provides the excess lifetime risk, excess future risk, baseline future risk and total future risk (excess + baseline).

Risk Estimates

Lifetime Risk of Developing Thyroid Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	104	461	1230

* Risk from the time of exposure to the end of the expected lifetime

Future Risk of Developing Thyroid Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Future Risk**	33.8	149	394
Baseline Future Risk**	330	347	365
Total Future Risk**	384	496	730

** Risk from 2013 to the end of the expected lifetime

The excess lifetime risk is a representation of the chances of developing cancer from the time of exposure until the end of life. The future risk represents the chance of developing cancer from the present time until the end of the life, assuming no cancer has manifested to date. The baseline future risk is the risk expected in the absence of exposure to radiation. The excess future risk is the risk attributable to the exposure to radiation.

Please note that both lifetime and future risks are cumulated risks from the time of exposure until the end of expected lifetime (for lifetime risk; ELR) and from the present time until the end of expected lifetime (for future risks; EFLR), respectively. By definition, future risk calculations account for the exposed person being alive and cancer free at the "present time". The "present time" is defined as the last year when the studied person is known to have been alive and cancer free and can be any time after exposure. (see Setting Assumptions, Settings and Report Options below for instructions on changing the "present time" setting)

When "present time" is less than 11 years after the time of exposure, the future risk is slightly higher than the lifetime risk, because the loss of risk due to starting with this recent time is offset by the increase in the probability of survival until that time. During this period (< 11 years) the future risk is only slightly higher than the lifetime risk, and this difference gets smaller for younger ages at exposure. This pattern reverses when the "present time" is >= 11 years after the time of exposure, because, after that time, the reduction of risk due to fewer years at risk exceeds any increase due to the higher probability of survival.

This difference is small enough so one could state that, given the uncertainties in risk, the lifetime risk and future risk are basically equal when "present" time is less than 11 years after the exposure.

Setting Assumptions, Settings and Report Options

This example case has been prepared in 2013, and the online calculator, by default, uses the current year as the present time for the purpose of estimating the future risk. Thus, the future risks displayed above represent the risk from year 2013 until the end of life.

In many risk assessment situations, it is of interest to calculate risk from moments in time different that the present year. For example, one may be interested in calculating risk for workers from the time their plant has closed, several years ago, or the risk for a patient from the year of the last medical examination. To accommodate such situations, the calculator allows the user to change the setting of the current year.

To change the current year setting to 2000, use the following steps:

- From the **Summary Report** page, click the **Back** button of the browser or the **Information** link in the top left to return to the main data input page.
- Click on the link labeled:

  ⊞ Assumptions, Settings and Report Options
- Key *2000* into the **Current Year Setting** field.

⊟ **Assumptions, Settings and Report Options**

These settings allows the user to control two sampling parameters, sample size and the random seed for sampling.

Simulation Sample Size	300
Random Seed	99

The reported future lifetime risk represents the risk from the "Current Year" to the end of the expected lifetime. By default, the current year is determined automatically, based on computer settings. However, for the purpose of testing alternative scenarios, different years may be selected.

Current Year Setting	2000

Click **Generate Results**.

The **Summary Report** page now provides the future risk from year 2000 until the end of life.

Risk Estimates

Lifetime Risk of Developing Thyroid Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Lifetime Risk*	104	461	1230

* Risk from the time of exposure to the end of the expected lifetime

Future Risk of Developing Thyroid Cancer (chances in 100,000) with a 90% Uncertainty Range

	Lower Bound	Mean	Upper Bound
Excess Future Risk**	57.4	254	675
Baseline Future Risk**	568	592	617
Total Future Risk**	653	846	1253

** Risk from 2000 to the end of the expected lifetime