FDA-iRISK® 4.2

Training Exercises Manual

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Contents

About this Manual

This training manual accompanies the FDA-iRISK speaker presentation. This manual was designed to provide participants with “hands-on” practical activities to help them practice the new concepts and tasks presented. To receive the best learning experience, it is recommended that participants have attended the FDA-iRISK presentations.

About FDA-iRISK

FDA-iRISK is a web-based system designed to model data concerning microbial and chemical hazards in food and return an estimate of the resulting health burden on a population level.

The data required to execute this analysis include:

- The food and its associated consumption data and processing/preparation methods.
- The hazard and its dose-response model.
- The anticipated health effects of the hazard when ingested by humans.

Each of these elements contributes an essential piece of information to the scenario on which the final estimate of health burden is based.

FDA-iRISK supports the following risk (exposure) scenarios:

- Acute exposure from a microbial hazard in a single food
- Acute exposure from a chemical hazard in a single food
- Chronic exposure from a chemical hazard in a single food
- Chronic exposure from a chemical hazard in multiple foods

FDA-iRISK supports the following methods for inputting risk estimates:

- Computed scenarios - Generate risk estimates using a Monte Carlo simulation of model elements that are user-defined (e.g. contamination levels, dose-response models and process models).
- Specified risk scenarios - Uses existing risk estimates that are user provided. The structure of risk scenarios also differs between acute microbial hazards in a single food and chronic chemical hazards in a single food.

About the Training Exercises

The exercises in this manual illustrate FDA-iRISK features and give you an opportunity to work with the FDA-iRISK interface. Risk scenarios and data provided in the FDA-iRISK system are for illustration purposes only; they do not represent endorsements by FDA, JIFSAN, or RSI.

This manual includes exercises for the following types of risk scenarios:

- Exercise 1 - Computed risk scenarios for a chemical hazard
  - Scenario C1 - A single food-hazard pair involving an acute chemical hazard
  - Scenario C2 - A single food-hazard pair involving a chronic chemical hazard
  - Scenario C3 – A single *exposure-only* scenario on a food-hazard pair
  - Scenario C4 – An *exposure-only* multifood-hazard combination
- Exercise 2 - Computed risk scenarios for acute exposure to a microbial hazard
  - Scenario M1 - A single food-hazard pair in one population group
  - Scenario M2 - A single food-hazard pair in three population groups

For each scenario, you will define the elements of a risk scenario and then define the risk scenario, itself. The elements of a complete risk scenario are the following:

- Hazard
- Food
- Dose-response model
- Metric
- Consumption patterns in the population
- Population of consumers
- Process model (i.e., food production, processing, and handling practices)

Once you add the hazard, you will add the dose-response model that you expect will operate for the chosen hazard, along with the metric that reveals the burden of disease measures associated with health effects (e.g., losses in Disability Adjusted Life Years, or DALYs)

Once you add the food, you will define the consumption pattern associated with the food and the anticipated population group exposed to the food-hazard combination.

You will also create a process model comprised of the process stages that describe the effect each has on the hazard.

By the end of the exercises, you will have had the opportunity to practice creating several risk scenarios in FDA-iRISK as well as to generate the Risk Estimates and Scenario Ranking Report and review the results.

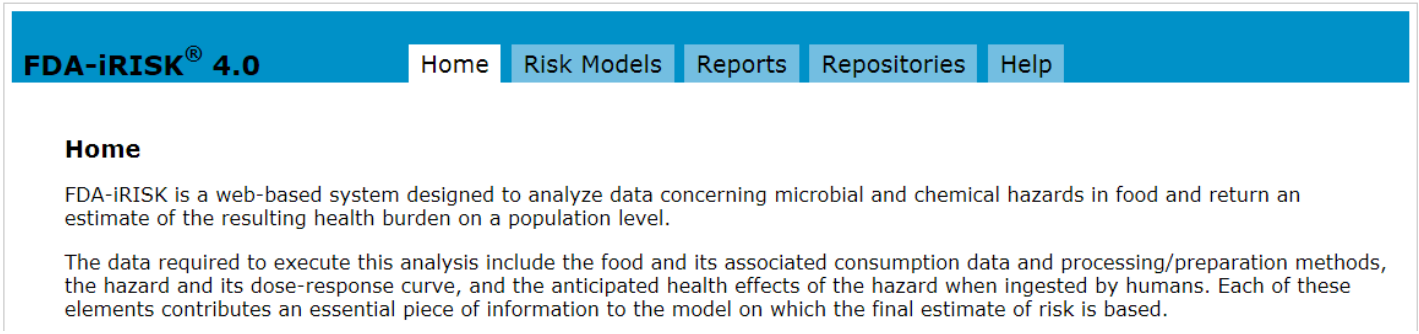
Note: Once you have defined a food and a hazard, FDA-iRISK is extremely flexible in terms of the

order in which you define the elements of a risk scenario. The sequence of the steps presented in this manual is just one way.

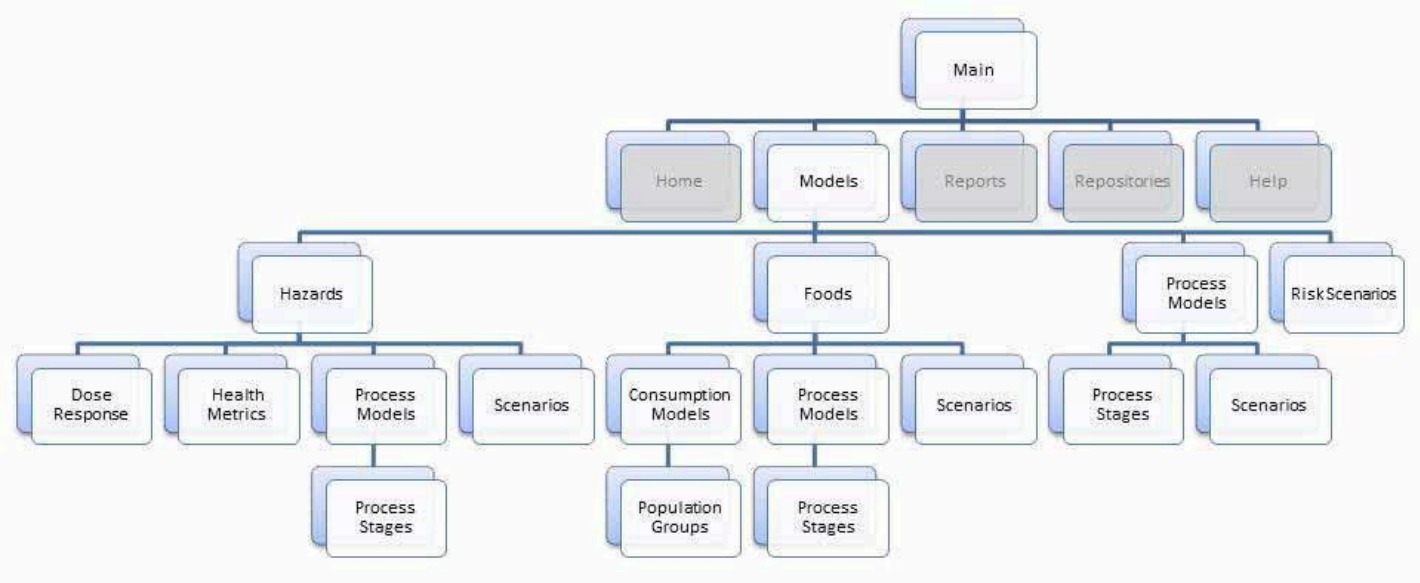
Accessing FDA-iRISK

To begin creating a risk scenario, you must have an FDA-iRISK account and be logged in.

Access the FDA-iRISK 4.0 Home page at https://irisk.foodrisk.org/, and register an account if necessary.



To help you navigate the software, the following figure illustrates the structure of the FDA-iRISK menus. You will primarily use the tabs under the Models tab on the main tab bar to complete the tasks required for the exercises in the manual:



In order to access the tabs below the Hazards, Foods, and Process Models tabs, you must add at least one hazard, food, and process model, respectively.

At any time during an exercise to develop a risk scenario, you can save the changes on the current page, exit FDA-iRISK and then resume working from where you left off at a later time.

EXERCISE 1

Risk Scenarios for Chemical Hazards

This exercise provides two computed risk scenarios for a chemical hazard.

- Scenario 1 - A single food-hazard pair involving an acute chemical hazard
- Scenario 2 - A single food-hazard pair involving a chronic chemical hazard

Scenario C1 - A Single Food-Hazard Pair Involving an Acute Chemical Hazard

You are creating a chemical risk scenario for an acute exposure to a chemical hazard, ammonia, occurring in frozen pizza as a result of a refrigerant leak. The pizza is consumed by a single population group of school children.

Complete the following tasks in your primary repository.

Task 1: Add the hazard, dose-response model, and a metric

Hazard

Add the hazard using the following specifications:

- **Name:** Ammonia
- **Type:** Chemical
- **Default Unit:** mg
- **Notes:**

  1. *Heading:* Description; *Text:* "Ammonia is a corrosive alkaline gas at room temperature, with an acrid odor that can be detected at concentrations of 35 mg per cubic meter of air (IPCS, 1990). It is used industrially and is also associated with normal biological activity, and typical levels range from less than 25 to 200 µg per cubic meter (IPCS, 1990). If exposure is brief, up to 100 mg per cubic meter is tolerated, but at higher exposures people experience irritation of the skin, eyes, and/or respiratory tract (IPCS, 1990)."
  2. *Heading:* References; *Text:* "International Programme on Chemical Safety (IPCS). 1990. Ammonia Health and Safety Guide. Available at: http://www.inchem.org/documents/hsg/hsg/hsg037.htm. Accessed Dec. 17, 2013."

(*Tip:* To navigate to the Hazards tab, click the Hazards link in the breadcrumb at the top of the page.)

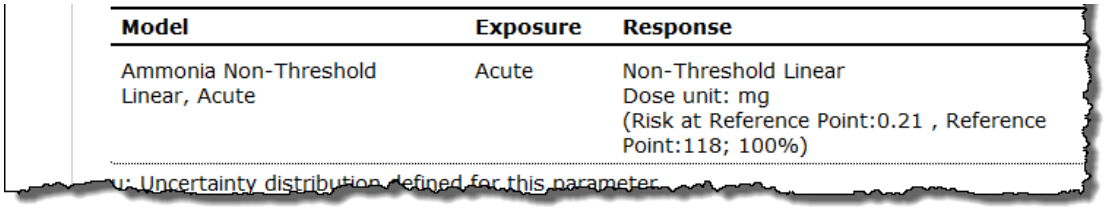
Dose-Response Model

Add the dose-response model using the following specifications:

- **Name:** Ammonia Non-Threshold Linear, Acute
- **Exposure Type:** Acute
- **Dose Units:** Mass (mg)
- **Response Type:** Non-Threshold Linear.
- **Risk at Reference Point:** 0.21
- **Reference Point:** 118 (mg)
- **Probability of Adverse Effect:** 100
- **Note:** *Heading:* Rationale
  Text: "Acute poisonings from ammonia by oral exposures are rare, and no dose-response model for this scenario was located in the literature. This dose-response model is based on an outbreak of ammonia poisoning from oral exposure reported by Dworkin et al., (2004). Assuming that each chicken tender weighed 30 g, and that the average level of ammonia measured in the food post-outbreak represents the average level at the time of exposure, the dose associated with various reported attack rates can be calculated. Subtracting the reported attack rate at zero exposure from the remaining attack rates gives an attack rate (risk at reference point) of 21% at an exposure (reference point) of 118 mg ammonia. This dose-response model also assumes that there is no threshold for effect.

  Dworkin MS, Patel A, Fennell ME, Vollmer M, Bailey S, et al. 2004. An Outbreak of Ammonia Poisoning from Chicken Tenders Served in a School Lunch. Journal of Food Protection® 67(6):1299-1232."

- When complete, the Dose Response list should display as:



Model	Exposure	Response
Ammonia Non-Threshold Linear, Acute	Acute	Non-Threshold Linear Dose unit: mg (Risk at Reference Point:0.21 , Reference Point:118; 100%)

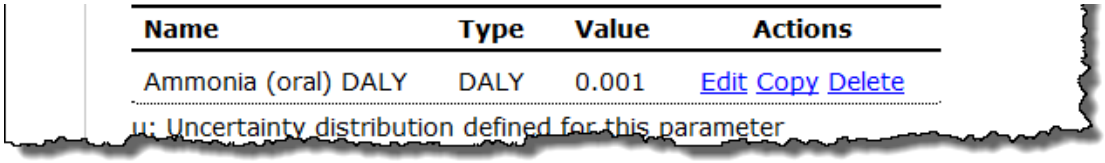
u: Uncertainty distribution defined for this parameter.

Metric

Add the metric using the following specifications:

- **Name:** Ammonia (oral) DALY
- **Type:** DALY
- **Value:** 0.001
- **Uncertainty:** none (do not click "Add")

When complete, the Metrics list on the Metrics tab should display as:



Name	Type	Value	Actions
Ammonia (oral) DALY	DALY	0.001	Edit Copy Delete

u: Uncertainty distribution defined for this parameter

Task 2: Add the food and its consumption pattern in the population group

Food

Add the food using the following specifications:

- **Name:** Frozen Pizza
- **Measured using:** Mass

Consumption Model

Add the consumption model using the following specifications:

- **Name:** Frozen Pizza Consumption by Children
- **Exposure Type:** Acute

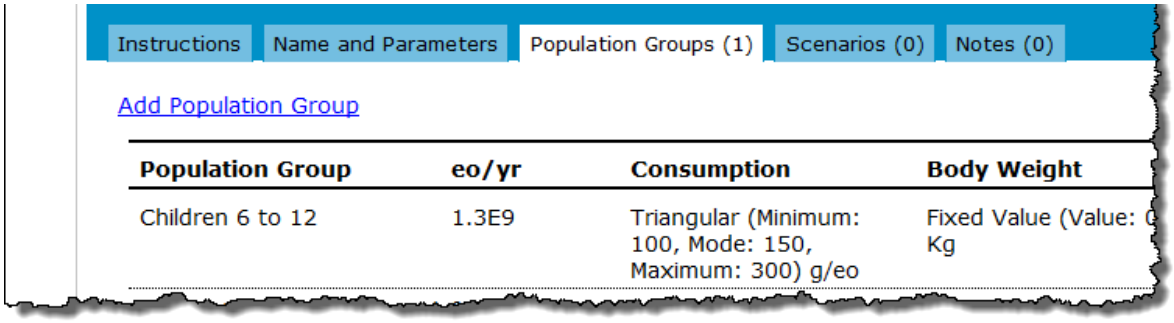
Click “Save”, and then define the Population Group.

Population Group

Add the population group using the following specifications:

- **Name:** Children 6 to 12
- **Eating Occasions per year:** 1.3E9
- **Amount Per Eating Occasion - Unit:** g
- **Amount Per Eating Occasion - Variability Distribution:** Triangular
- **Amount Per Eating Occasion - Minimum:** 100
- **Amount Per Eating Occasion - Mode:** 150
- **Amount Per Eating Occasion - Maximum:** 300
- **Body Weight:** Can be left at “0” for this scenario. Body weight is not required unless dose-response models are used that have doses expressed per kg body weight.

When complete, the Population Groups list should display on the Consumption Model page as:


Instructions
Name and Parameters
Population Groups (1)
Scenarios (0)
Notes (0)
Add Population Group
Population Group
eo/yr
Consumption
Body Weight
Children 6 to 12
1.3E9
Triangular (Minimum: 100, Mode: 150, Maximum: 300) g/eo
Fixed Value (Value:
Kg

Task 3: Add the process model

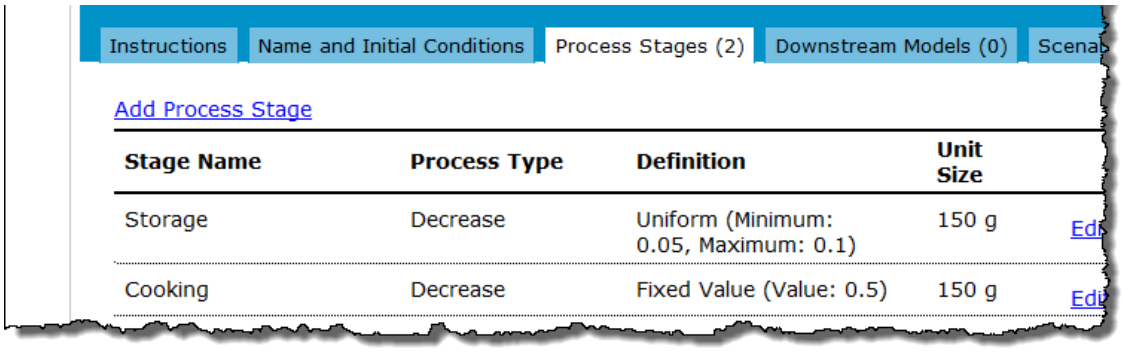
Now that you have created the hazard and food elements for the risk scenario, you need to create a process model. Add a process model using the following specifications:

- **Name:** Ammonia in Frozen Pizza
- **Hazard:** Ammonia
- **Food:** Frozen Pizza
- **Define Initial Conditions Using:** "Single Set of Parameters"
- **Initial Conditions:**
  This Process Model describes a situation in which a refrigerant line has ruptured, contaminating the product. Therefore, leave the Initial Units are Contaminated box checked. In this example, an accident of this type is assumed to be a one-in-a-million occurrence, so enter "1E-6" as the initial prevalence.
  The units are individual pizzas each weighing 150 g, so enter "150" as a Fixed Value and select "g" as the unit. Assume that the level of contamination is represented by a triangular distribution with minimum concentration being 0.7 mg/g, the mode being 1.3 mg/g, and the maximum concentration being 2 mg/g.

Add process stages to the process model using the following specifications:

Process Stage Name	Specifications
Storage	**Process Type:** Decrease **Variability Distribution:** Uniform **Minimum:** 0.05 **Maximum:** 0.1
Cooking	**Process Type:** Decrease **Variability Distribution:** Fixed Value **Value:** 0.5 (At this stage the concentration of the hazard decreases by 50%)

The Process Stages list on the Process Stages tab should display as:



Ensure that “Ammonia in Frozen Pizza” is listed in your Process Models list.

Task 4: Add the risk scenario

You have now defined all required elements for this risk scenario. Next, you will create the computed risk scenario for single hazard and single food called “Ammonia in Frozen Pizza in Children”.

The Type is “Computed using FDA-iRISK model for single hazard and single food”

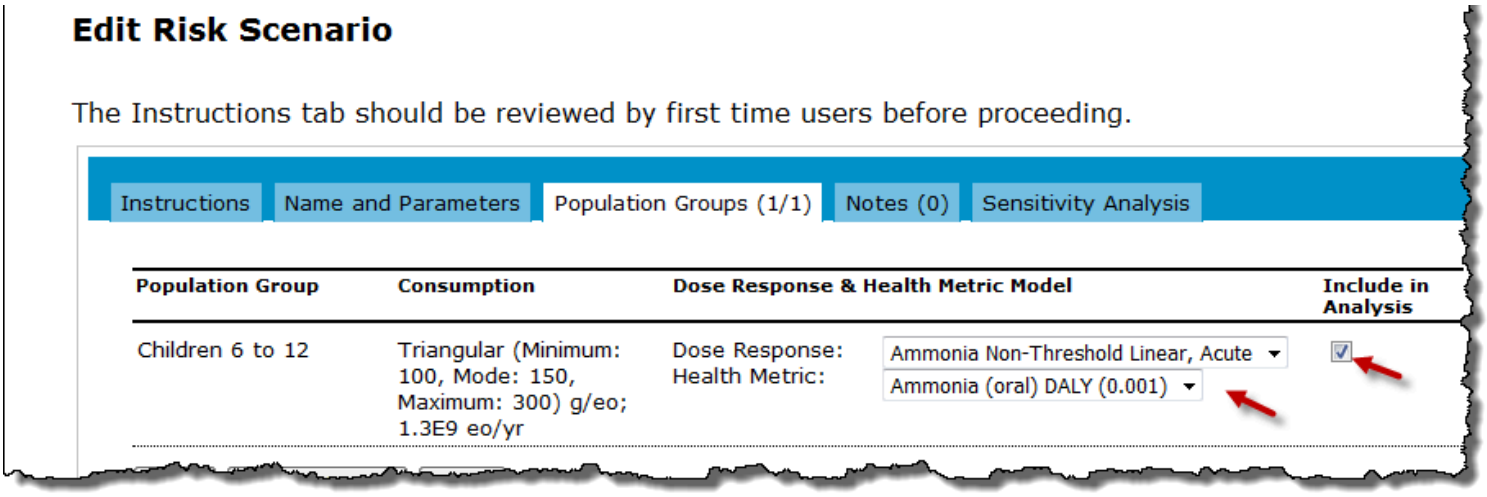
Leave the “Exposure only” box clear.

Process Model is Ammonia in Frozen Pizza.

Exposure Type is “Acute”, and Metric Type is “DALY”.

Consumption Model is Frozen Pizza Consumption by Children.

Once added, you will select the “Children 6 to 12” population group to include in the analysis. (This is required in order to create and generate the Risk Estimates and Scenario Ranking report.) Be sure to confirm that the correct Dose-Response model and Heath Metric are selected for the population group.



When complete, the Risk Scenarios list on the Risk Scenarios tab should display as:

Shared	Scenario	Validation	Actions
	Ammonia in Frozen Pizza in Children *(Frozen Pizza, Ammonia, DALY, Acute, Computed)*	Not Checked	Edit Copy Delete

Task 5: Create and generate the Risk Estimates and Scenario Ranking report

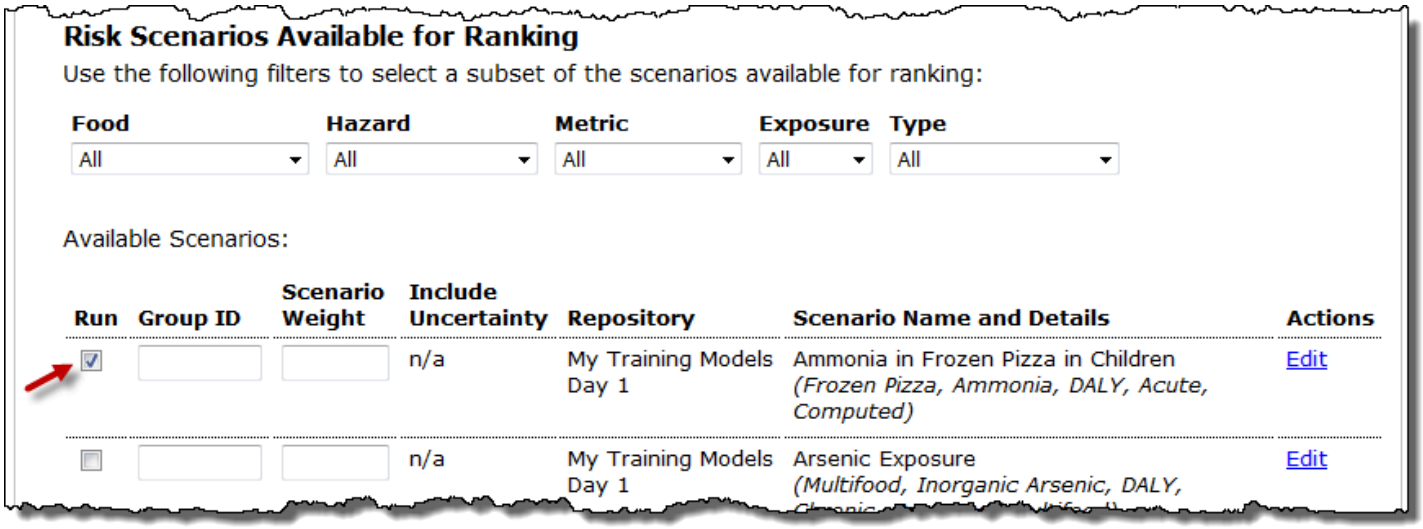
You will create a Risk Estimates and Scenario Ranking report called, “FDA-iRISK Scenario Report for

Ammonia in Frozen Pizza" for the risk scenario that you created in this activity.

Hint: Click the Reports tab on the main tab bar at the top of the page and choose to Create a "Risk Estimates and Scenario Ranking" Report Type.

Confirm the appropriate repository is checked in the "List scenarios for" field below the Report Abstract field.

Select the Run check box to the left of the desired scenario and then click "Generate Report for Checked".

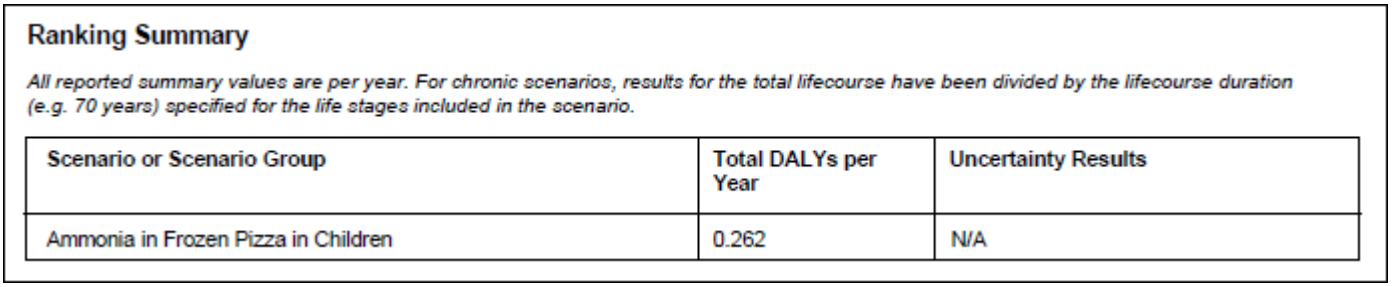


Task 6: Review the Risk Estimates and Scenario Ranking report

On the Report History tab of the Reports page, click the "Refresh Lists" button until your report disappears from the list of Pending Reports and appears in the list of Completed Reports.

Finally, view your detailed report in PDF format (check the "Details" and "Notes" boxes before clicking on "View PDF") and compare it with the results shown below.

The report's cover page includes the report title, the abstract (if provided), and the disclaimer. The summary of the rankings starts on the second page. In this case, there is only one scenario:



Ranking Summary for Risk Scenarios (Ungrouped)

All reported summary values are per year. For chronic scenarios, results for the total lifecourse have been divided by the lifecourse duration (e.g. 70 years) specified for the population groups included in the scenario.

Scenario	Lifecourse Duration	Eating Occasions or Consumers	Total Illnesses	Mean Risk of Illness	Total DALYs per Year	DALYs Per EO or Consumer	Total DALYs per Year (Weighted)
Ammonia in Frozen Pizza in Children	N/A	1.30E+9	262	2.02E-7	0.262	2.02E-10	0.262

Several results are provided in the summary sections. All are per year values unless the Annualize Chronic Results option was unselected.

- **Lifecourse Duration** Applies to chronic chemical hazard scenarios and is the total lifespan considered by the scenario (e.g. 70 years).
- **Eating Occasions or # Consumers** "Eating occasions**"** is used for acute hazards and is the total for all population groups provided. "# Consumers" applies to chronic chemical hazard scenarios.
- **Total Illnesses** The total number of illnesses generated for the scenario (annual).
- **Mean Risk of Illness** The mean risk of illness per eating occasion (total number of illnesses divided by the number of eating occasions (or consumers)).
- **Total DALYs per Year** As this is a DALY metric scenario, the total number of DALYs for the year.
- **DALYs per Eating Occasion or Consumer.** The DALYs divided by the number of eating occasions (or consumers).
- **Weighted DALYs** These may differ from Total DALYs per Year If a scenario weight was added.

Notice that multiplying the number of eating occasions by the burden per eating occasion gives the DALY value.

If you selected the Details check box on the Report History page, the next set of pages provides a scenario-by- scenario summary. The first section summarizes the scenario. It re-states the elements contained in the scenario, as well as indicating whether the Monte Carlo simulation converged or not. If the model converged, it reports the number of variability samples used.

Scenario Details for: Ammonia in Frozen Pizza in Children

Type:	Results Computed	Scenario Weight:	N/A
Hazard:	Ammonia (Chemical)	Metric Type:	DALY
Food:	Frozen Pizza	Exposure Type:	Acute
Process Model:	Ammonia in Frozen Pizza	Converged:	Yes (by 18000 variability samples)
Consumption Model:	Frozen Pizza Consumption by Children	Include Uncertainty:	No

The next section summarizes changes in concentration and prevalence as the food and hazard move through the process model.

Process Model: Ammonia in Frozen Pizza

	Initial Conditions	Model Outputs*
Prevalence:	1E-6	**1.00E-6**
Concentration:	Triangular (Units: mg/g) Minimum: 0.7 Mode: 1.3 Maximum: 2 Computed Mean: 1.33 mg/g	**0.000617 g/g**
Unit Mass:	Fixed Value (g) Value: 150	**150 g**

* Final prevalence and Prevalence-Weighted mean concentration

Process Stages for Ammonia in Frozen Pizza:

Process Stage	Process Type	Definition	Concentration (g/g)	Prevalence
Storage	Decrease	Uniform Minimum: 0.05 Maximum: 0.1	0.00123	1.00E-6
Cooking	Decrease	Fixed Value Value: 0.5	0.000617	1.00E-6

The initial values provided are repeated, and final values reported. As well, the concentration and prevalence are reported for the end of each process stage.

The next section summarizes the risk estimates generated for the population group as a result of the final concentration and prevalence, as well as serving size (amount consumed). A summary of the results is presented first, followed by the definitions and results for the population groups.

Result Summary

Mean Exposure: See population groups

Total Number of Illnesses: 262

Total DALY/Year: 0.262

Population Group Definitions:

Population Group	Consumption	Dose Response	Health Metric
Children 6 to 12 Body Weight: Fixed Value (Units: Kg) Value: 0	Eating Occasions: 1.3E9 eo/yr Per Eating Occasion: Triangular (Units: g/eo) Minimum: 100 Mode: 150 Maximum: 300	Ammonia Non-Threshold Linear, Acute Non-Threshold Linear (Dose unit: mg) Risk at Reference Point: 0.21 Reference Point: 118 Probability of adverse effect: 100%	Ammonia (oral) DALY (0.001 DALYs)

Correlation Option: No Correlation

Population Group Results:

Population Group	Mean Dose* (mg)	Mean** Prevalence in Servings	Mean Probability of Illness	Number of Illnesses per year	Total Metric Per Year (DALYs)
Children 6 to 12	0.0648	1.75E-6	2.02E-7	262	0.262

* Mean dose per Contaminated serving

** Proportion of contaminated servings

Health Metric Details: Ammonia (oral) DALY

DALY/Case: 0.001

If the scenario contained more than one population group, each would be summarized separately.

Finally, if you selected the Notes check box on the Report History page, any non-private notes associated with the scenario and its elements would be included at the end of the scenario's summary.

Scenario C2 - A Single Food-Hazard Pair Involving a Chronic Chemical Hazard

You are creating an FDA-iRISK scenario for chronic exposure to Aflatoxin B1 in corn tortilla chips. Most of the steps are similar to the previous scenario. However, this one includes 5 population groups differing in age and body weight, that collectively define the population exposed to this chronic hazard.

Complete the following tasks in your primary repository.

Task 1: Add the hazard, dose-response model, and a metric

Hazard

Add the hazard using the following specifications:

- **Name:** Aflatoxin B1
- **Type:** Chemical
- **Default Unit:** ng (nanogram)

When complete, ensure that Aflatoxin B1 is listed in the Hazards list on the Hazards tab.

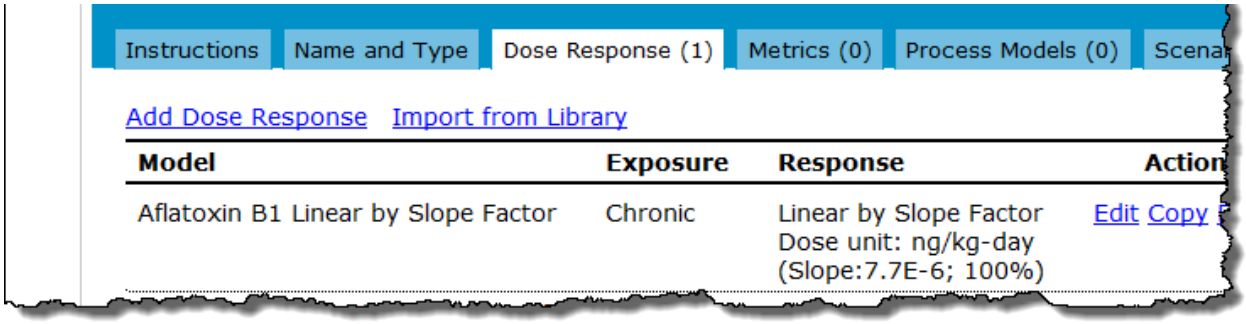
Dose-Response Model

The dose-response model describes the probability of developing liver cancer over a lifetime of exposure to Aflatoxin B1 in the food.

Add the dose-response model using the following specifications:

- **Name:** Aflatoxin B1 Linear by Slope Factor
- **Exposure Type:** Chronic
- **Confirm units for the dose:** mass/kg-day
- **Response Type:** Select "Linear by Slope Factor" as the response type.
- Enter a slope of "7.7E-6" and specify the dose units as "ng"/kg-day. The probability of adverse effect given response is kept as "100%".

When complete, the Dose Response list should display as:



Metric

Add the metric using the following specifications:

- **Name:** Liver Cancer
- **Type:** DALY
- **Value:** To determine the value, you will compute the metric representing liver cancer, rather than inputting it directly.

- **Uncertainty:** none (do not click “Add”)

(Hint: Click the Compute from Health Endpoints link.)
The health end-points associated with liver cancer are fatal liver cancer (being the disability or “morbidity” associated with a case that becomes fatal), non-fatal liver cancer, and the fatality itself.

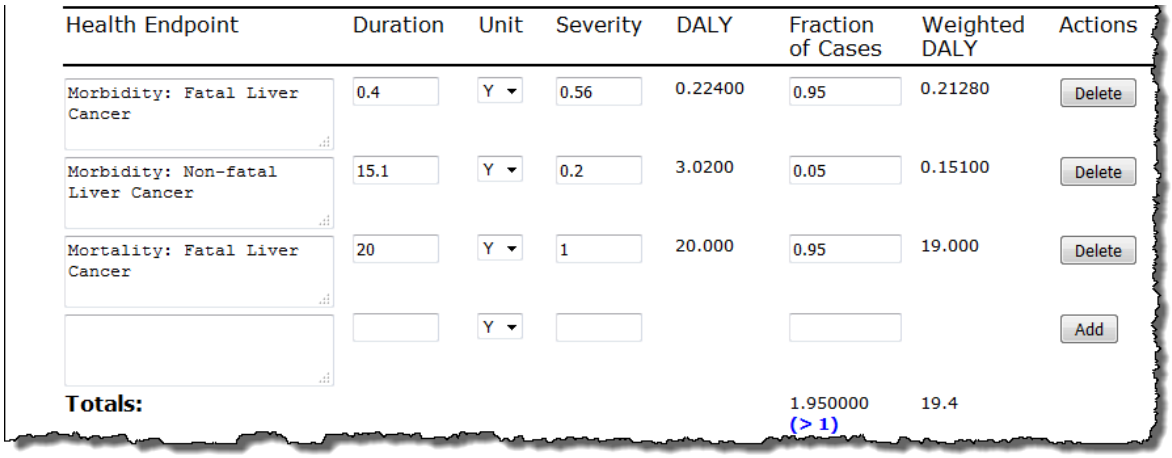
Add the following specifications to calculate the health endpoints:

(Hint: Click “Add” after defining each)

Health Endpoint Name	Duration	Unit	Severity	Fraction of Cases
Morbidity: Fatal Liver Cancer	0.4	Y (Years)	0.56	0.95
Morbidity: Non-fatal Liver Cancer	15.1	Y (Years)	0.2	0.05
Mortality: Fatal Liver Cancer[a]	20	Y (Years)	1	0.95

a. The life expectancy associated with different ages can be obtained from life tables. The median age at death from liver cancer is 62 years, so the duration of the fatality is considered to be 20 years (life expectancy at age 62). The severity weight assigned to death is 1. Fatal cases are assumed to comprise 95% of all liver cancer cases.

When complete, the computed DALY should display as:



Health Endpoint	Duration	Unit	Severity	DALY	Fraction of Cases	Weighted DALY	Actions
Morbidity: Fatal Liver Cancer	0.4	Y	0.56	0.22400	0.95	0.21280	Delete
Morbidity: Non-fatal Liver Cancer	15.1	Y	0.2	3.0200	0.05	0.15100	Delete
Mortality: Fatal Liver Cancer	20	Y	1	20.000	0.95	19.000	Delete
		Y					Add
Totals:					1.950000 (> 1)	19.4	

FDA-iRISK alerts you whenever the fraction of cases adds up to a value other than 1. Values less than 1 imply that health endpoints are being ignored. In this case, the value greater than 1 reflects the fact that some cases experience more than one health endpoint sequentially.

Ensure that Liver Cancer is listed under the Metrics tab for the hazard Aflatoxin B1.

FDA-iRISK assigns this metric to each case of illness predicted.

Task 2: Add the food and its consumption pattern in the population group

Food

Add the food using the following specifications:

- **Name:** Tortilla Chips
- **Measured using:** Mass

Consumption Model

Add the consumption model using the following specifications:

- **Name:** Tortilla Chip Consumption
- **Exposure Type:** Chronic
- **Annual Consumers:** 25E6 (i.e. 25 million)
- **Uncertainty:** none (do not click “Add”)

Life Stages

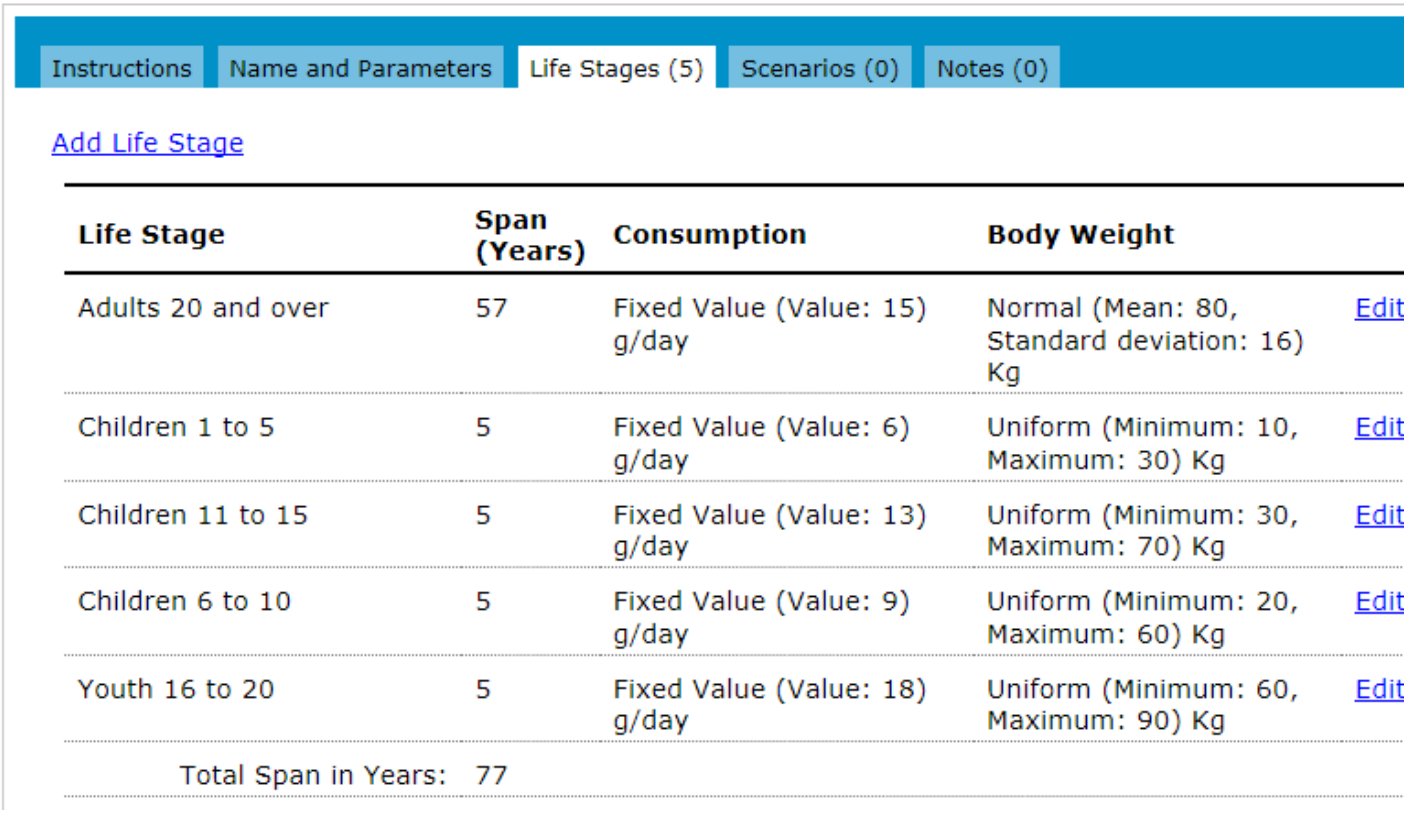
Because this is a chronic exposure scenario and the dose is calculated as a fraction of body weight, it is advisable to specify a consumption model for different ages. This allows FDA-iRISK to calculate a weighted average daily dose over the lifetime (the Lifetime Average Daily Dose or LADD) that takes into account potentially higher “per kg” doses during childhood.

Define each Life Stage individually in terms of the body weight and average daily consumption of tortilla chips.

Add the following Life Stages:

Population Group Name	Span in Years	Avg Daily Consumption	Body Weight
Children 1 to 5	5	Fixed Value of 6 grams per day	Uniform distribution ranging from 10 to 30 kg
Children 6 to 10	5	Fixed Value of 9 grams per day	Uniform distribution ranging from 20 to 60 kg
Children 11 to 15	5	Fixed Value of 13 grams per day	Uniform distribution ranging from 30 to 70 kg
Youth 16 to 20	5	Fixed Value of 18 grams per day	Uniform distribution ranging from 60 to 90 kg
Adults 20 and over	57	Fixed Value of 15 grams per day	Normal distribution mean: 80; SD:16 kg

When complete, the Life Stages list should display as:



Instructions | Name and Parameters | Life Stages (5) | Scenarios (0) | Notes (0)

Add Life Stage

Life Stage	Span (Years)	Consumption	Body Weight	
Adults 20 and over	57	Fixed Value (Value: 15) g/day	Normal (Mean: 80, Standard deviation: 16) Kg	Edit
Children 1 to 5	5	Fixed Value (Value: 6) g/day	Uniform (Minimum: 10, Maximum: 30) Kg	Edit
Children 11 to 15	5	Fixed Value (Value: 13) g/day	Uniform (Minimum: 30, Maximum: 70) Kg	Edit
Children 6 to 10	5	Fixed Value (Value: 9) g/day	Uniform (Minimum: 20, Maximum: 60) Kg	Edit
Youth 16 to 20	5	Fixed Value (Value: 18) g/day	Uniform (Minimum: 60, Maximum: 90) Kg	Edit
Total Span in Years:	77			

Task 3: Add the process model

Add a process model using the following specifications:

- **Name:** Aflatoxin B1 in Tortilla Chips
- **Hazard:** Aflatoxin B1
- **Food:** Tortilla Chips
- **Define Initial Conditions Using:** “Single Set of Parameters”
- **Initial Conditions:** Assume that the tortilla chips have already been contaminated and that the level and prevalence are known. The mass of each package of tortilla chips is 270 g. The prevalence is defined as 0.01 and the level (in contaminated units) is defined as a normal distribution having a mean of 150 µg/kg and a standard deviation of 30 µg/kg. (ng/g is equivalent to µg/kg)

No more stages are required as the chips are ready to be consumed.

Task 4: Add the risk scenario

You have now defined all required elements for this risk scenario.

Next, you will create the computed risk scenario for single hazard and single food called “Aflatoxin B1 in Tortilla Chips”.

The Type is “Computed using FDA-iRISK model for single hazard and single food”

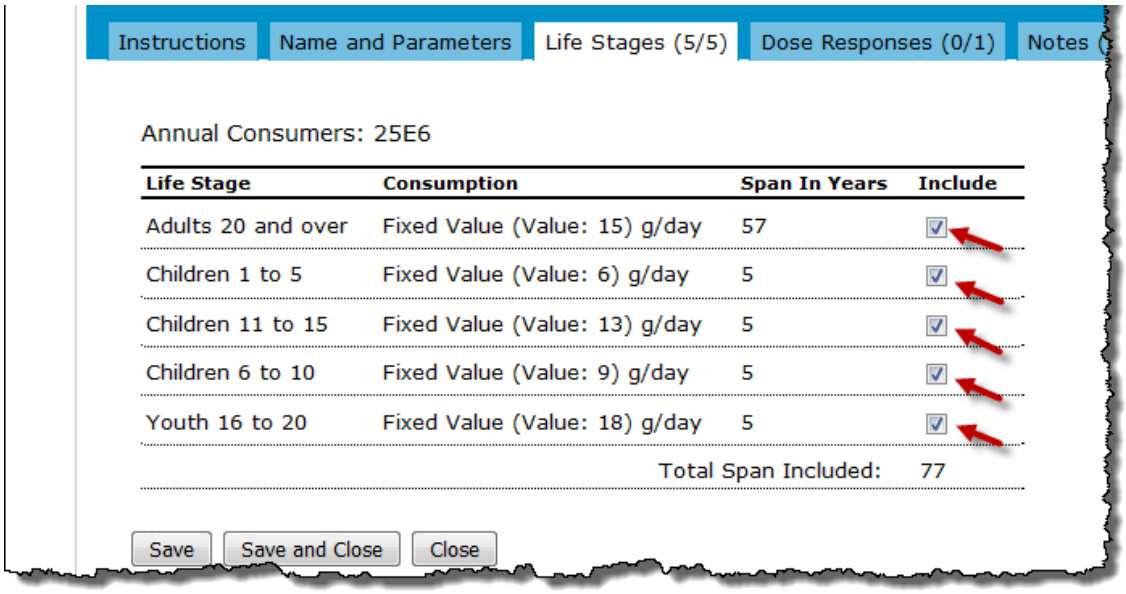
Leave the “Exposure only” box clear.

Process model should be “Aflatoxin B1 in Tortilla Chips”

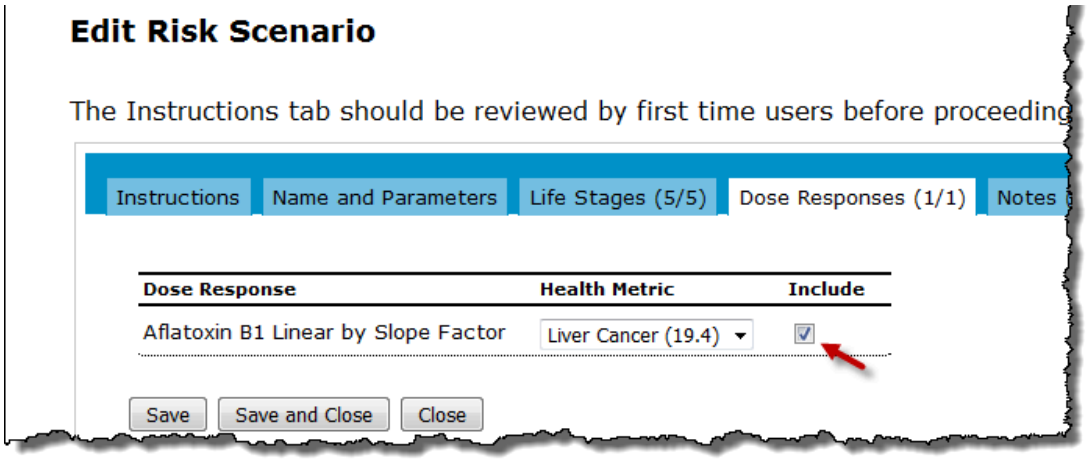
Choose a “Chronic” Exposure Type, and “DALY” Metric Type.

Hint: Computed risk scenarios must be linked to the food, hazard, dose-response, metric, consumption model, and process model.

After adding the scenario, you will select the Life Stages to include in the analysis.



Finally, you will select the “Aflatoxin B1 Linear by Slope Factor” dose-response model to include and the associated metric to use for the dose-response model (from the drop-down menu).



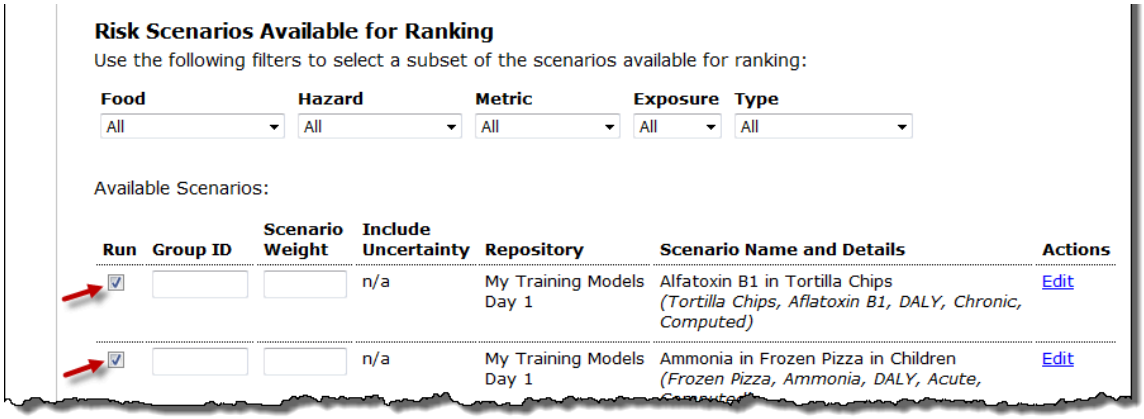
Task 5: Create and generate the Risk Estimates and Scenario Ranking report

You will create a Risk Estimates and Scenario Ranking report called, “Ranking Report for Ammonia and Aflatoxin B1” for both risk scenarios that you created in this activity.

Click the Reports tab on the main tab bar at the top of the page and choose to Create a “Risk Estimates and Scenario Ranking” Report Type.

Confirm the appropriate repository is checked in the “List scenarios for” field below the Report Abstract field.

Select the Run check box to the left of both scenarios and then click “Generate Report for Checked”.



Task 6: Review the Risk Estimates and Scenario Ranking report

On the Report History tab of the Reports page, click the “Refresh Lists” button until your report disappears from the list of Pending Reports and appears in the list of Completed Reports.

Finally, view your detailed report in PDF format (check the “Details” and “Notes” boxes before clicking on “View PDF”) and compare it with the results shown below.

Ranking Summary

All reported summary values are per year. For chronic scenarios, results for the total lifecourse have been divided by the lifecourse duration (e.g. 70 years) specified for the life stages included in the scenario.

Scenario or Scenario Group	Total DALYs per Year	Uncertainty Results
Alfatoxin B1 in Tortilla Chips	15.7	N/A
Ammonia in Frozen Pizza in Children	0.262	N/A

Note: All chronic results have been computed by dividing the total for the lifecourse by the duration of the lifecourse in years to provide a yearly value for ranking. See the detailed results sections for the complete lifecourse results, or multiply the values shown in this summary by the duration of the lifecourse.

Ranking Summary for Risk Scenarios (Ungrouped)

All reported summary values are per year. For chronic scenarios, results for the total lifecourse have been divided by the lifecourse duration (e.g. 70 years) specified for the population groups included in the scenario.

Scenario	Lifecourse Duration	Eating Occasions or Consumers	Total Illnesses	Mean Risk of Illness	Total DALYs per Year	DALYs Per EO or Consumer	Total DALYs per Year (Weighted)
Alfatoxin B1 in Tortilla Chips	77	2.50E+7	0.811	3.25E-8	15.7	6.30E-7	15.7
Ammonia in Frozen Pizza in Children	N/A	1.30E+9	262	2.02E-7	0.262	2.02E-10	0.262

Note: All chronic results have been computed by dividing the total for the lifecourse by the duration of the lifecourse in years to provide a yearly value for ranking. See the detailed results sections for the complete lifecourse results, or multiply the values shown in this summary by the duration of the lifecourse.

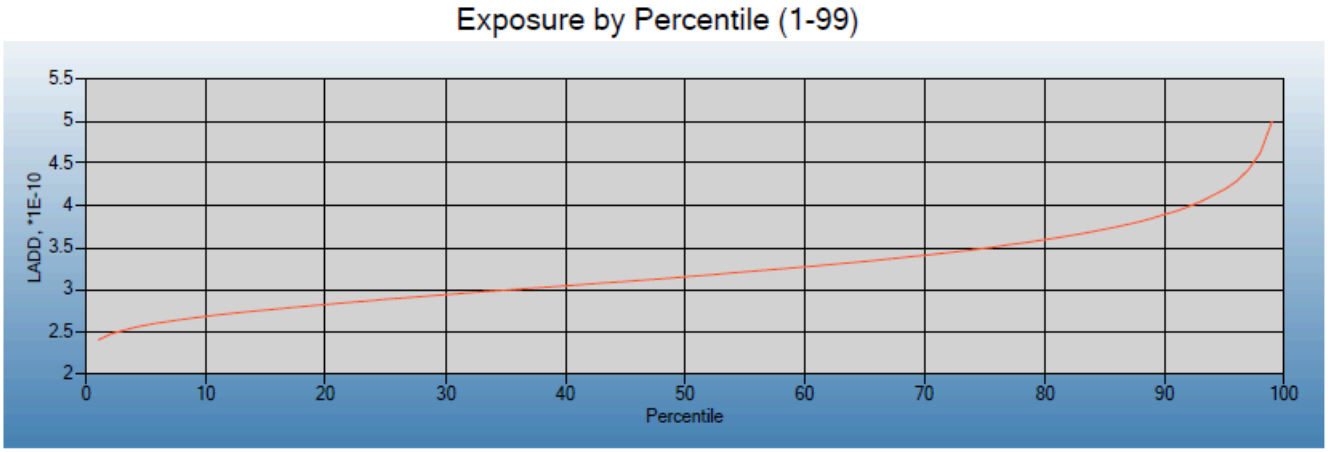
For the chronic exposure to Aflatoxin B1 scenario, the lifecourse duration provides the length of exposure in years, and the number of consumers exposed is shown next to it. The predicted values for total illnesses, mean risk of illness (per consumer), and burden in DALYs are all given on an annualized basis, by dividing the model results (for chronic exposures) by the value for lifecourse duration.

The value for total illnesses can be obtained by multiplying the number of consumers by the mean risk of illness per consumer, while the burden per consumer is obtained by dividing the annual DALY value by the number of consumers.

You may also create a report by choosing to unselect the “Annualize Chronic Results” check box on the Risk Estimate and Scenario Ranking page. The generated report includes lifetime risk estimates,

for example, total illnesses and total DALYs in a lifetime.

Exposure for the chronic scenario is provided in a chart and table in the details section for the Aflatoxin B1 scenario:



Exposure for Aflatoxin B1 (g/kg-day):					
Median:	3.16E-10	**95th:**	4.19E-10	**99th:**	5.00E-10

Scenario C3 - A Chronic Exposure, Single Food-Hazard Pair, Exposure-Only Scenario

You are creating a chemical exposure scenario for a chronic exposure to a chemical hazard, cadmium, occurring in fluid milk.

Complete the following tasks in your primary repository.

Task 1: Add the hazard

Hazard

Add the hazard using the following specifications:

- **Name:** Cadmium
- **Type:** Chemical
- **Default Unit:** mg
- **Notes:** can be omitted for now

When complete, the Hazards list on the Hazards tab should include Cadmium.

Note that for an "exposure-only" scenario, no dose-response model, nor health effect, needs to be defined.

However, a consumption model will need to be defined for the food, as the consumption pattern determines the exposure in combination with the process model predicting the extent of contamination at consumption.

Task 2: Add the food and its consumption pattern in the population group

Food

Add the food using the following specifications:

- **Name:** Milk
- **Measured using:** Mass

When complete, the Foods list on the Foods tab should include Milk.

Consumption Model

Add the consumption model using the following specifications:

- **Name:** Lifetime Average Fluid Milk Consumption
- **Exposure Type:** Chronic

- **Number of Consumers:** 3.15E8

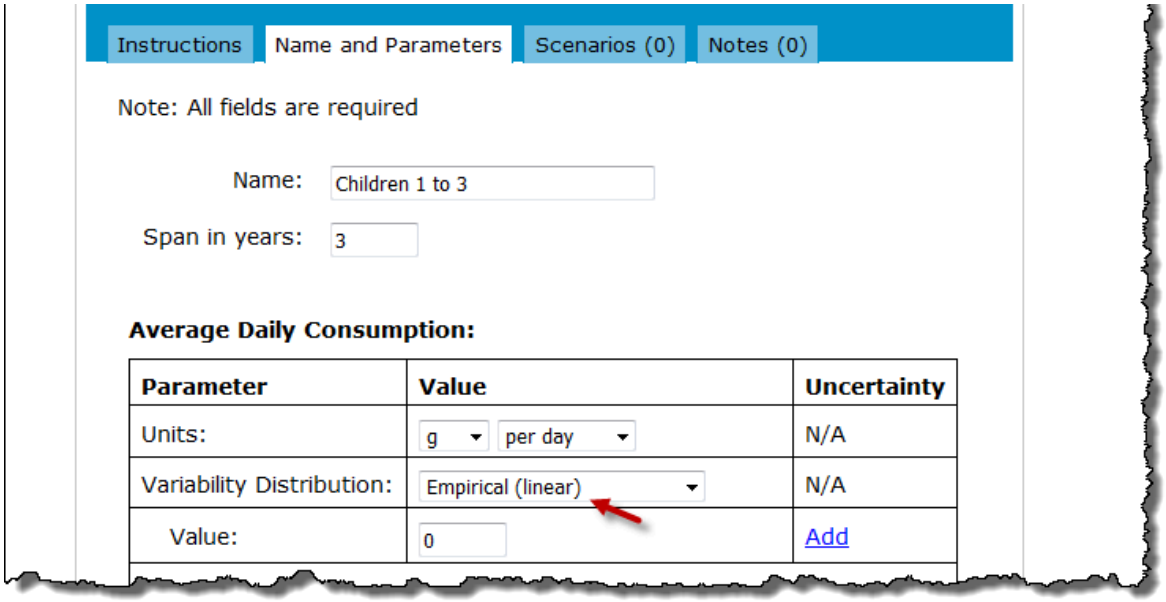
Click “Save”, and then define the Life Stages.

Life Stages

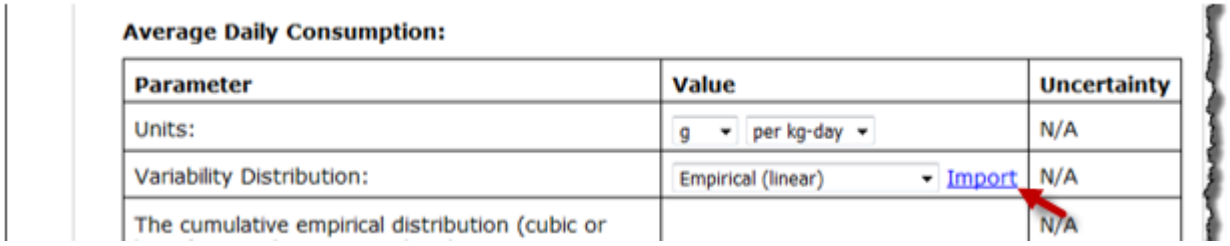
Add the population group using the following specifications:

Life Stage	Span in years	Consumption Units	Fluid Milk Consumption (probability, g/kg-day)
Children 1 to 3	3	g / kg-day	0, 0 0.25, 13.7618 0.5, 22.1476 0.75, 32.0454 1, 74.833
Children 4 to 13	10	g / kg-day	0, 0 0.25, 1.2133 0.5, 3.3375 0.75, 6.326 1, 21.7323
Persons 14 and up	64	g / kg-day	0, 0 0.25, 0.1085 0.5, 0.505 0.75, 1.5874 1, 9.2808

Within each life stage definition, select “Empirical (linear) as the Variability Distribution.



Click “Import” to import consumption percentile amounts from an external file which will be provided to you in Excel format.

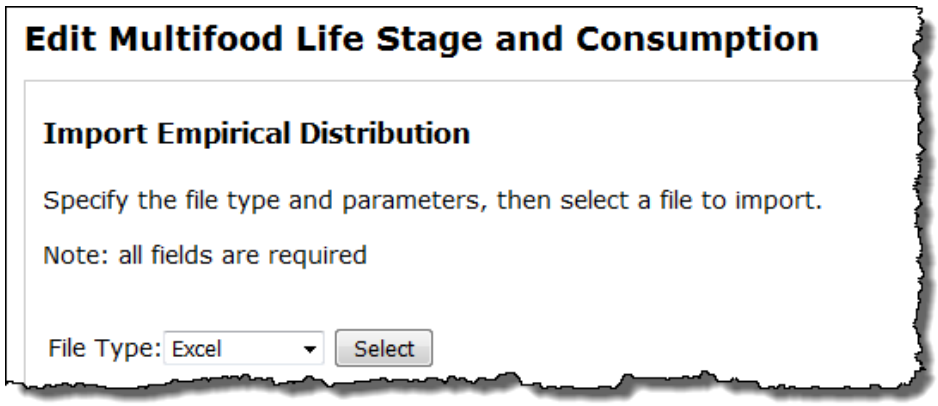


Note: Importing Consumption Data Files

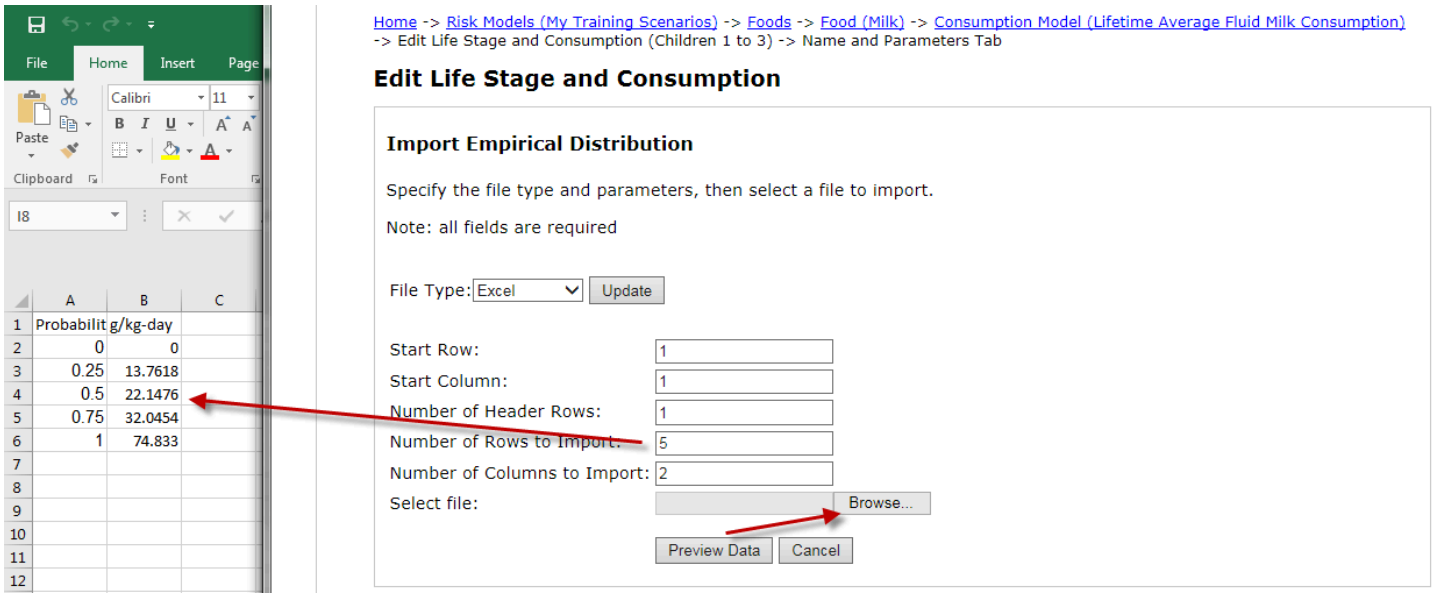
A user can create a separate file to hold the data and import into the model directly from the file. Use a text, csv or Excel file to hold the data.

This has been done with these consumption data and the files are available from your instructors.

When defining each life stage, select Empirical (linear) as the distribution of Average Daily Consumption. Next click “Import” to import data from an external file, and select Excel as the type.

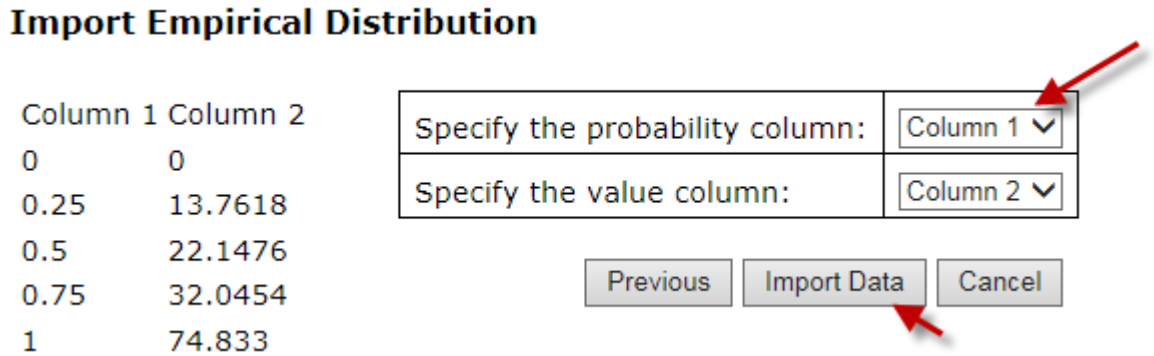


In the Import page, enter the required values by consulting your data file; note that the header row is not included in the count of rows to import. Click “Browse”.



Browse through your Documents Library and select the appropriate file.

Then click “Preview Data” to view the data about to be imported. Verify the column of the probability values and the amount consumed values, and click “Import Data”.



The Table will automatically be filled in, and the data can be viewed as a list or a table.

Average Daily Consumption:

Parameter	Value
Units:	g ▾ per kg-day ▾
Variability Distribution:	Empirical (linear) ▾ Import
The cumulative empirical distribution (cubic or linear) is used to enter a distribution using cumulative probability/value pairs. It may be entered as a table (default) or in a textbox. When entered as a table, insert, delete or add rows as required. When entered in a textbox, each pair must be on a separate line and the format must be "cumulative probability,value" (e.g. 0.1, -3). Cumulative probabilities should be expressed as a number between 0 and 1. The first row must have a cumulative probability of 0 (minimum of the distribution). The last row must have a cumulative probability of 1 (maximum of the distribution).	Enter as Table ▾

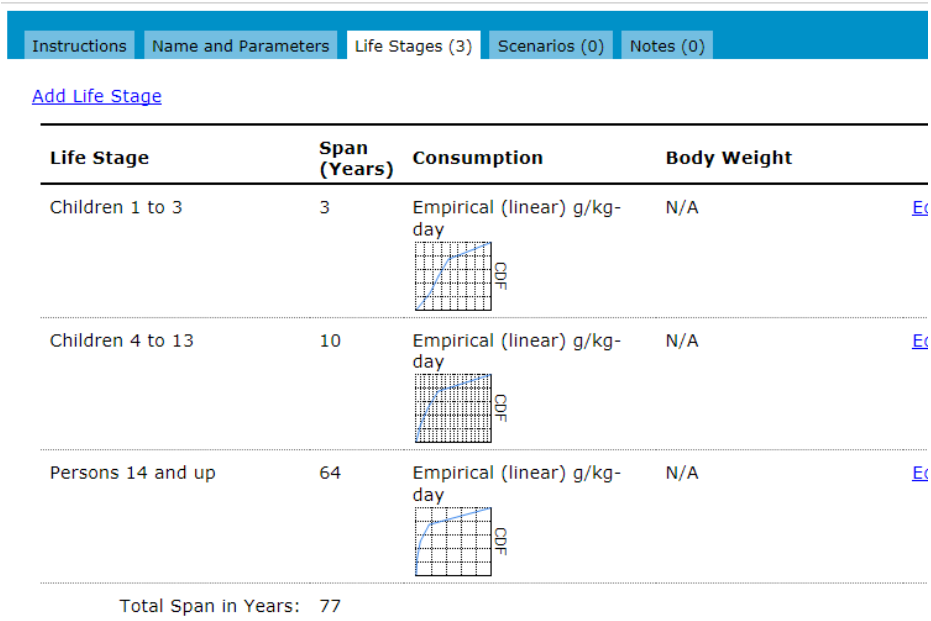
Probability	Value	Actions
0	0	Insert Delete
0.25	13.7618	Insert Delete
0.5	22.1476	Insert Delete
0.75	32.0454	Insert Delete
1	74.833	Insert Delete
Number of Rows to Add: 10 Add		

While normally the lifetime consumption data might be more finely-resolved (e.g. life stages spanning 5 years), this pattern has been simplified due to time considerations.

Make sure to specify the Units as g per kg-day.

Note that body weight is not required when the consumption amount is provided per kg body weight.

When finished, the Chronic Consumption Model should display as below:



Task 3: Add the process model

Now that you have created the hazard and food elements for the risk scenario, you need to create a process model. Add a process model using the following specifications:

- **Name:** Cadmium in Fluid Milk
- **Hazard:** Cadmium
- **Food:** Milk
- **Define Initial Conditions Using:** “Single Set of Parameters”
- **Prevalence:** 1
- **Unit Mass:** 250 g
- **Initial Concentration Units:** mg/kg
- **Initial Concentration Distribution:** Empirical (linear): 0,0.001; 0.97, 0.001; 1, 0.004

Initial Concentration:

Parameter	Value	Uncertainty
Units:	mg / kg Update	N/A
Variability Distribution:	Empirical (linear) Import	N/A
The cumulative empirical distribution (cubic or linear) is used to enter a distribution using cumulative probability/value pairs. It may be entered as a table (default) or in a textbox. When entered as a table, insert, delete or add rows as required. When entered in a textbox, each pair must be on a separate line and the format must be "cumulative probability,value" (e.g. 0.1, -3). Cumulative probabilities should be expressed as	Enter as Table	N/A

Probability	Value	Actions
0	0.001	Insert Delete
0.97	0.001	Insert Delete
1	0.004	Insert Delete

Number of Rows to Add: 10 Add

Note: The Unit Mass defined is irrelevant for a chemical scenario with a prevalence of 1. This is because the chemical hazard is assumed to be distributed homogeneously throughout the food, and so there is no way that portioning or aggregating units of food to achieve the consumed amount can affect exposure.

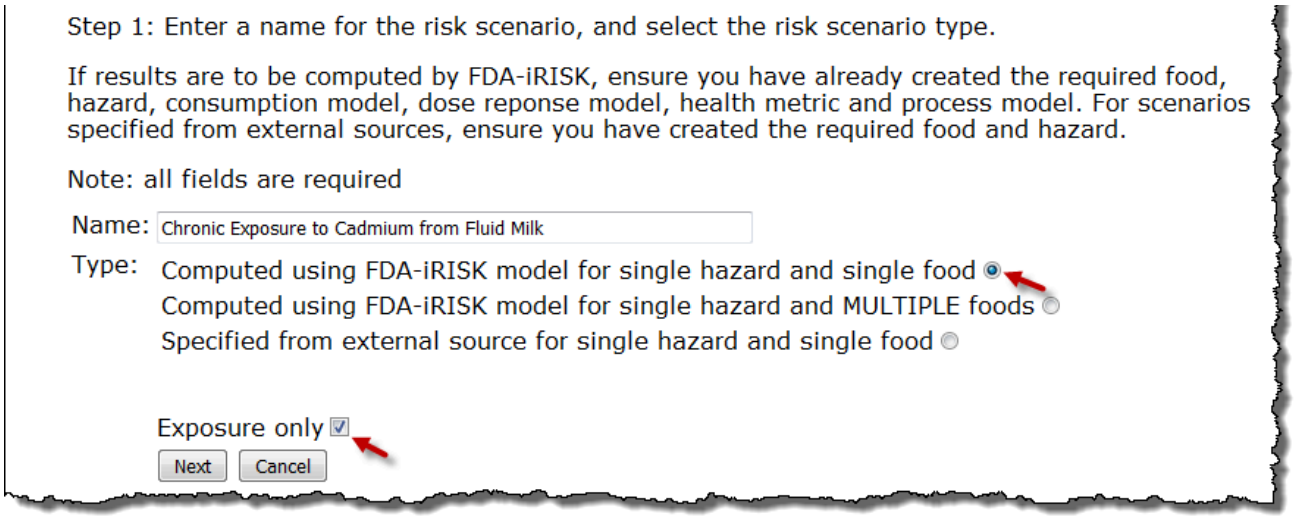
Click Save and Close.

Task 4: Add the risk scenario

You have now defined all required elements for this exposure-only risk scenario. Next, you will create the computed risk scenario for single hazard and single food called “Cadmium in Fluid Milk, Exposure Only”.

The Type is “Computed using FDA-iRISK model for single hazard and single food”

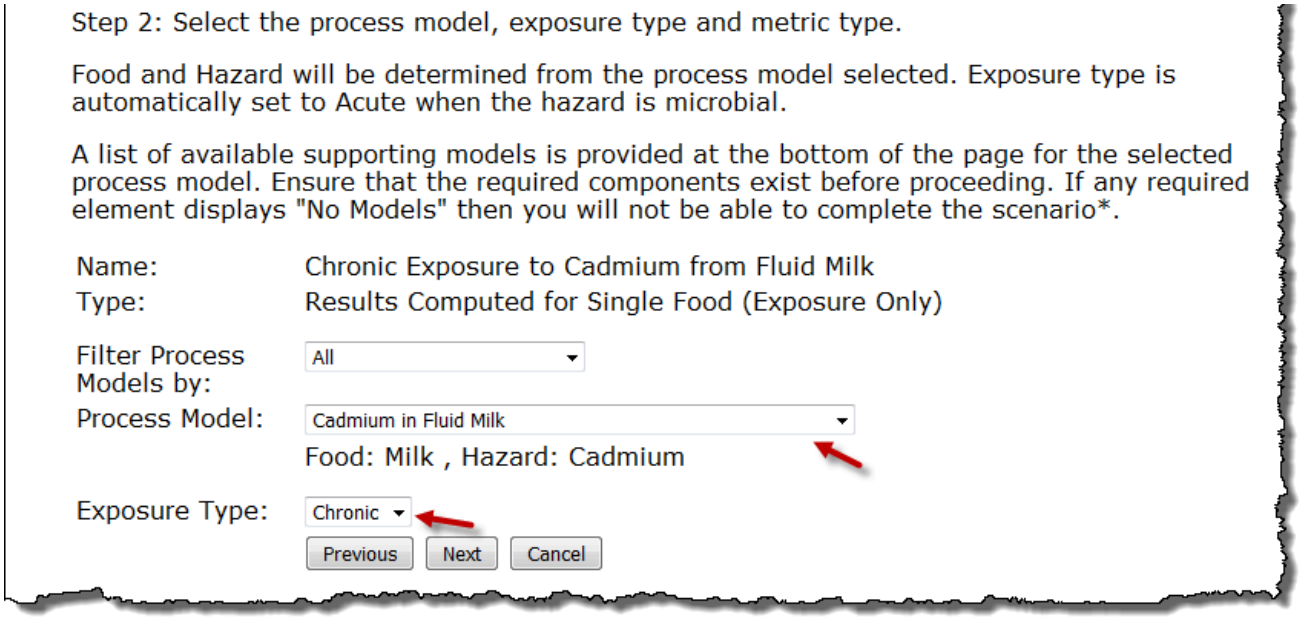
Check the “Exposure only” box.

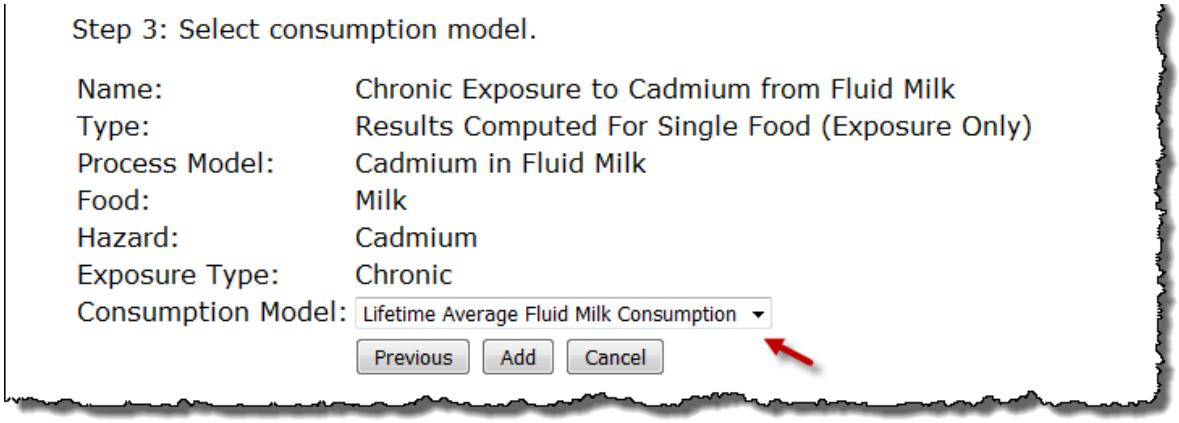


Select the appropriate process model, and choose a “Chronic” Exposure Type.

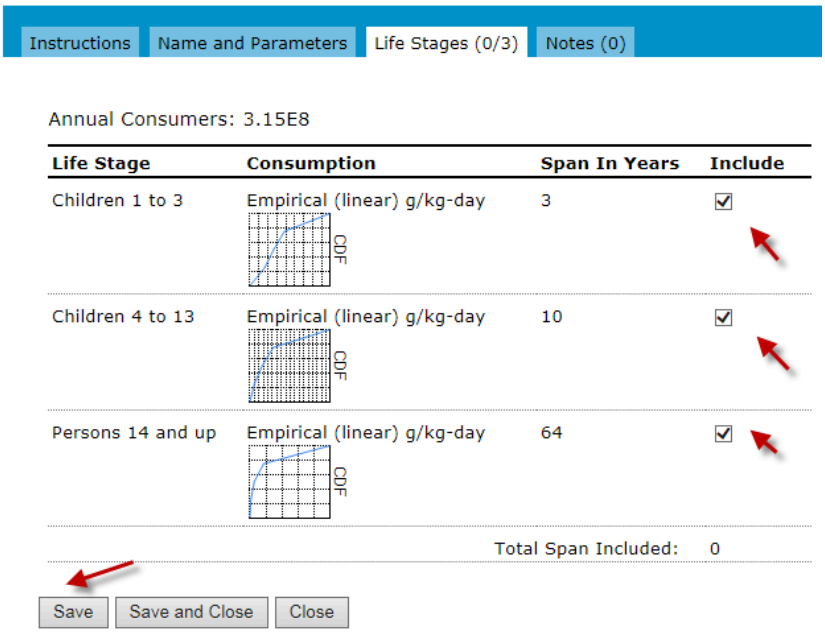
Select the appropriate consumption model, and the life stages defined for the consumption model.

Note that no Dose-Response models or Metrics need to be specified in an exposure-only scenario.





Next select the desired life stages



Task 5: Create and generate the Risk Estimates and Scenario Ranking report

You will create a Risk Estimates and Scenario Ranking report called, “Chronic Exposure to Cadmium from Fluid Milk”.

Click the Reports tab on the main tab bar at the top of the page and choose to Create a “Risk Estimates and Scenario Ranking” Report Type.

Confirm the appropriate repository is checked in the “List scenarios for” field below the Report Abstract field.

Select the Run check box to the left of the scenario and then click “Generate Report for Checked”.

Task 6: Review the Risk Estimates and Scenario Ranking report

On the Report History tab of the Reports page, click the “Refresh Lists” button until your report disappears from the list of Pending Reports and appears in the list of Completed Reports.

Finally, view your detailed report in PDF format (check the “Details” and “Notes” boxes before clicking on “View PDF”) and compare it with the results shown below.

Report Title: Chronic Exposure to Cadmium from Fluid Milk

Scenario Details for: Cadmium in Fluid Milk, Exposure Only

Type:	Results Computed (Exposure Only)	Scenario Weight:	N/A
Hazard:	Cadmium (Chemical)	Metric Type:	N/A
Food:	Milk	Exposure Type:	Chronic (Exposure Only)
Process Model:	Cadmium in Fluid Milk	Converged:	Yes (by 18000 variability samples)
Consumption Model:	Lifetime Average Fluid Milk Consumption	Include Uncertainty:	No

The Scenario Details section indicates that the simulation converged successfully (i.e. reached a stable result) within 18,000 iterations.

Process Model: Cadmium in Fluid Milk

	Initial Conditions	Model Outputs*
Prevalence:	1	**1.000**
Concentration:	Empirical (linear) (Units: mg/kg)	**1.04E-9 g/g**
	((0,0.001), (0.97,0.001), (1,0.004))	

The Process Model section reproduces the concentration data, and displays the overall mean concentration calculated over the simulation, in this case 1.04E-9 g/g.

In the Result Summary section, the mean exposure among consumers is given as 3.38E-9 g cadmium from milk, per kg of body weight, each day.

Result Summary

Mean Exposure: 3.30E-9 g/kg-day **Total Number of Illnesses:** N/A

Scenario C4 - A Chronic Exposure, Multi-food-Hazard Pair, Exposure-Only Scenario

You are creating a multi-food exposure-only model. This model will use Arsenic (inorganic) as the hazard.

Complete the following tasks in your primary repository. Define the hazard “Arsenic”.

Task 1: Add the hazard

Hazard

Add the hazard using the following specifications:

- **Name:** Arsenic
- **Type:** Chemical
- **Default Unit:** mg

When complete, ensure that Arsenic is listed in the Hazards list on the Hazards tab.

.

Task 2: Add the additional foods and associated consumption models

Foods

Add the foods using the following specifications:

- **Name:** Canned Tuna
- **Measured using:** Mass

And:

- **Name:** Salmon Steaks
- **Measured using:** Mass

Consumption Models

Add the consumption models using the following specifications:

- **Name:** Lifetime Canned Tuna Consumption
- **Exposure Type:** Chronic - Multifood
- **Number of Consumers:** 3.15E8 (will be defined with the scenario)

Click “Save”, and then define the Life Stages according to the appropriate columns of the table below.

- **Name:** Lifetime Salmon Steak Consumption

- **Exposure Type:** Chronic - Multifood
- **Number of Consumers:** 3.15E8 (will be defined with the scenario)

Click “Save”, and then define the Life Stages according to the appropriate columns of the table below.

Since the consumption data are in empirical distributions and so may be tricky to enter by hand, we have created external files that you can import directly into your model. The instructor will provide access to the relevant files. Instructions for importing follow below.

Life Stage, Span in Years, and Consumption of Canned Tuna and of Salmon Steak in g/kg-day

Life Stage	Age and Gender	Consumption Units	Canned Tuna Consumption (probability, g/kg-day)	Salmon Steak Consumption (probability, g/kg-day)
Children 1 to 3	1Y,0M – 3Y,11M; Both	g / kg-day	0, 0 0.25, 0.0226 0.5, 0.03051 0.75, 0.04024 1, 0.0825	0, 0 0.25, 0.00259 0.5, 0.00478 0.75, 0.00788 1, 0.02428
Children 4 to 13	4Y,0M -13Y,11M; Both	g / kg-day	0, 0 0.25, 0.01185 0.5, 0.01592 0.75, 0.02104 1, 0.04282	0, 0 0.25, 0.00402 0.5, 0.00712 0.75, 0.01161 1, 0.03376
Persons 14 and up	14Y;0M-77Y;11M; Both	g / kg-day	0, 0 0.25, 0.01825 0.5, 0.02579 0.75, 0.03537 1, 0.07839	0, 0 0.25, 0.01099 0.5, 0.02008 0.75, 0.03335 1, 0.1002

Make sure to specify the Units as g per kg-day.

Name: Children 1 to 3

Age and Gender (end age must be greater than start age):

Gender	Start: Year	Month	End: Year	Month
Both	1	0	3	11

Average Daily Consumption:

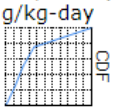
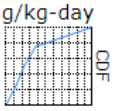
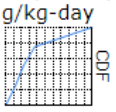
Units:	g per kg-day
Distribution:	Empirical (linear) Import
The cumulative empirical distribution (cubic or linear) is used to enter a distribution using cumulative probability/value pairs. It may be entered as a table (default) or in a textbox. When entered as a table, insert, delete or add rows as required. When entered in a textbox, each pair must be on a separate line and the format must be "cumulative probability,value" (e.g. 0.1, -3). Cumulative probabilities should be expressed as a number between 0 and 1. The first row must have a cumulative probability of 0 (minimum of the distribution). The last row must have a	Enter as Table

Probability	Value	Actions
0	0	Insert Delete
0.25	0.00259	Insert Delete
0.5	0.00478	Insert Delete
0.75	0.00788	Insert Delete
1	0.02428	Insert Delete

Number of Rows to Add: 10 Add

Note that body weight is not required when the consumption amount is provided per kg body weight.

When finished, the Chronic Consumption Model (for salmon steak in this case) should display as below. While normally the lifetime consumption data would be more finely-resolved (e.g. life stages spanning 5 years), this pattern has been simplified due to time considerations.

Life Stage	Gender	Start Age	End Age	Consumption	Actions
Children 1 to 3	B	1yr 0mo	3yr 11mo	Empirical (linear) g/kg-day 	Edit Copy Delete
Children 4 to 13	B	4yr 0mo	13yr 11mo	Empirical (linear) g/kg-day 	Edit Copy Delete
Persons 14 and up	B	14yr 0mo	77yr 11mo	Empirical (linear) g/kg-day 	Edit Copy Delete

Task 3: Add the process models

Now that you have created the hazard and food elements for the exposure scenario, you need to create two process models. Use the steps performed for Scenario C3 to define the process models for the two foods Canned Tuna, and Salmon Steaks using the following specifications.

Arsenic in Canned Tuna

- **Name:** Arsenic in Canned Tuna
- **Hazard:** Arsenic
- **Food:** Canned Tuna
- **Define Initial Conditions Using:** "Single Set of Parameters"
- **Prevalence:** 1
- **Unit Mass:** 200 g
- **Initial Concentration Units:** mg/kg
- **Initial Concentration Distribution:** Empirical (linear): 0,0.006; 0.03, 0.3; 0.5,0.9; 0.75,1.2; 1, 1.9

The Unit Mass defined is irrelevant for a chemical scenario with a prevalence of 1. This is because the chemical hazard is assumed to be distributed homogeneously throughout the food, and so there is no way that portioning or aggregating units of food to achieve the consumed amount can affect exposure.

Click Save and Close.

Arsenic in Salmon Steaks

- **Name:** Arsenic in Salmon Steaks
- **Hazard:** Arsenic
- **Food:** Salmon Steaks
- **Define Initial Conditions Using:** "Single Set of Parameters"
- **Prevalence:** 1
- **Unit Mass:** Uniform (100,300) g
- **Initial Concentration Units:** mg/kg
- **Initial Concentration Distribution:** Empirical (linear): 0,0.01; 0.1,0.2; 0.5,0.3; 0.75,0.4; 1, 0.6

The Unit Mass defined is irrelevant for a chemical scenario with a prevalence of 1. This is because the chemical hazard is assumed to be distributed homogeneously throughout the food, and so there is no way that portioning or aggregating units of food to achieve the consumed amount can affect exposure.

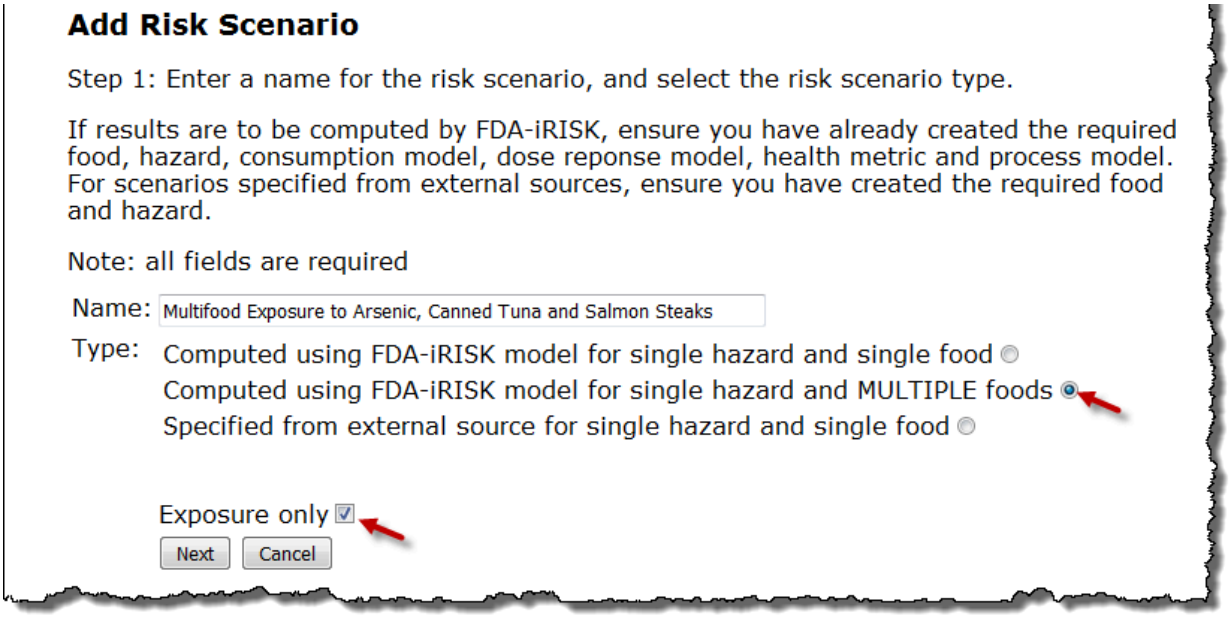
Click Save and Close.

Task 4: Add the risk scenario

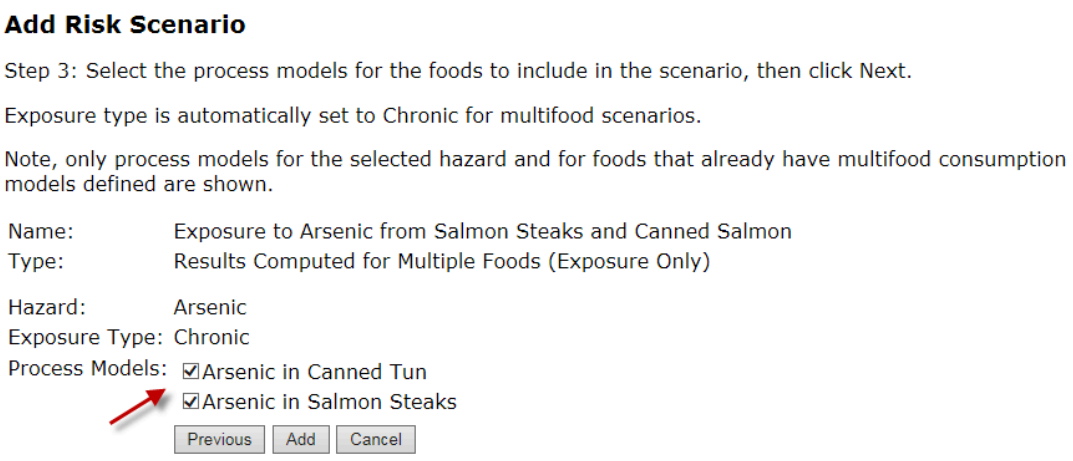
You have now defined all required elements for this exposure-only scenario.

Next, you will create the computed scenario for single hazard and multi-food called “Exposure to Arsenic from Salmon Steaks and Canned Salmon”.

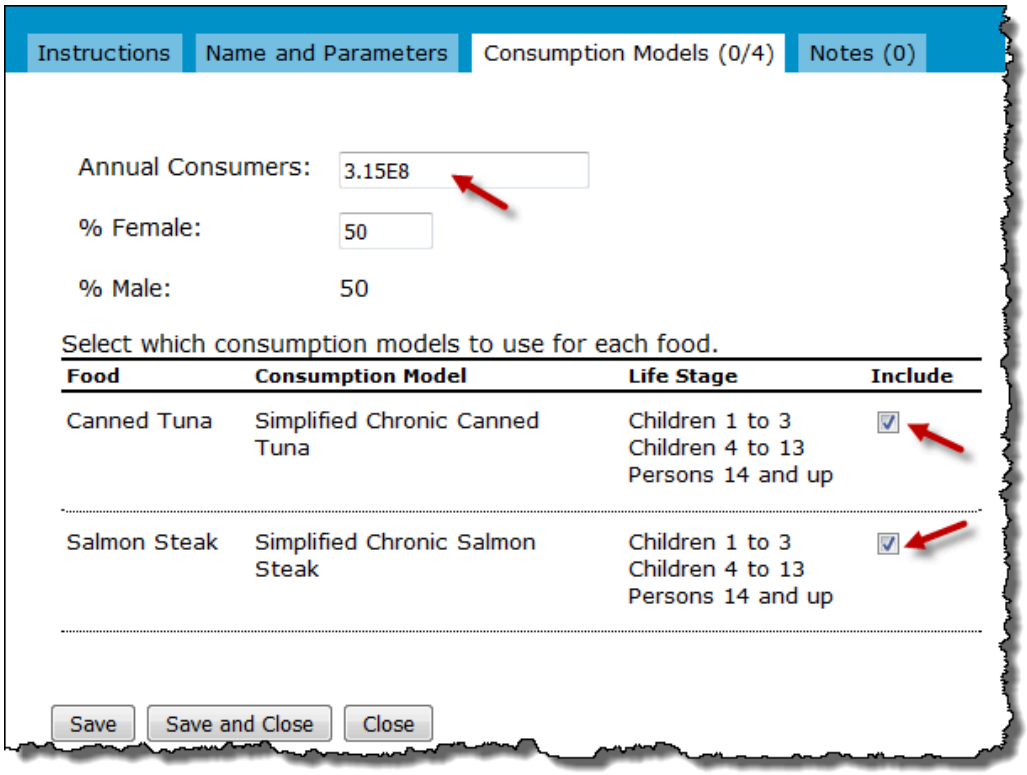
Ensure that you select “Computed using FDA-iRISK model for single hazard and MULTIPLE foods”, and “Exposure only” from the options.



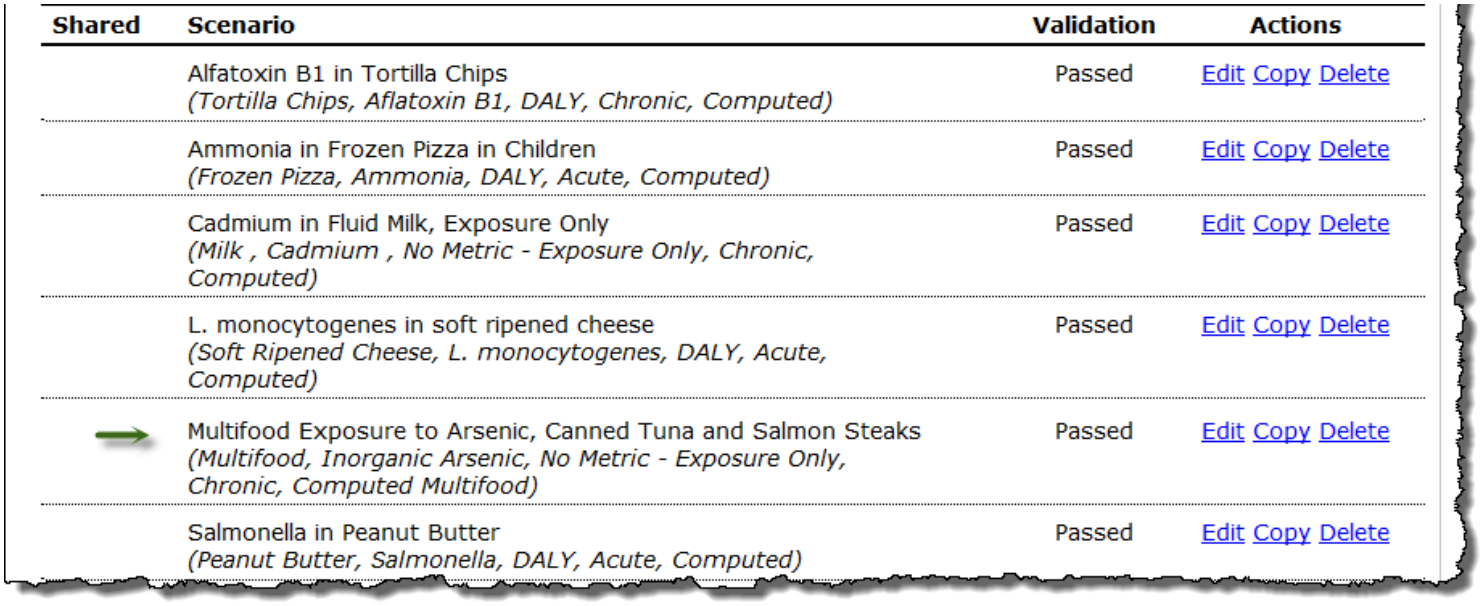
Select all relevant process models:



The tool identifies the remaining elements required by the scenario. Click on “Consumption Models” to select the desired models and define Annual Consumers.



Your model should be displayed as follows in the Scenario list:



Task 5: Create and generate the Risk Estimates and Scenario Ranking report

You will create a Risk Estimates and Scenario Ranking report called, “Multifood Exposure to Arsenic,

Canned Tuna and Salmon Steaks".

Click the Reports tab on the main tab bar at the top of the page and choose to Create a "Risk Estimates and Scenario Ranking" Report Type.

Confirm the appropriate repository is checked in the "List scenarios for" field below the Report Abstract field.

Select the Run check box to the left of the scenario and then click "Generate Report for Checked".

Task 6: Review the Risk Estimates and Scenario Ranking report

On the Report History tab of the Reports page, click the "Refresh Lists" button until your report disappears from the list of Pending Reports and appears in the list of Completed Reports.

Finally, view your detailed report in PDF format (check the "Details" and "Notes" boxes before clicking on "View PDF") and compare it with the results shown below

Finally, view your detailed report in PDF format.

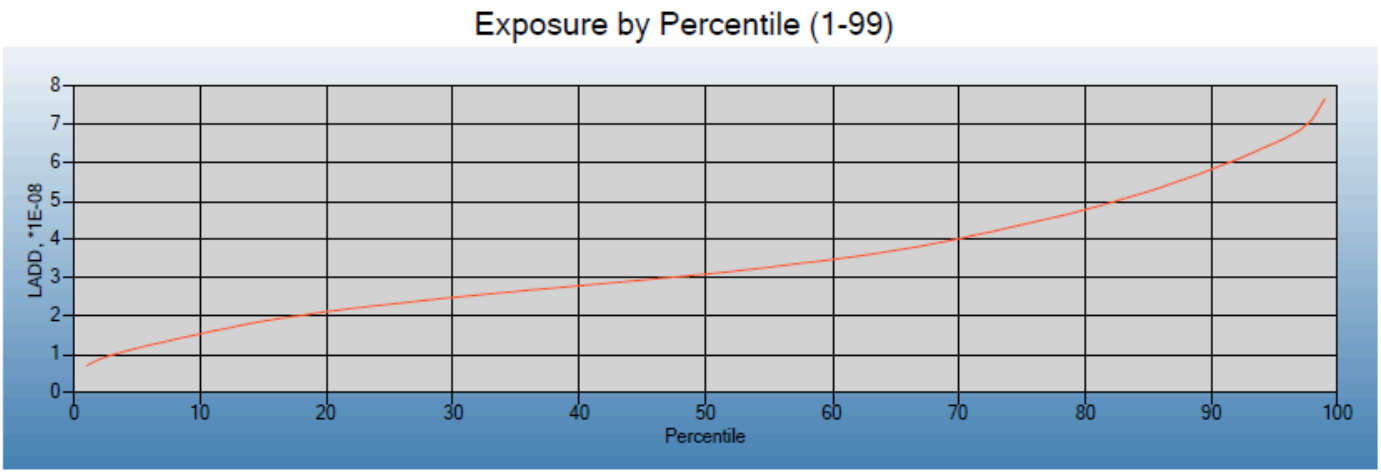
The results report provides the Lifetime Average Daily Dose (LADD) of arsenic from the two foods, both as a mean value and by percentiles of the population.

Scenario Details for: Exposure to Arsenic from Salmon Steaks and Canned Salmon

Group:	N/A		
Hazards:	Arsenic (Chemical)	Scenario Type:	Results Computed (Multifood) - Exposure Only
Foods:	Canned Tuna, Salmon Steaks	Exposure Type:	Chronic
Process Models:	Arsenic in Canned Tun, Arsenic in Salmon Steaks	Metric Type:	
Consumption Models:	Lifetime Canned Tuna Consumption, Lifetime Salmon Steak Consumption	Scenario Weight:	N/A
Converged:	Yes (by 18000 variability samples)	Include Uncertainty:	No
Diet:	N/A		

Exposure

Annual Consumers:	3.15E8	% Female:	50
Lifetime Average Daily Dose:	3.42E-8 g/kg-day	% Male:	50



Exposure for Arsenic (g/kg-day):					
Median:	3.10E-8	**95th:**	6.51E-8	**99th:**	7.67E-8

The results also provide the overall mean concentration of arsenic in each food.