CRC SimPLER

User Guide

Community Reception Center Simulation Program for Leveraging and Evaluating Resources (CRC SimPLER) helps radiation emergency planners understand their current capacity, forecast potential bottlenecks, and estimate additional resource needs when planning for population monitoring during response to a radiation emergency.

This interactive tool can also be used as a training tool for locations that are beginning to draft their population monitoring plans and those who have not conducted CRC full-scale exercises.

Version 2.0 8/4/2021

Disclaimer

These instructions and the corresponding software, the CRC SimPLER (Community Reception Center Simulation Program for Leveraging and Evaluating Resources), are based on information obtained from real exercises and calculational models. Reasonable efforts have been made to present accurate and reliable information. The user, however, assumes responsibility for the consequences of using this information. Neither the Centers for Disease Control and Prevention, nor any of their employees, make any warranty, express or implied, or assume any legal responsibility for the accuracy or completeness of the information and instructions contained on this website and the CRC SimPLER software. Use of specific trade names and commercial sources does not constitute an endorsement by the authors or by the Centers for Disease Control and Prevention.

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Overview

Purpose

Population monitoring at Community Reception Centers (CRCs) is one of the most challenging activities that the local and state health departments will be involved in during response to a radiological event. Setting up and staffing CRCs requires extensive planning. The Community Reception Center Simulation Program for Leveraging and Evaluating Resources (CRC SimPLER) helps radiation emergency planners understand their current capacity, forecast potential bottlenecks, and estimate additional resource needs when planning for population monitoring during response to a radiation emergency. This software can also be used as a training tool for locations that are beginning to draft their population monitoring plans and those who have not conducted CRC full-scale exercises.

Key Features

- Accessible from any computer with internet access
- Simple interface with graphical outputs
- Ability to export data
- Links to references and resources

CRC SimPLER focuses on typical or anticipated activities that are needed to conduct population monitoring, such as contamination screening, decontamination, registration, and mental health counseling.

Design

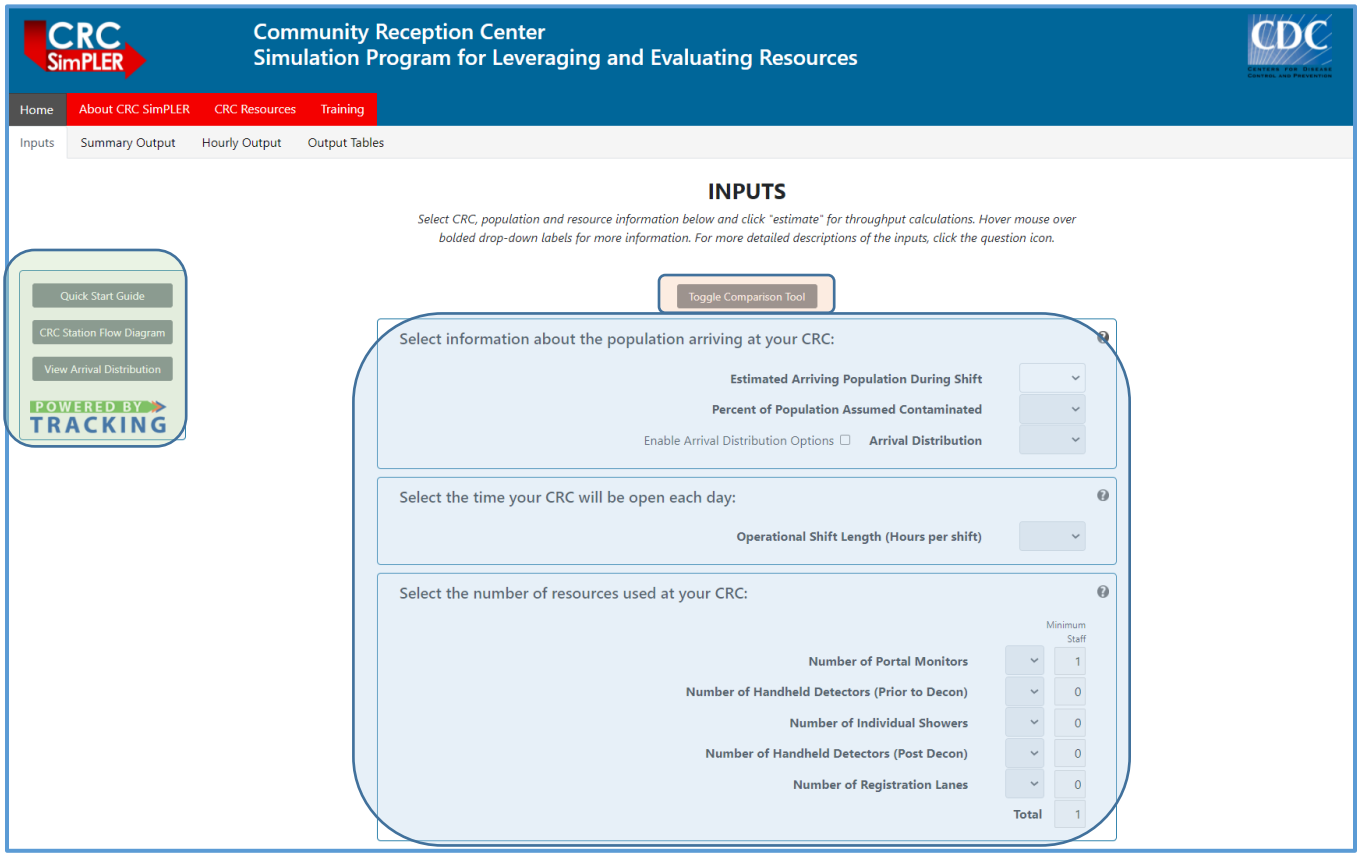
This program was developed using modelling software and incorporates actual timing data collected from CRC exercises across the country, making predictions more accurate than ones used in similar products. In addition, CRC SimPLER has been tested with state and local planners to ensure that it is easy to use.

Introduction to CRC SimPLER

This section describes the content of each screen in CRC SimPLER. The next section will provide instructions on how to use CRC SimPLER and the outputs the tool provides.

Input Screen

This is the CRC SimPLER home screen. This is where you will select inputs to estimate CRC throughput and capacity.



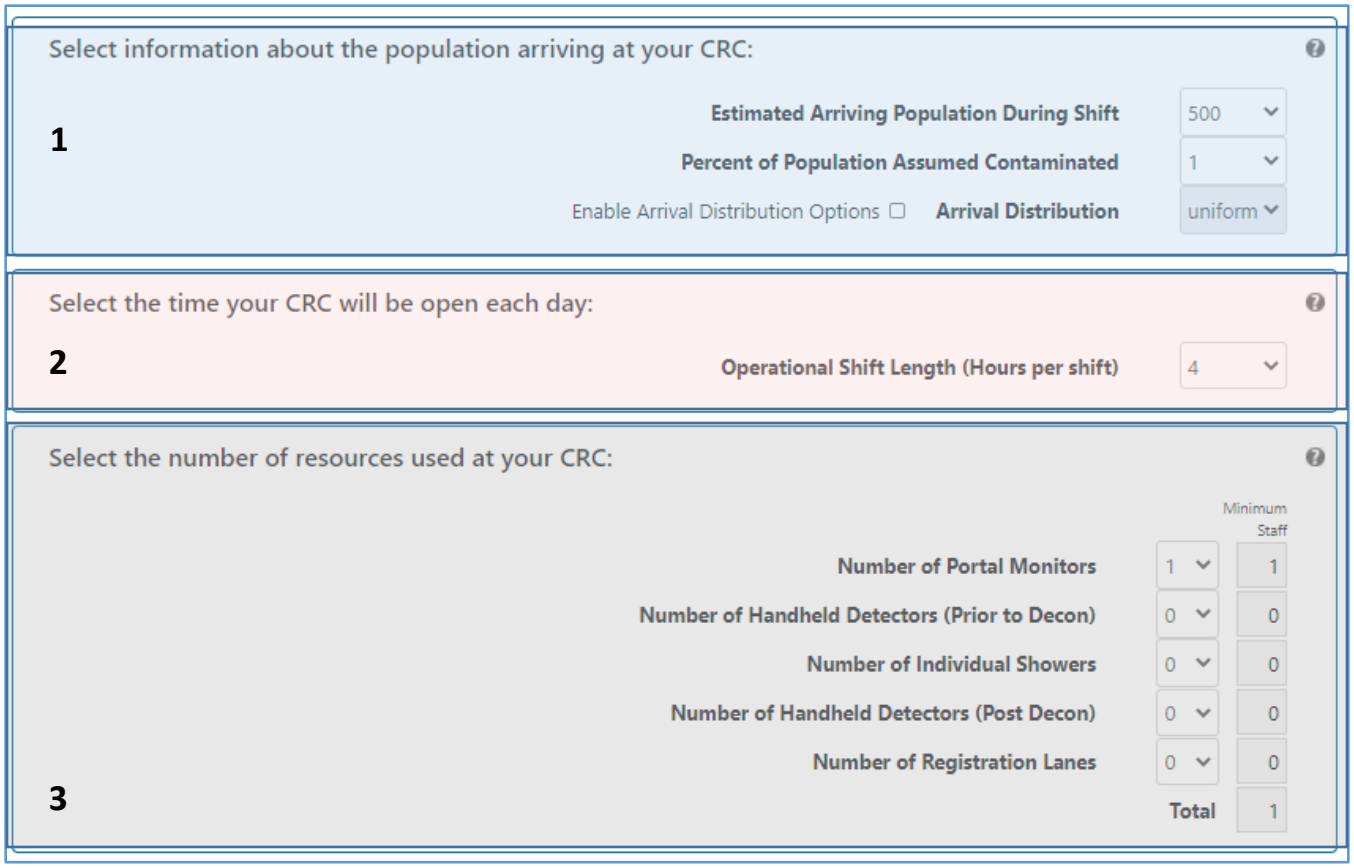
The Inputs Tab includes:

- Inputs area – Enter information to perform CRC SimPLER throughput estimate
- Toggle Comparison Tool – This button turns on and off the comparison feature within CRC SimPLER to allow for a side-by-side comparison of two different CRCs.
- Helpful information (located on the left margin)– These buttons link to additional information that might be helpful for new users or those who may want visual aids for CRC flow and population arrivals.

Inputs Area

The Inputs Area is broken into 3 sections.

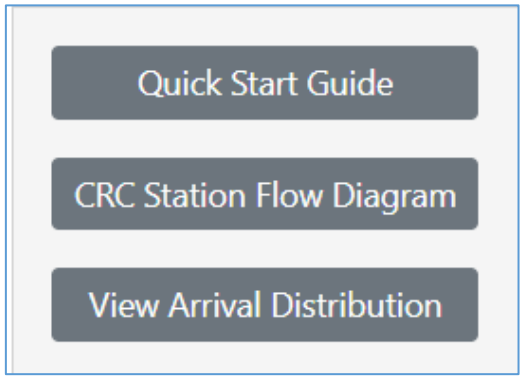
1. How many people are anticipated to arrive at the CRC on a given day? How many might be contaminated? How might they be arriving?
2. How long will the CRC be open each day?
3. What resources and stations will be operating at the CRC?



Toggle Comparison Tool

Toggle Comparison Tool: a feature that allows for users to do a side-by-side comparison of two CRC scenarios. By selecting this button, an additional column for input selection becomes available to the right of the input area. To turn off the comparison tool, select the button again. More information on how to use the Comparison Tool is found in the following sections.

Helpful information

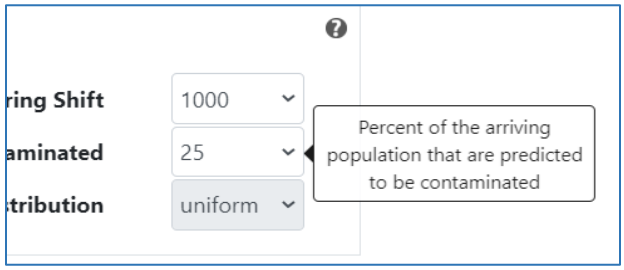


First Time Walkthrough: a pop-up window appears that provides step-by-step instructions for using CRC SimPLER.

View CRC Station Flow Diagram: a pop-up window that shows the CRC stations used in the CRC SimPLER model and the resources associated with each station.

View Arrival Distribution Examples: a pop-up window that provides descriptions and images of each type of arrival distribution. This also explains when to use each type of distribution.

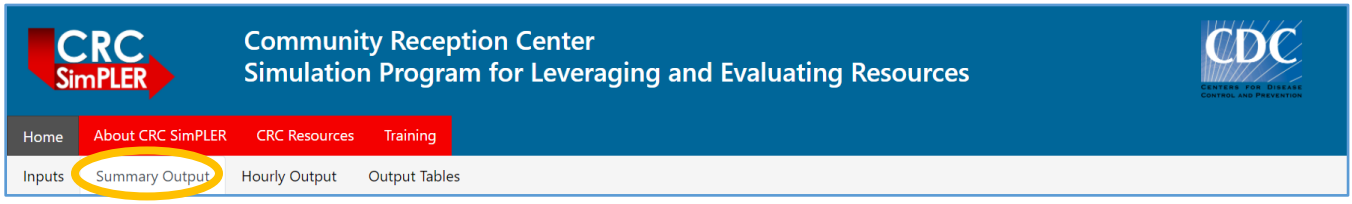
Tooltips are available as hover tooltips and pop-up tooltips throughout the CRC SimPLER site.



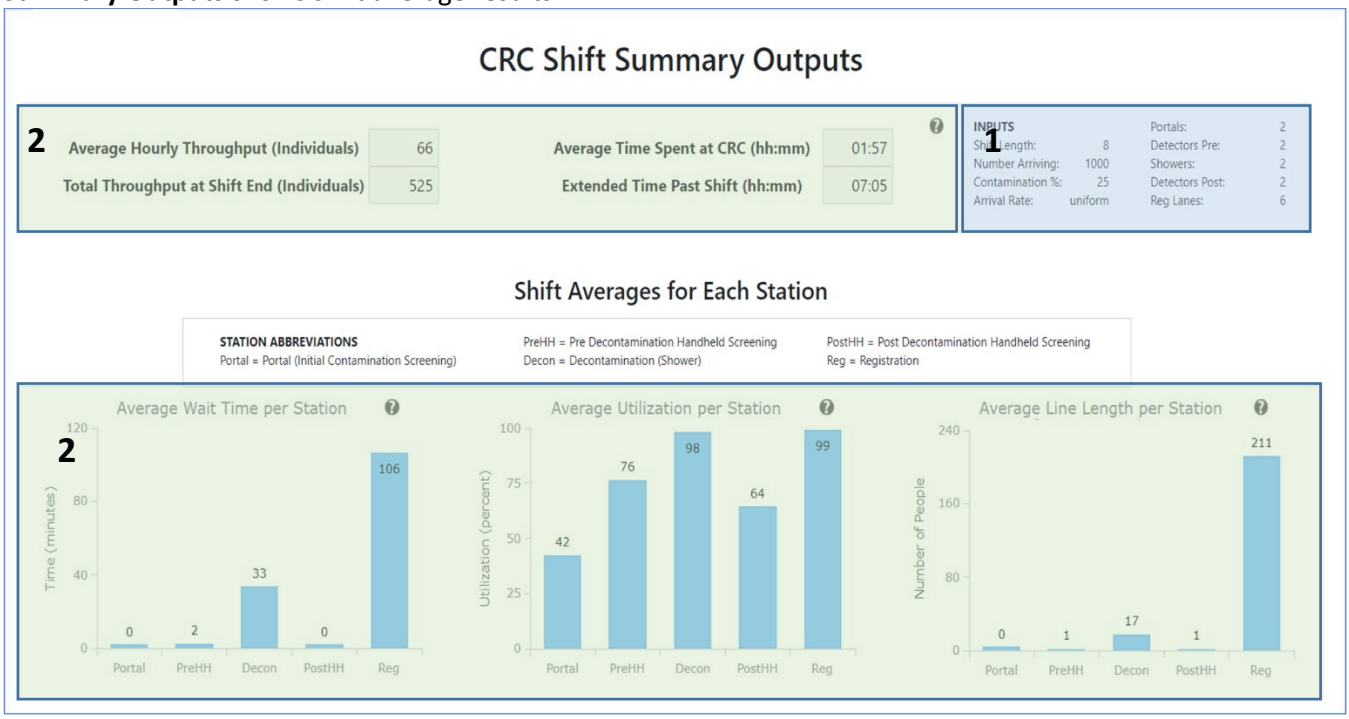
Hover tooltips are available when you hover over drop-down menus. These are meant to provide a quick explanation or description of the drop down.

Pop-up tooltips are identified by the question mark symbol. Clicking on the question mark will open a pop-up window with tooltips that provide more information on each bolded section found on the Inputs Screen.

Summary Outputs



Summary Outputs shows shift average results.

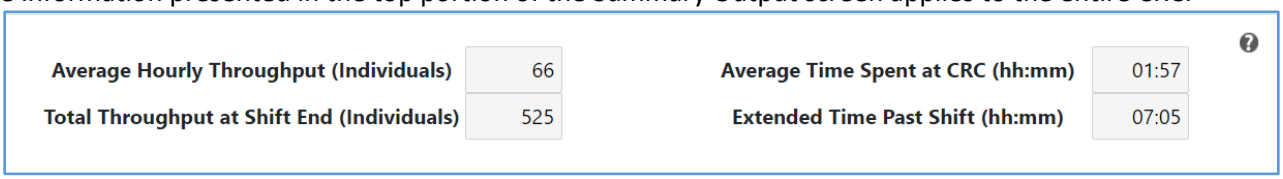


The Summary Output Screen includes:

1. Inputs Summary –This box displays inputs for the current CRC SimPLER output so users can take screen shot or print the Summary Output Screen for easy presentation to decision makers and other planners.
2. CRC Summary Outputs– Calculated data based on the information used on the input screen. Data is broken into CRC Information as a Whole (where entire CRC operations are encompassed in the outputs) and CRC Stations (where station data is presented as shift averages) for wait times, utilization, and line length.

CRC Information as a Whole

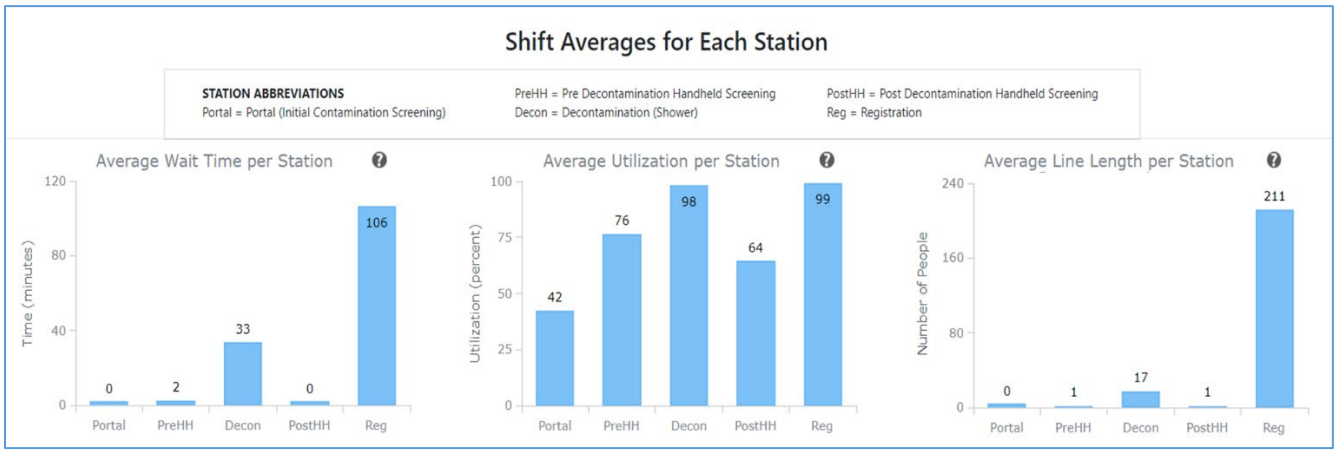
The information presented in the top portion of the Summary Output screen applies to the entire CRC.



- **Average Hourly Throughput (Individuals):** Average number of individuals processed each hour during the shift
- **Total Throughput at Shift End (Individuals):** Number of individuals who have completed the population monitoring process at the end of the shift
- **Average Time Spent at CRC (hh:mm):** Average time spent by an individual receiving services at the CRC
- **Extended Time Past Shift (hh:mm):** Additional staff time needed past shift end to process remaining individuals

CRC Stations

The information presented in the bottom portion of the **Summary Output** screen is broken down by station and is averaged over the course of the shift. Each graph focuses on one characteristic that often affects throughput and highlights bottlenecks. Using all three graphs together allows you to get a more detailed perspective of each station within your CRC.



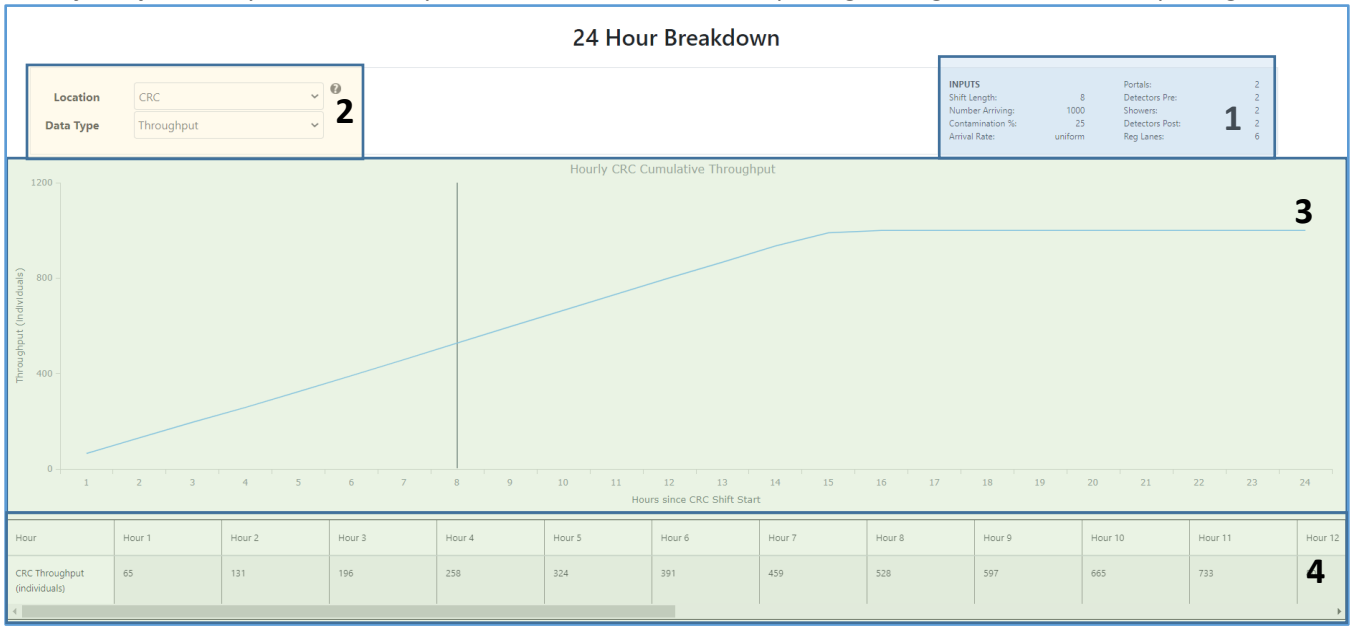
Average Wait Times per Station: The average amount of time an individual spends waiting in line before receiving service at each station for the shift.

Average Utilization per Station: Think of this as the percent of time that the station is busy. For example, during an 8-hour shift, a staff member at a station that is utilized 99% on average is not idling or waiting to serve additional individuals and they are busy for the full 8hours of a shift. Meanwhile a staff member at a station that is utilized 50% might be waiting to receive individuals and only be busy for 4 out of the hours of the shift. Stations might be utilized at capacity for the beginning of the shift surge and then decrease as the shift progresses, so it is important to look at both average and hourly utilization.

Average Line Length per Station: The average number of individuals who are waiting in line before receiving service at each station.

Hourly Outputs

Hourly Outputs lets you view hourly data from the start of CRC opening through 24 hours after opening.



The Hourly Output Screen includes:

1. Inputs Summary –This box displays inputs for the current CRC SimPLER output so users can take screen shot or print the Summary Output Screen for easy presentation to decision makers and other planners.
2. Selection Drop Downs – the two types of drop-down menus are **Location** and **Data Type**. All combinations are found in table 1 below.

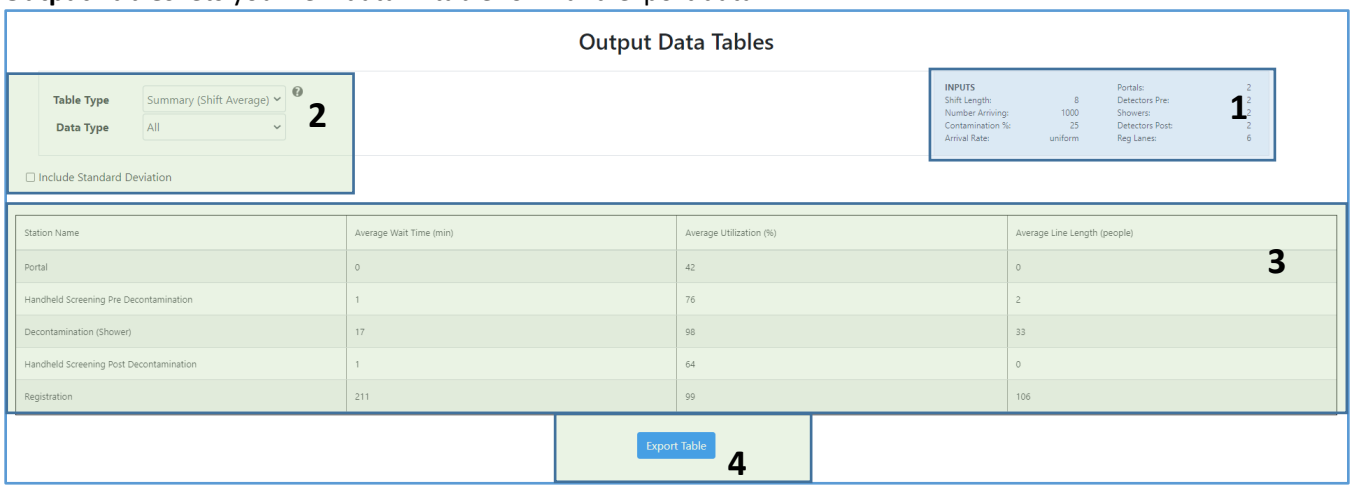
Table 1: Available option combinations for 24-hour plot

	CRC	Contamination Screening (Portal)	Pre-Decon Handheld Screening	Decontamination (Showers)	Post-Decon Handheld Screening	Registration
Wait Time		X	X	X	X	X
Line Length		X	X	X	X	X
Utilization		X	X	X	X	X
Throughput (Cumulative)	X	X	X	X	X	X
Individual time	x					

3. Hourly Output Plot Area – Line plot corresponding to drop down selection. The vertical line marks the end of shift. “0” hours mark the opening of the CRC.
4. Hourly Output Corresponding Data Table – Table corresponding to data on the line plot.

Output Tables

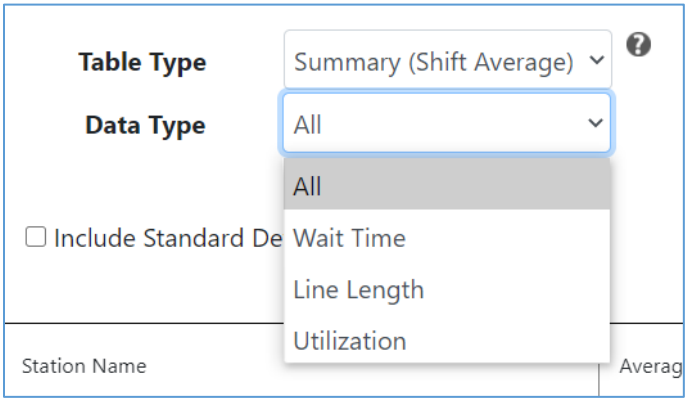
Output Tables lets you view data in table form and export data.



The Output Tables Screen includes:

1. Inputs Summary –This box displays inputs for the current CRC SimPLER output so users can take screen shot or print the Summary Output Screen for easy presentation to decision makers and other planners.
2. Table Type and Data Type Drop Down Menu– Options for selecting what information to display in the Table Area.
3. Table Area- Output data corresponding to Table and Data Type selection from drop down menu
4. Export to Excel – Export Table button will export all CRC SimPLER inputs and outputs to an Excel File

Summary (Shift) tables



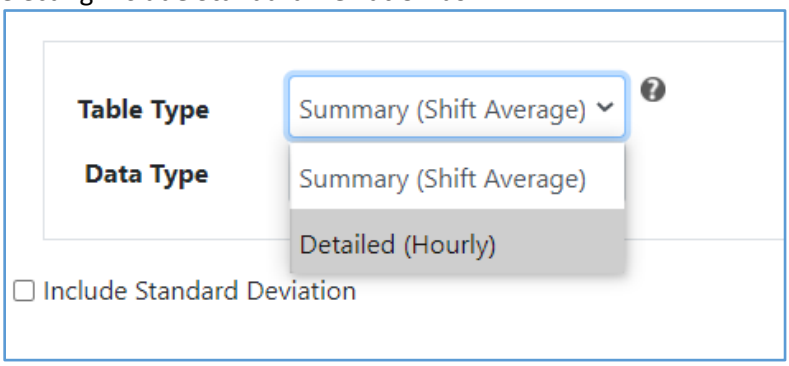
Data from the graphs on the **Summary Output tab** are presented here on the **Output Table** screen in table form.

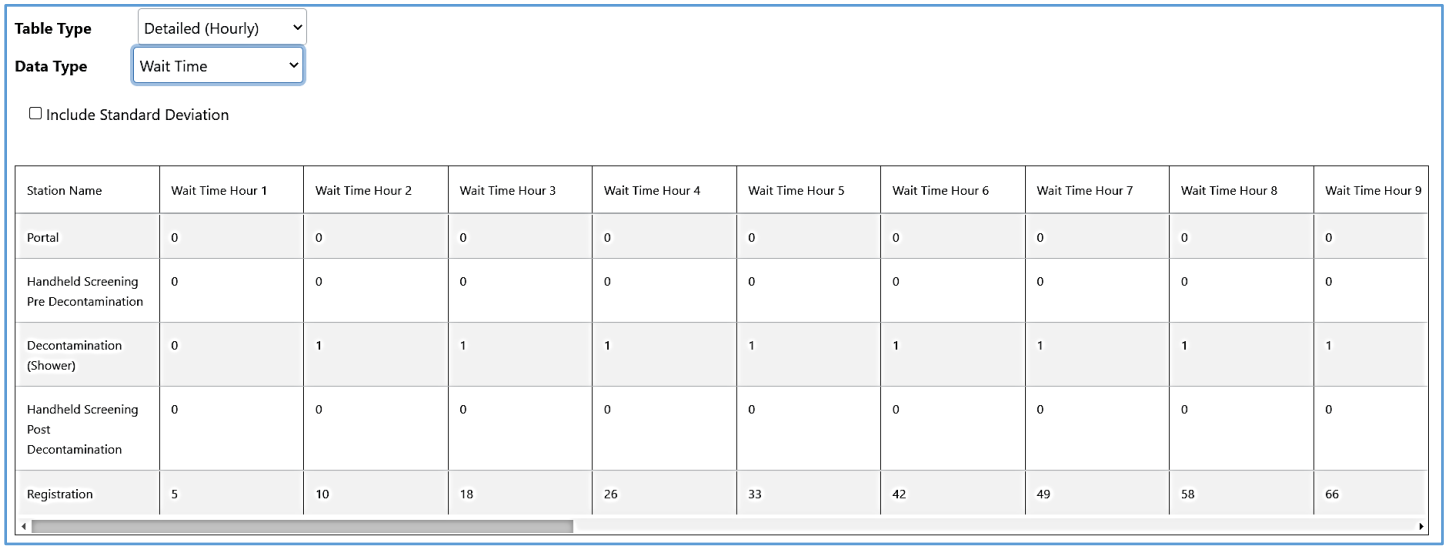
Station Name	Average Wait Time (min)	Average Utilization (%)	Average Line Length (people)
Portal	0	30	0
Handheld Screening Pre Decontamination	0	51	0
Decontamination (Shower)	1	79	3
Handheld Screening Post Decontamination	0	49	0
Registration	93	98	84

You can choose to include standard deviation by selecting **Include Standard Deviation** box.

Detailed (Hourly) tables

Data from the graphs on the **Hourly Output tab** are presented here in table form. You can choose to include standard deviation by selecting **Include Standard Deviation** box.





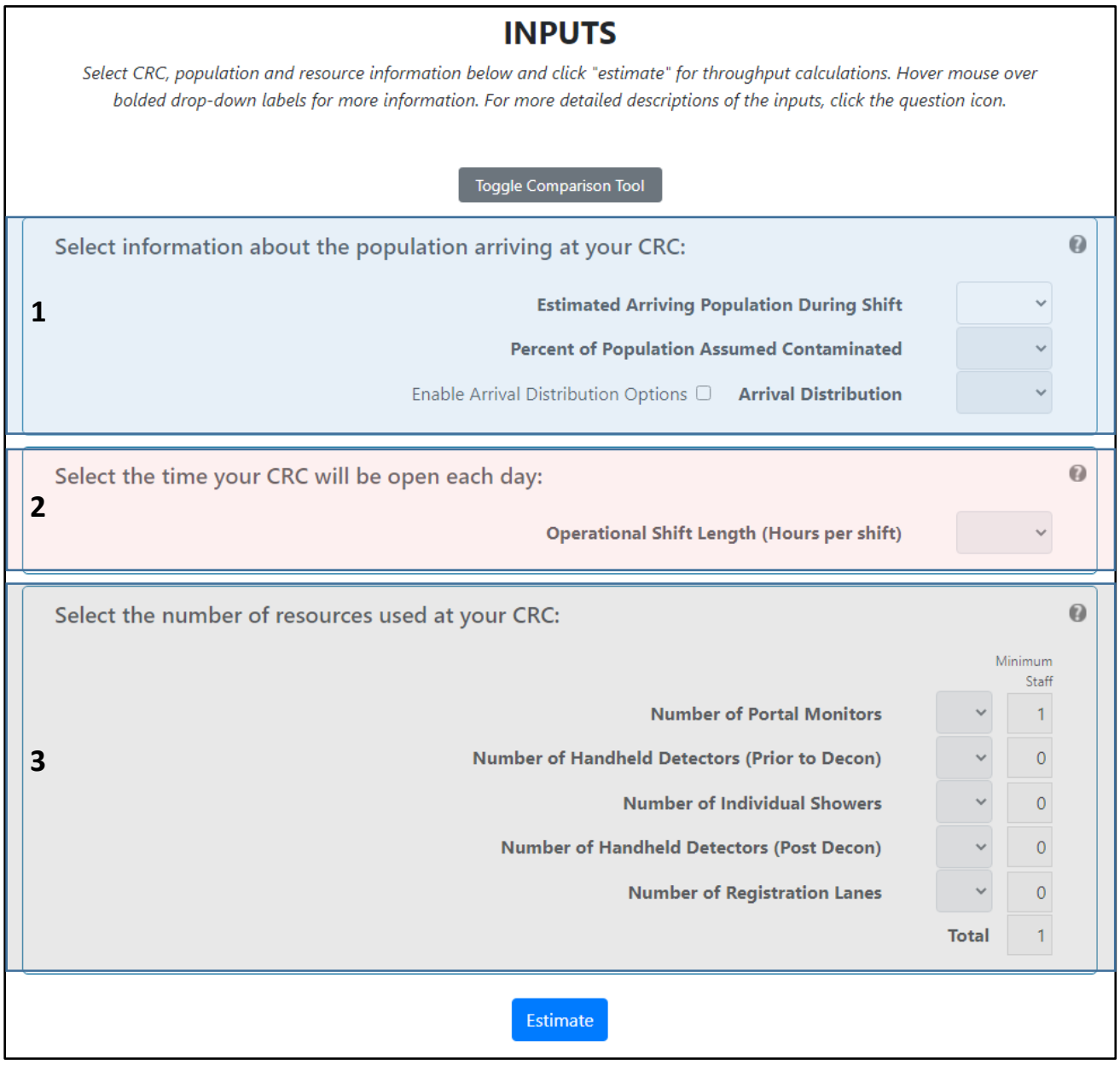
Station Name	Wait Time Hour 1	Wait Time Hour 2	Wait Time Hour 3	Wait Time Hour 4	Wait Time Hour 5	Wait Time Hour 6	Wait Time Hour 7	Wait Time Hour 8	Wait Time Hour 9
Portal	0	0	0	0	0	0	0	0	0
Handheld Screening Pre Decontamination	0	0	0	0	0	0	0	0	0
Decontamination (Shower)	0	1	1	1	1	1	1	1	1
Handheld Screening Post Decontamination	0	0	0	0	0	0	0	0	0
Registration	5	10	18	26	33	42	49	58	66

Using CRC SimPLER

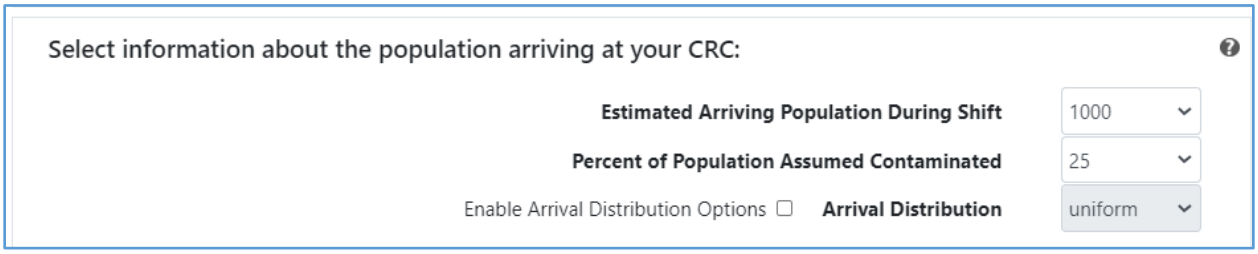
This section uses an example to show how the tool works.

Step 1. Entering CRC and Population Information

You will go through each section and select information on the **Input** screen then click **Estimate** to produce your CRC SimPLER outputs.



1. **Select information about the arriving population at your CRC**. It is possible that you may not know all information about the potential arriving population. Suggestions are provided in the tool for each input value.



A. The **Estimated Arriving Population During Shift** is the number of people you anticipate will arrive during the operational shift of your CRC. This is essentially your *desired throughput*. This number depends on many factors including the type of incident and location.

TIPS:
If you are unsure of the population size that might be arriving during each shift, you can start with a smaller population size for your first SimPLER estimate and see if your CRC set up is achieving the desired throughput.

If your CRC achieves *desired throughput*, you can go back to the Input Screen and raise the population size to determine the maximum for throughput capacity of your CRC based on current resources.

B. The **Percent of Population Assumed Contaminated** is based on the assumed type of incident, and screening criteria to be used at your facility. This percent will be applied to your estimated arriving population to estimate how many individuals will require decontamination.

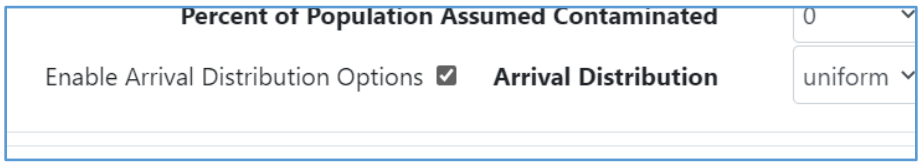
   A contaminated individual is considered someone that registers higher than the threshold screening levels that have been set at the facility. Other factors that can affect the percent contamination of the population are proximity to the incident and time since the incident. It is recommended that planners coordinate with their radiation control program to best decide what percent is most likely for their response plans.

TIPS:
For an event that impacts a large population, but has low potential to contaminate the population, select a smaller contamination percentage.

Screening criteria may change during the radiation response. For a very large population, it might be beneficial to use a higher screening value for your contamination criteria so that individuals who are highly contaminated can quickly receive care. This could be simulated by changing the percent contamination from 5% to 1%, or a similar change in percent.

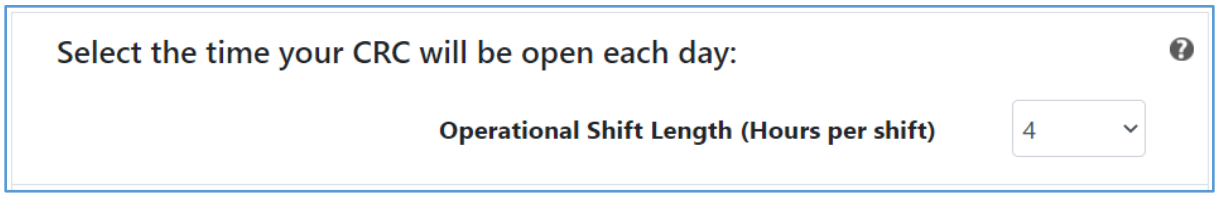
C. The **Arrival Distribution** influences the rate that the population will be arriving at the CRC. The default arrival distribution is uniform which represents a constant rate over the course of the shift.

To change the **Arrival Distribution**, select the **Enable Arrival Distributions Options** box. This allows you to select from other types of arrivals.



TIPS:
It is difficult to predict how a population may arrive at your CRC (rate of arrival). Starting with a Uniform Arrival distribution and then comparing with other distributions will allow users to see how different types of arrivals might affect their throughput estimates. It is possible that the Summary Outputs might not vary as much with changing arrival distributions. Hourly Outputs will show a more direct impact of changing the arrival distributions.

2. **Select the Time your CRC will be open each day**. Operational shift length is the time, in hours, that your CRC will be open each day.

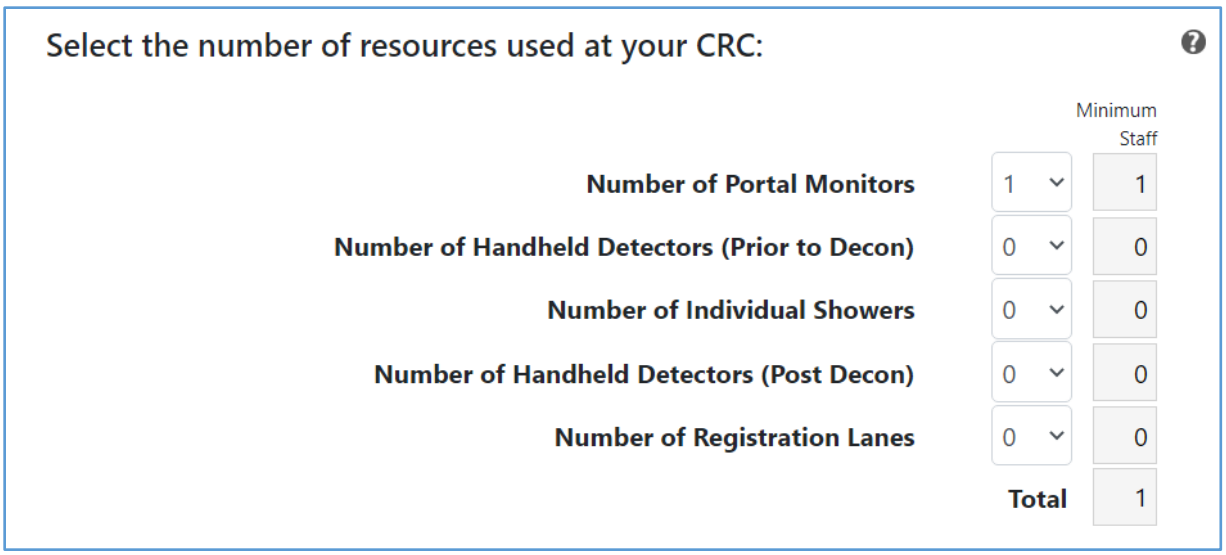


TIPS:
If you are operating more than one shift during the day with little to no stops in service, select the total number of hours your CRC will be open to see total throughput for the CRC over the course of the day.

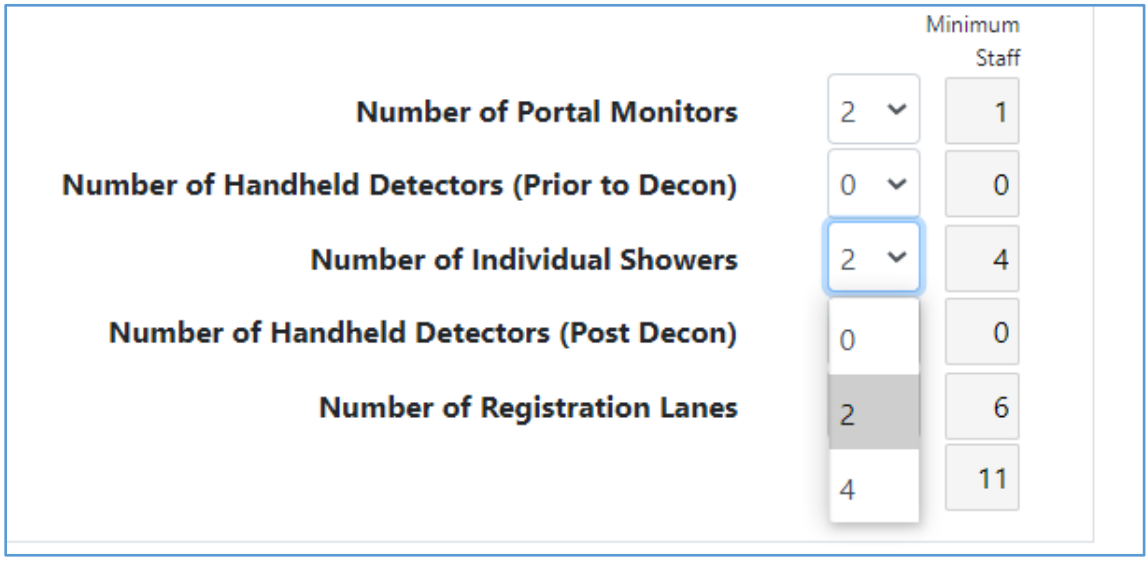
If you are operating more than one CRC, you should calculate throughput estimates separately for each CRC.

3. **Select the number of resources used at your CRC.** If you do not have a resource or that station is not utilized in your plans, select "0".

   As resources are selected, the minimum staff at each station will auto populate on the right. The minimum staff number is a measure for how many staff members are needed to operate the equipment only. Staffing may vary from CRC to CRC, but it is encouraged that each station has at least the minimum number of staff when assigning resources and equipment. It is possible to have more than the minimum staff assigned to equipment. For example, 2 staff per handheld detector versus the minimum of one. The minimum staff does not include staff such as incident manager, safety officers, security, and traffic control, etc.



TIPS:
When Showers are selected, resources must be assigned to Post Decontamination as individuals who receive decontamination should be monitored to ensure that contamination has been removed. Detectors prior to decontamination may be set to "0" to allow for CRC plans that have contaminated individuals move directly to Decon.

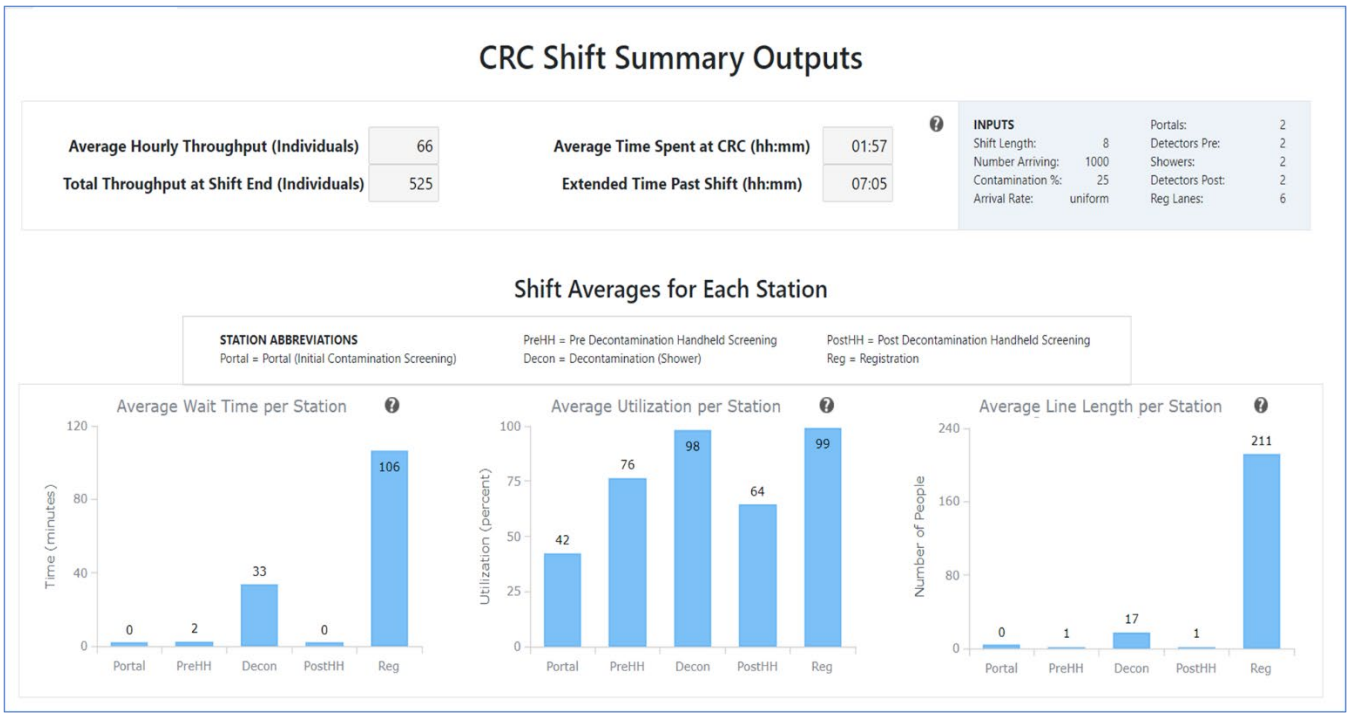


Click **Estimate** to view your CRC throughput estimates and results.

Step 2. View Summary Outputs

This section will walk through how to use the information provided on the **Summary Output** Screen.

Remember: Hover over tool tips are available for the top section of the screen. Pop-up tooltips are available for the top section and each graph.



What the Data Mean

Average Hourly Throughput

Often this is a metric that is set by emergency planners and CRC managers to determine if they are on track to achieve a projected throughput. This is meant to help those who have throughput goals expressed as an hourly rate to determine if they are achieving their throughput goals.

Total Throughput at Shift End

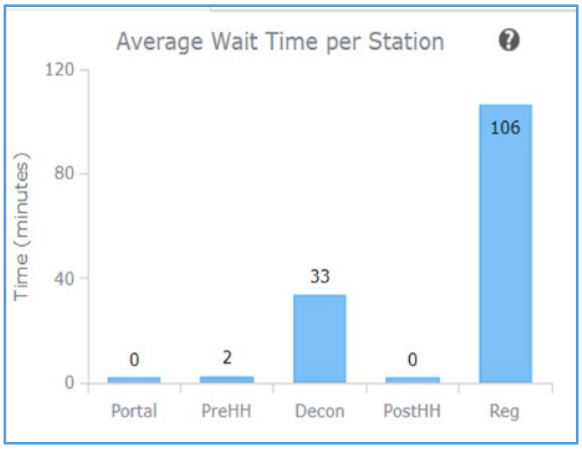
This answers the question “Can I achieve my throughput goals based on the selected resources?” If the total throughput at the end of the shift does not equal the population that was assumed to be arriving on the input screen, then throughput goals have not been achieved.

Average Time Spent at CRC by an Individual

This can be used to determine the efficiency of wait times and total processing time for individuals arriving at the CRC. If someone spends more time at the CRC, more resources may be needed.

Extended Time Past Shift

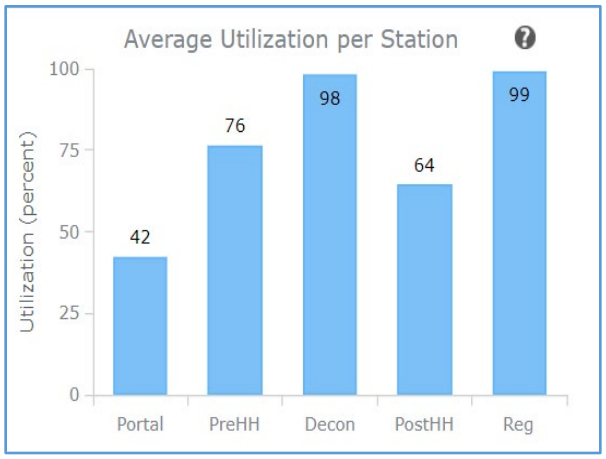
This answers the question, “How much longer will I need to stay open past the CRC operational shift to process the remaining individuals through my CRC?” This helps determine if additional staff will need to be called in and/or if overtime is needed for current staff.



Average Wait Time per Station

Definition: The average amount of time an individual spends waiting in line before receiving service at each station for the shift.

How to use: Wait times can be useful when considering where to add additional lanes of service, where additional security or line monitoring might be needed, or if adjustments to service times can be made to shorten wait times. For example: shortening service time would be to shorten registration forms by removing questions that are not required for immediate or short-term follow-up for individuals. Basic contact information can be collected to allow for additional collection later.



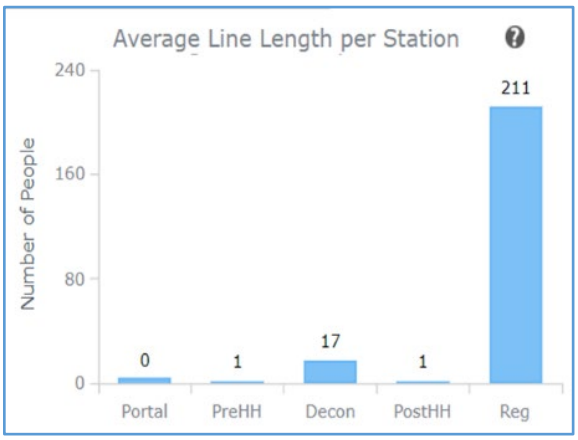
Average Utilization per Station

Definition: The percent of the total shift that the station is being used. Think of this as the percent of time that the station is busy. A staff member at a station that is 99% utilized on average is not idling or waiting to serve additional individuals while a staff member at a station that is 60% utilized might have some down time and be waiting to receive individuals. Stations might be utilized at capacity for the beginning of the shift surge and then as the shift progresses, they can decrease in utilization.

How to use: Average utilization is useful for determining where additional resources can be added or removed. Utilization above 90% is a good starting point when looking to add more resources. As resources become more readily available, lower rates of utilization can be used to evaluate where to place additional equipment or personnel. For a closer look at where additional staff or resources could be temporarily placed to alleviate surges, view the 24-hour break down of the utilization in the Hourly Outputs tab.

Correlating Information Across Graphs: If utilization is high along with long lines and excessive wait times, the station is most likely a bottleneck and additional resources will be most effective if placed here. If utilization is

high but line lengths and wait times are relatively low, priority might be placed lower on requesting additional resources for this station.



Average Line Length per Station

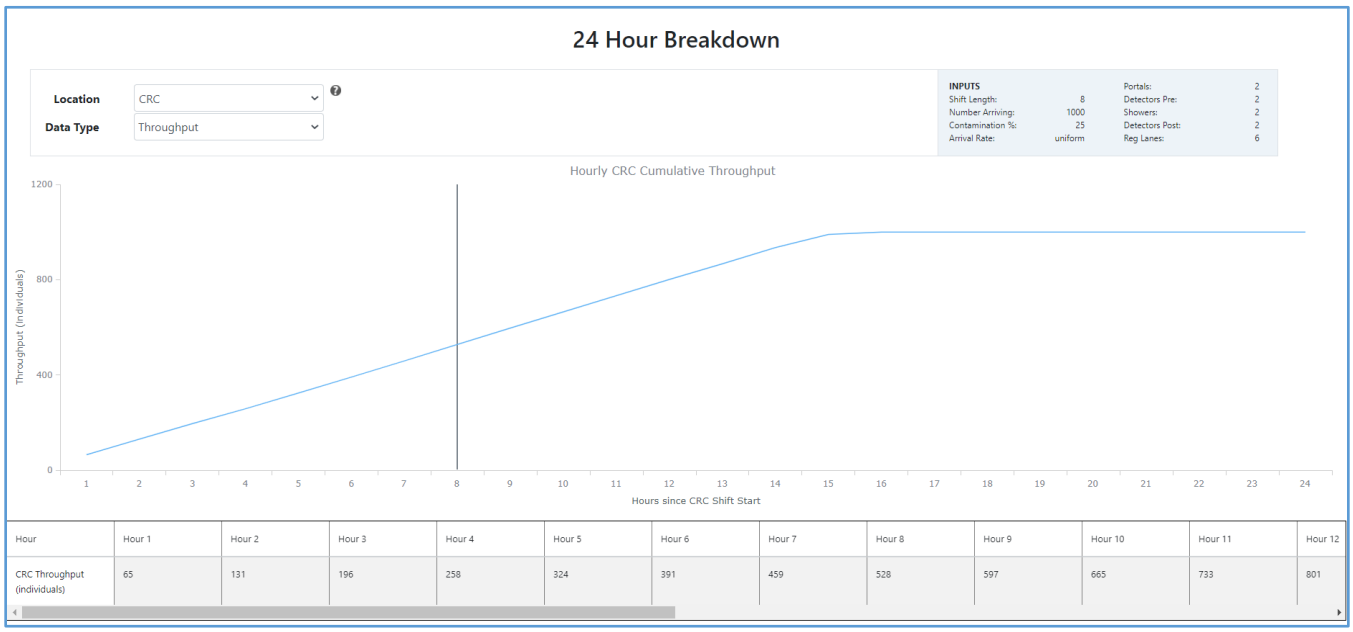
Definition: The average number of individuals who are waiting in line before receiving service at each station.

How to use: Average line length can be used to assess space allocations for lines and CRC set up. It is important to note that if there are long lines but wait times are low, this is not necessarily a bottleneck but will require enough building capacity to hold the individuals.

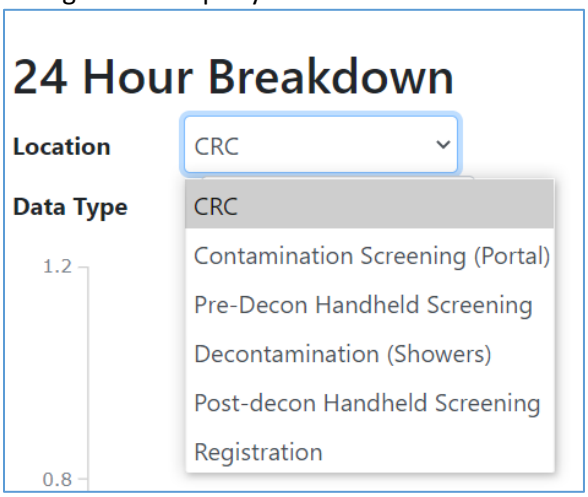
Step 3. View Hourly Outputs

Hourly Outputs can be viewed by selecting the Location and Data Type from the two drop down menus at the top of the page. Data begins at the start of CRC opening and goes through 24 hours from the start of the shift. The vertical line represents the end of the CRC shift.

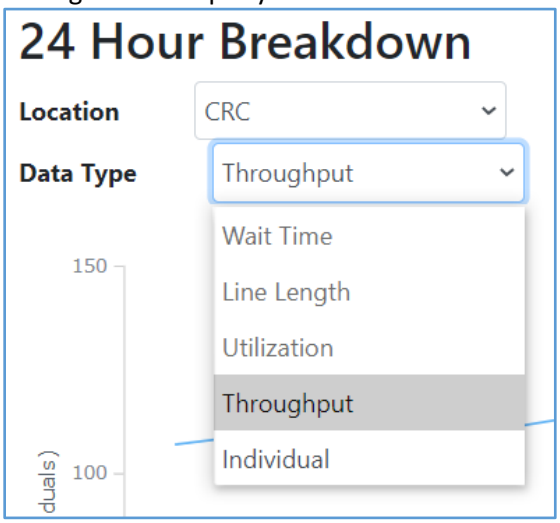
Remember: The pop-up tool tip provides more details and suggestions on how to use the data.



1. Select the **Location** corresponding to the output you would like to view for the 24-hour plot.



2. Select the **Data Type** corresponding to the output you would like to view for the 24-hour plot



24-hour Breakdown Option Combinations

Detailed data can be useful for understanding how and when bottlenecks may develop, the impact of line build up over time, and when stations may reach their maximum capacity. These data can be useful to understand how stations continue to operate after the shift end and how long remaining individuals will be at each station.

	CRC	Contamination Screening (Portal)	Pre-Decon Handheld Screening	Decontamination (Showers)	Post-Decon Handheld Screening	Registration
Wait Time		X	X	X	X	X
Line Length		X	X	X	X	X
Utilization		X	X	X	X	X
Throughput (Cumulative)	X	X	X	X	X	X
Individual time	x					

- **CRC Throughput (Individuals):** Presents cumulative throughput for each hour of CRC operation and extends to 24 hours after CRC opening.
    - **How to use:** Cumulative throughput can be used to evaluate when throughput begins to slow down and when additional resources or staff might need to be added during the shift. This can be a good indicator of when bottlenecks may begin to appear.
    - This answers the question "Can I achieve my throughput goals based on the selected resources?" If the total throughput at the end of the shift does not equal the population that was arriving on the input screen, then throughput goals have not been achieved.

- **CRC Individual Time (hh:mm):** Provides the average time an individual would spend receiving services at the CRC for each hour of CRC operation and extends to 24 hours after CRC opening. Individual time includes all wait times and processing time for each station that the individual goes through.
    - **How to use**: This can be used to determine the efficiency of wait times and total processing time for individuals arriving at the CRC. If someone spends more time at the CRC, more resources may be needed.

- **Station Wait Time (hh:mm):** Presents average individual wait times at each station for each hour of CRC operation and extends to 24 hours after CRC opening.
    - **How to use:** Station wait times can be useful when considering where to add additional lanes of service, where additional security or line monitoring might be needed, or if adjustments to service times can be made to shorten wait times. For example: shortening service time would include for example, shortening registration forms by removing questions that are not required for immediate or short-term follow-up for individuals. This change will result in shorter wait after shift end.

- **Station Utilization (percent):** The cumulative percentage that the station is being used starting at the opening of the CRC and extending to 24 hours after CRC opening. Think of this as the percent of time that the station is busy.
    - **How to use:** Station utilization is useful for determining where additional resources can be added or removed. Utilization above 90% is a good starting point when looking to add more resources. As resources become more readily available, lower rates of utilization can be used to evaluate where to place additional equipment or personnel.

- **Station Line Length (Individuals):** The average number of individuals who are waiting in line before receiving service at each station for each hour of CRC operation from the start of CRC opening and extends to 24 hours after CRC opening.
    - **How to use:** Average line length can be used to assess space allocations for lines and CRC set up. It is important to note that if there are long lines but wait times are low, this is not necessarily a bottleneck but will require enough building capacity to hold the individuals.

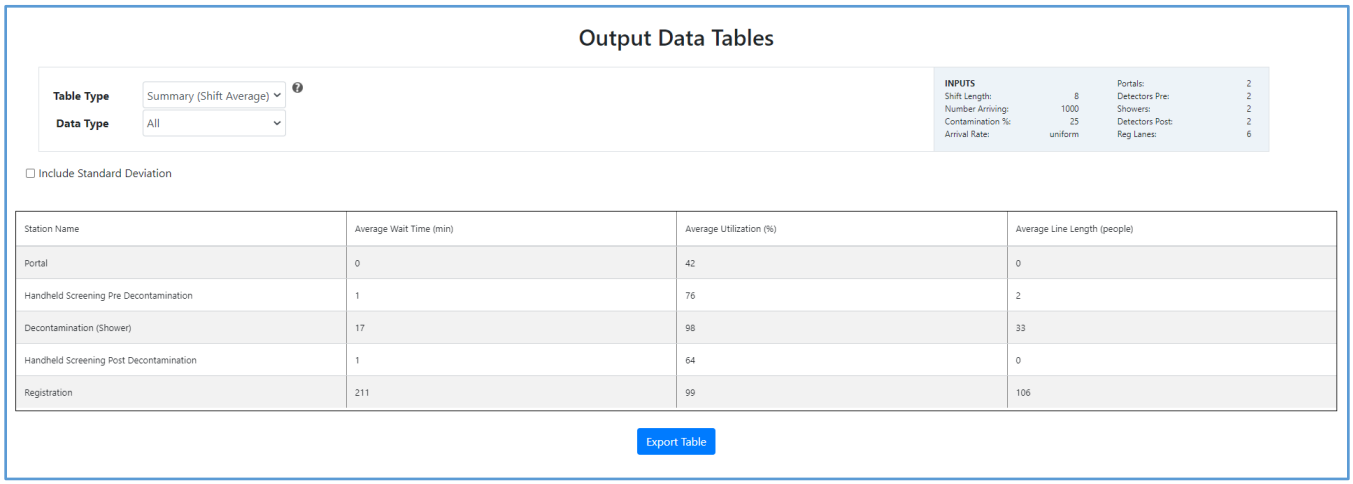
- **Station Throughput (Individuals):** Presents hourly station throughput for each hour of CRC operation and extends to 24 hours after CRC opening.
    - **How to use:** Hourly station throughput can be used to evaluate when throughput begins to slow down and when additional resources or staff might need to be added during the shift. This can be a good indicator of when bottlenecks begin to appear. Throughput should decrease after shift end.

Correlating Information Across Graphs: If utilization is high along with long lines and excessive wait times, the station is most likely a bottleneck and additional resources will be most effective if placed here. If utilization is high but line lengths and wait times are relatively low, there would be a lower priority for requesting additional resources for this station.

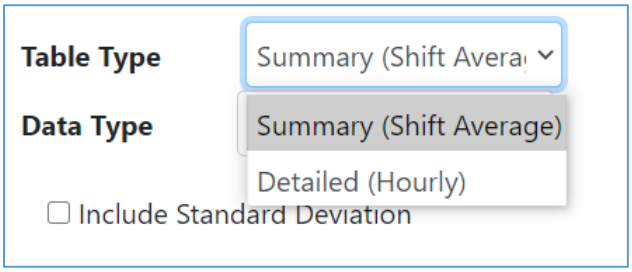
Step 4. View Output Tables

Summary and hourly output tables are available in the **Output Tables tab**.

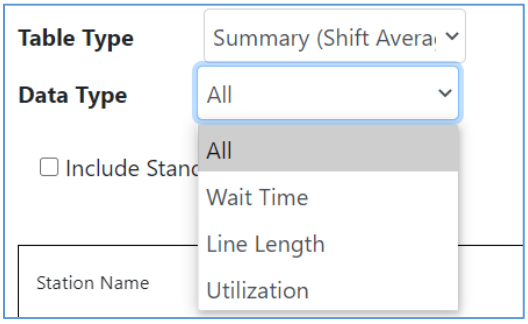
> Remember: The pop-up tool tip provides more details and suggestions on how to use the data.



1. Select the **Table Type** you would like to view.



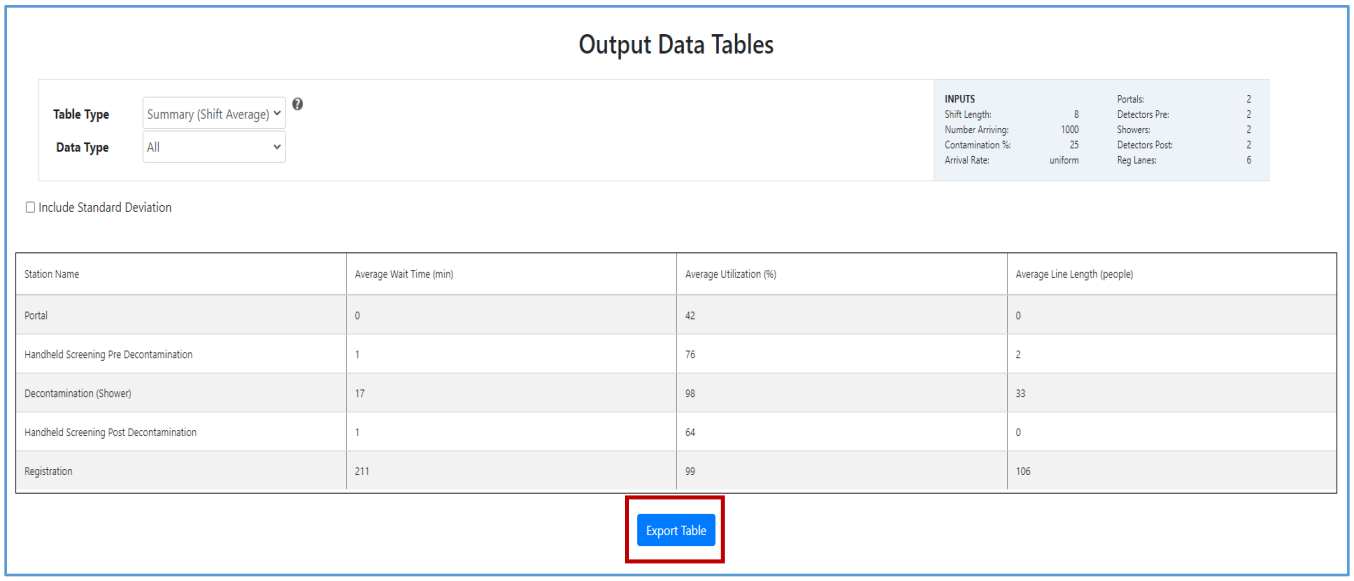
2. Select the **Data Type** you would like to view.



3. Select **Include Standard Deviation** if you would like to add standard deviation to the table.

Step 5. Exporting and Saving Data

To export data from CRC SimPLER, click the **Export Table** button. All CRC SimPLER inputs and outputs are exported as a .xlsx file where you can name your file. Default file name is results.xlsx.



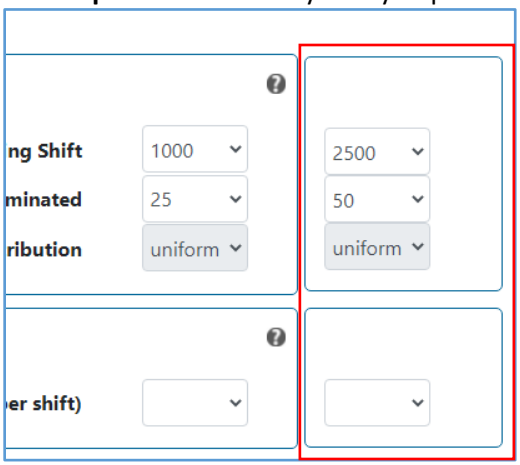
Your download (filename.xlsx) from CRC SimPLER include:

- All input information
- Summary Output Data
- Hourly Output Data

Step 6*: Using the Comparison Tool (optional)

Now that you have walked through using the tool, go back to the **Input** tab and select the **Toggle Comparison Tool** button.

Select information for the comparison inputs the same way that you previously entered information in **Step 1**.



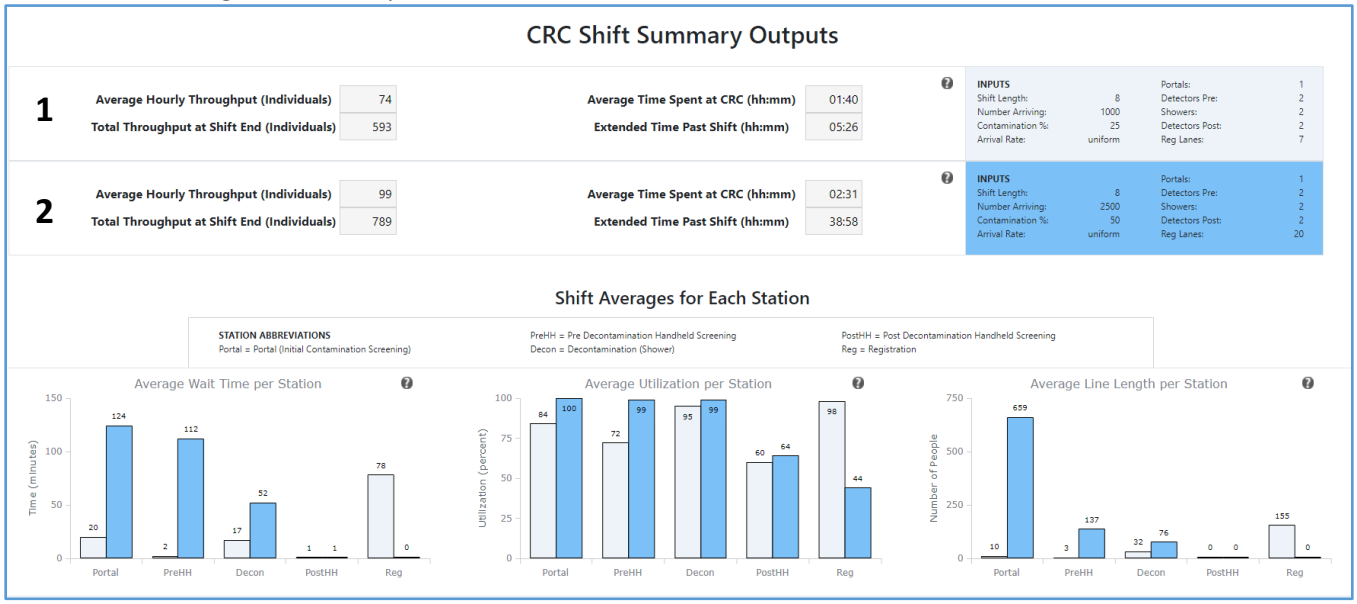
Click **Estimate** to view your CRC throughput estimates and results for both scenarios.

Step 7*: Comparison Tool Outputs

The **Summary Output, Hourly Output,** and **Output Tables** tabs all function the same as steps 2-5. The key difference is that now two scenarios are present on each screen. Differences for **Summary Output** and **Hourly Output** tabs are presented below.

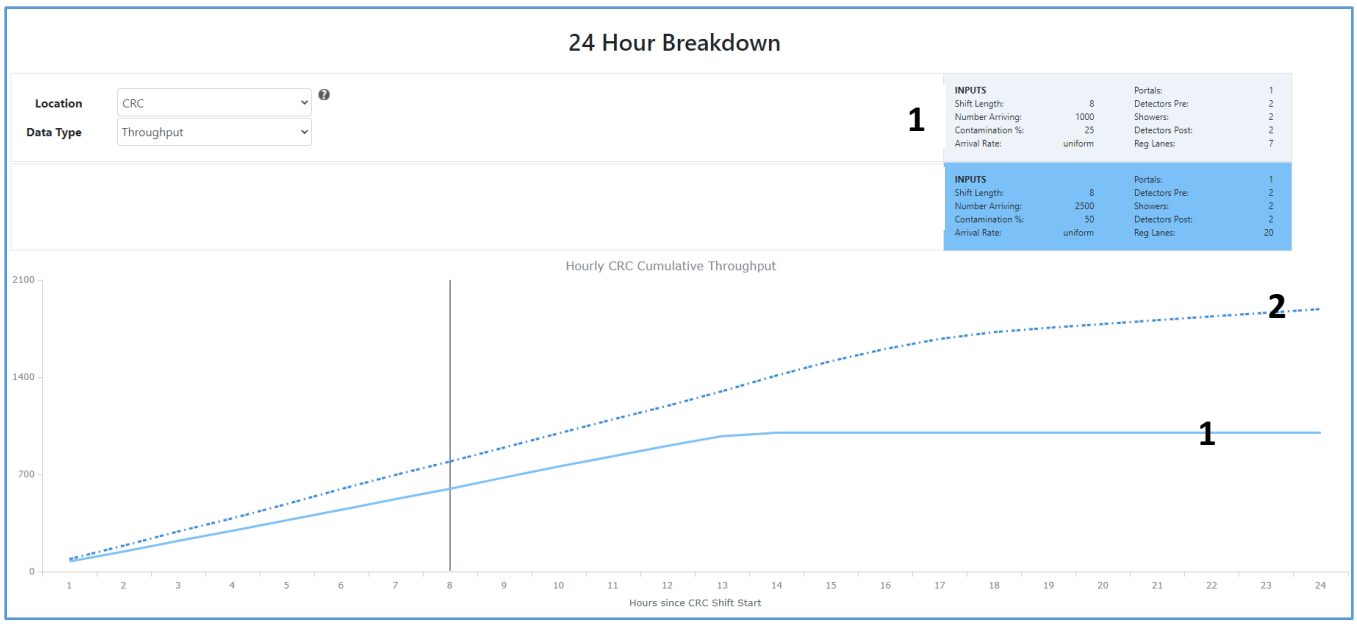
Summary Output

Scenarios 1 and 2 are presented on the Summary Output tab below. Corresponding data for each scenario in the *Shift Averages* section match the color represented on the top left of the screen. Scenario 1 is the left bar and scenario 2 is the right bar in the pair.



Hourly Output

Scenarios 1 and 2 are presented on the Hourly Output tab below. Scenario 1 is the full line and scenario 2 is represented by the dashed line.

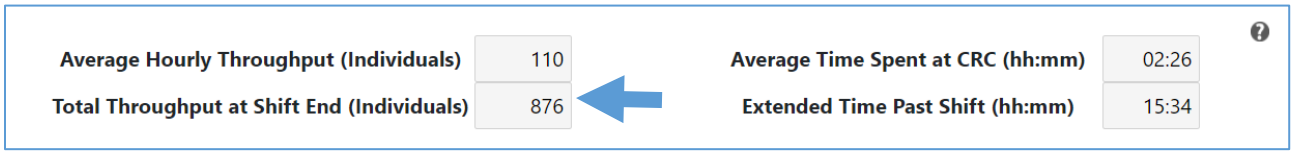

24 Hour Breakdown
Location
CRC
Data Type
Throughput
1
INPUTS
Shift Length: 8
Number Arriving: 1000
Contamination %: 25
Arrival Rate: uniform
Portals: 1
Detectors Pre: 2
Showers: 2
Detectors Post: 2
Reg Lanes: 7
INPUTS
Shift Length: 8
Number Arriving: 2500
Contamination %: 50
Arrival Rate: uniform
Portals: 1
Detectors Pre: 2
Showers: 2
Detectors Post: 2
Reg Lanes: 20
Hourly CRC Cumulative Throughput
2100
1400
700
0
2
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours since CRC Shift Start

Using CRC SimPLER to Answer Specific Questions

This section takes specific questions that you might be trying to answer by using CRC SimPLER and provides guidance on where to find the information in the tool and how to apply the data to aid in planning and decision making.

Can I achieve my throughput goals with my current resources?

Information Location: **Total Throughput at Shift End** on **Summary Output** tab



What does the information mean?

Total Throughput at Shift End can be used to assess if throughput goals are being met during a shift for a given CRC based on current resource inputs.

- If **Total throughput at Shift End** is close to or equal to the population size selected on the input screen, then throughput goals can be achieved with the current CRC setup.
- If **Total Throughput at Shift End** is 5-10% lower than the population size selected on the input screen, then desired throughput goals are not being met. Station specific data can be used to identify which stations might potentially be causing bottlenecks and where additional resources would be most impactful for improving throughput.

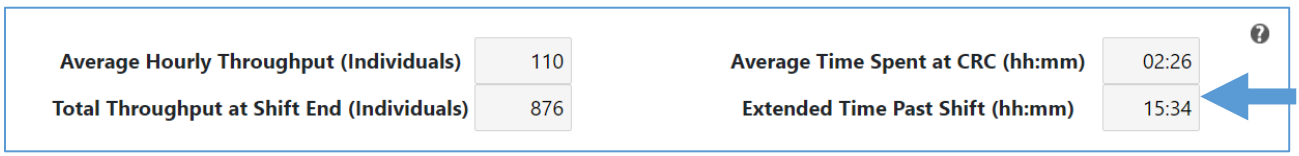
How do you apply the data to decide which actions to take?

Likely bottlenecks can be identified by large lines, long wait times and near 100% utilization. After determining which stations are causing bottlenecks, perform another CRC SimPLER calculation adding resources to the bottleneck stations. For example: if decontamination resources were the bottleneck and it is unlikely that additional showers can be added, the percent of population contaminated can be adjusted and lowered to see if "raising screening criteria" helps improve throughput. Prior to raising screening criteria during an event, CRC mangers should coordinate with radiation professionals in their state.

Continue to adjust resources until desired throughput is met or an acceptable increase in total throughput is found.

How much longer will I need to stay open to process everyone arriving at the CRC?

Information Location: **Extended Time Past Shift** on **Summary Output** tab



What does the information mean?

Extended Time Past Shift can be used to determine how much longer the CRC will need to stay open to finish population monitoring activities. This time is based on the CRC operating with the same resources and set up after the CRC stops receiving new individuals.

How do you apply the data to decide which actions to take?
Planners should determine how long they are comfortable staying open past the CRC closing to finish processing all remaining individuals. It is possible that the time left to process the remaining individuals is low enough that planners feel there is no action needed to be taken. If the amount of time is longer than planners would like to stay open or can stay open, resources should be adjusted, and another CRC SimPLER estimate should be done.

To help reduce the amount of additional time needed to process remaining individuals, the stations that were causing bottlenecks should be identified. When performing the next CRC SimPLER estimate, those stations and their resources should be adjusted to determine the impact of adding one or more additional resources. It is possible that a combination of additional resources, such as adding 2 more registration lanes and one portal monitor, would be more beneficial than adding 2 portal monitors.

> **Tip:** Adding resources to the station that had the highest utilization along with line length and wait times is the easiest way to reduce additional time required to process remaining individuals.

How long can individuals arriving at my CRC expect to be there?

Information Location: **Average Time Spent at CRC** on **Summary Output** tab

Average Hourly Throughput (Individuals)	110	**Average Time Spent at CRC (hh:mm)**	02:26
Total Throughput at Shift End (Individuals)	876	**Extended Time Past Shift (hh:mm)**	15:34

What does the information mean?
Average time spent at CRC is an individual's time spent receiving services at the CRC. This value can be used to determine the efficiency of wait times and total processing time for individuals arriving at the CRC. If someone spends more time at the CRC, it may require more resources.

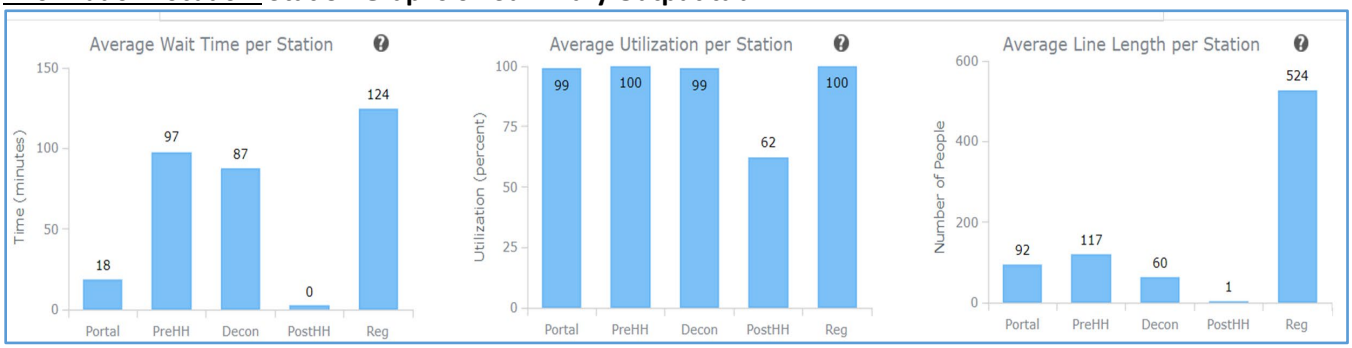
How do you apply the data to decide which actions to take?
It is hard to set a limit on how long someone should spend at the CRC receiving services. Planners should determine what they think is appropriate and if they have the staff and security in place to manage individuals who become unruly as their processing time increases.

For example: a CRC manager feels that people who need to receive services are likely to start leaving or stop coming to a CRC should their wait and processing times exceed 2 hours. Depending on the type of event or ability to send people to other CRC locations, it might be appropriate to issue public messaging indicating that showering before coming to the CRC or going to location B will result in shorter waiting times. It is possible that the event and restricted resources mean that planners decide 4-6 hour processing times are acceptable. The longer someone is idling in lines at the CRC, the more likely they will need additional resources or staff attention.

To reduce the amount of time someone spends at the CRC, identify the stations with the highest wait times. In the next CRC SimPLER estimate, add additional resources to that station and the results should show lower wait times and lower overall average time someone spends at the CRC. Users should continue this process until an acceptable average processing time is reached or it is not feasible to acquire more resources for those stations.

What station is causing bottlenecks?

Information Location: **Station Graphs** on **Summary Output tab**



What does the information mean?

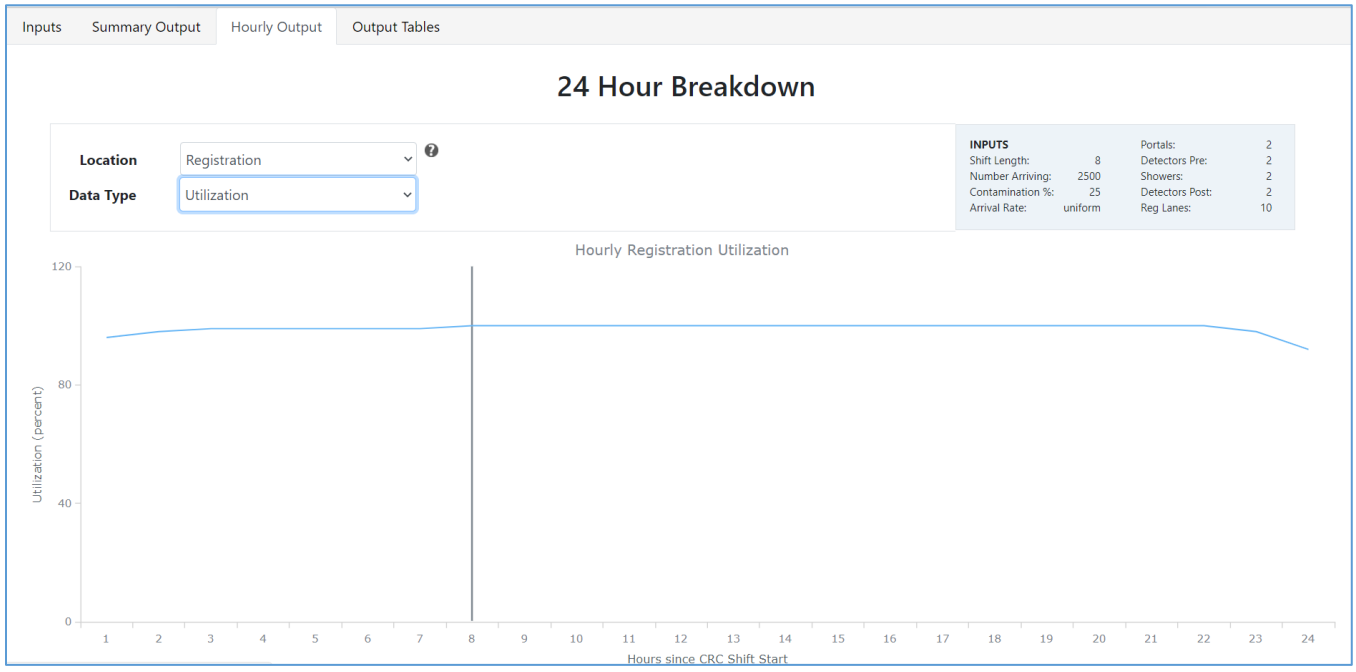
If station Utilization is 90% or higher, it is likely a potential bottleneck. If in addition to high utilization there are long lines and excessive wait times, the station is most likely a bottleneck and additional resources will be most effective if placed here. If utilization is high but line lengths and wait times are relatively low, there is a lower priority for requesting additional resources for this station.

How do you apply the data to decide which actions to take?

Hourly Outputs Tab provides more information on when bottlenecks begin to appear and if additional resources are needed the entire shift or at certain time frames during the shift. Instructions on applying 24-hour data are found in the next section, *How quickly do bottlenecks appear?*

How quickly do bottlenecks appear?

Information Location: Station plots on **Hourly Tab**



What does the information mean?

When utilization approaches 90% and remains steady at high utilization, this is likely the start of the bottleneck. If utilization is high along with long lines and excessive wait times, the station is most likely a bottleneck and additional resources will be most effective if placed here. If utilization is high but line lengths and wait times are relatively low, priority might be placed lower on requesting additional resources for this station.

Another possibility is that utilization is very high in the beginning of the shift or for a period during the shift where surges of people are arriving, but it quickly falls and returns to an acceptable utilization rate. This is most likely not the highest priority bottleneck so other stations should be viewed to determine where additional resources would be most beneficial over the course of the whole shift.

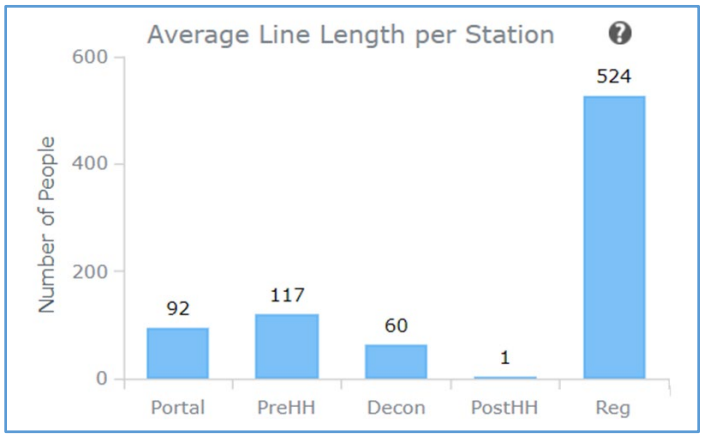
How do you apply the data to decide which actions to take?
If bottlenecks seem to appear almost immediately or within the first hour or two of a shift and remain constant, the CRC will not have enough resources to process all arriving individuals. Planners should add additional resources to this station and perform another CRC SimPLER estimate to see if the addition of resources pushes the bottlenecks to later in the shift or removes them completely.

If bottlenecks seem to appear almost immediately or within the first hour or two of a shift but seem to decrease as the shift goes on, CRC managers might move staff or resources from other stations to overcome the initial bottleneck and then return to their own stations as the opening surge is complete. Make sure that staff and resources are not being taken from stations with high utilization as they are needed there.

If bottlenecks appear later or near the end of the shift, it might be possible for staff or resources to be moved from lower utilized stations to help bottleneck stations temporarily alleviate their hold ups.

Do I have enough space to handle bottlenecks?

Information Location: **Average Line Length per Station** on the **Summary Output** tab

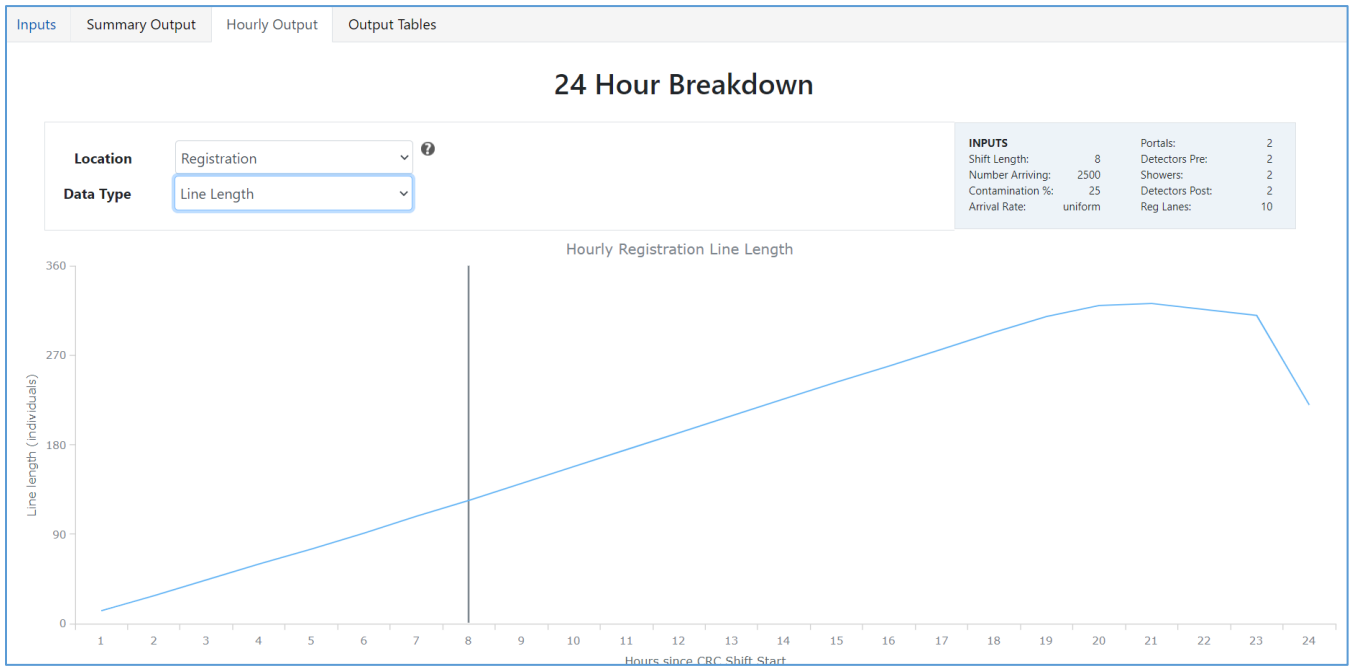


What does the information mean?
Average line length is the average number of individuals who are waiting in line before receiving service at each station. It is important to note that if there are long lines but wait times are low, this is not necessarily a bottleneck but will require enough building capacity to hold the individuals.

How do you apply the data to decide which actions to take?

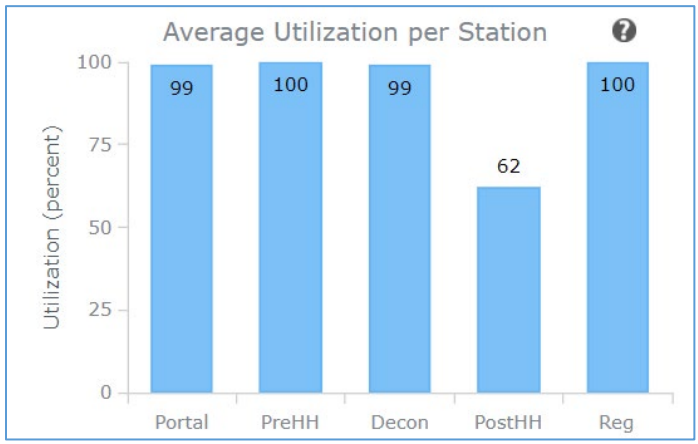
Average line length can be used to assess space allocations for lines and CRC set up. Planners should use average line length to determine if their CRC location has the capacity for the lines that may develop during CRC operation. Hourly averaged line length can be viewed in the Hourly Output tab. This will show peaks in line length and when lines might start to decrease over a 24-hour period.

In the example below, the line length at registration continues to increase after the shift end. This is because individuals are arriving from other stations within the CRC, but the registration line is not moving at a fast-enough rate to decrease the line. Registration is the last station before leaving the CRC so relieving the bottleneck at registration would immediately improve the throughput for the overall CRC.



Where can I possibly pull additional staff from to alleviate my bottlenecks?

Information Location: **Utilization** on the **Summary Output tab** and **Hourly Output tab**



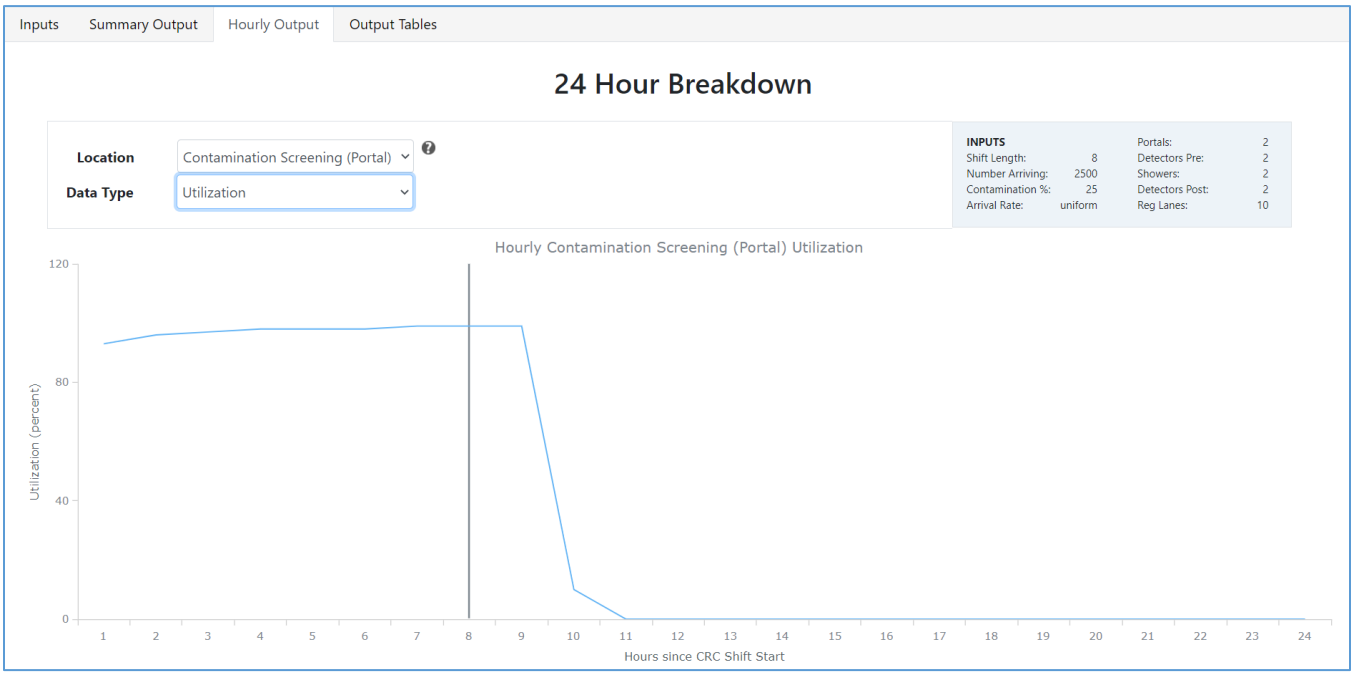
What does the information mean?

Average Utilization is the percent of time that the station is being used for the entire shift. Think of this as the percent of time that the station is busy. A staff member at a station that is 99% utilized on average is not idling or waiting to serve additional individuals while a staff member at a station that is 60% utilized might have some down time and will be waiting to receive individuals. Stations might be utilized at capacity for the beginning of the shift surge and then as the shift progresses, they can decrease in utilization.

How do you apply the data to decide which actions to take?

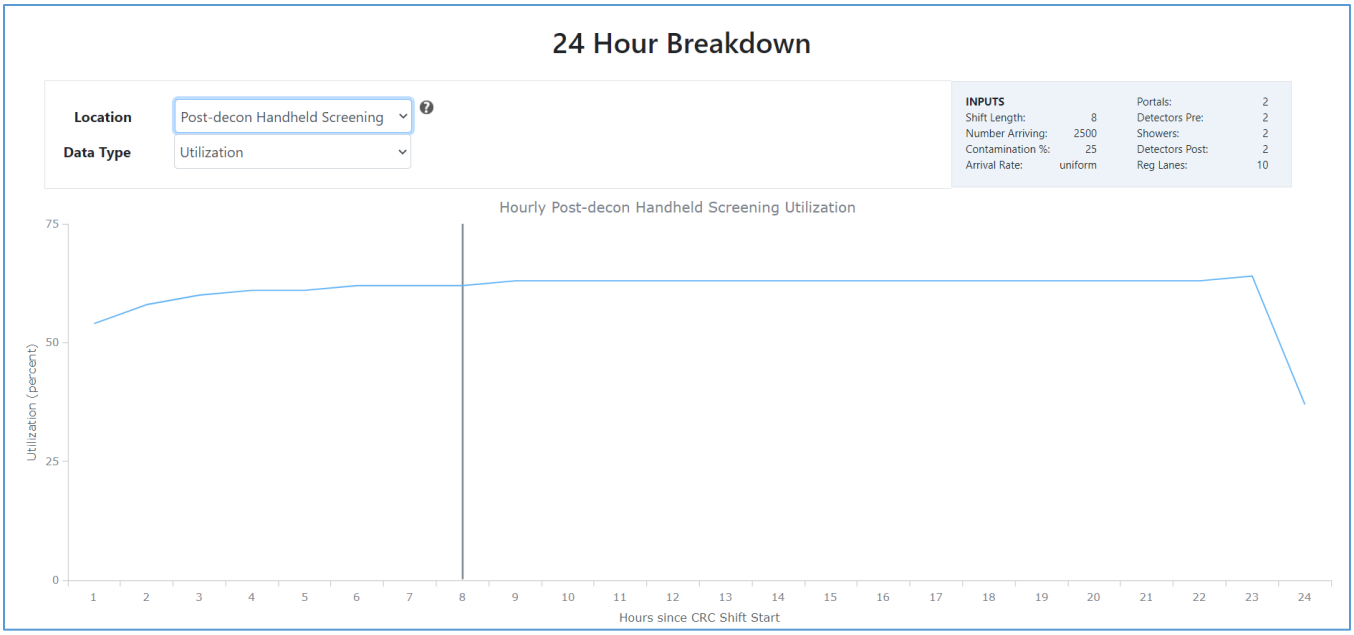
Average utilization is useful for determining where additional resources can be added or removed. Utilization above 90% is a good starting point when looking to add more resources. As resources become more readily available, lower rates of utilization can be used to evaluate where to place additional equipment or personnel.

In this example, almost all stations have high utilization. For a closer look at where additional staff or resources could be temporarily placed to alleviate surges, view the 24-hour break down of the utilization in the hourly breakdown tab.



Contamination Screening is the first station where individuals receive service, so it is likely the first station to have staff available to assist at other stations. The Hourly Contamination Screening Utilization plot shows that the Contamination Screening station remains busy over the course of the shift but quickly decreases after the shift end. Staff would not be able to assist during the shift but might be able to move to other stations after the shift ends. This station would not be the best choice to move staff from initially.

Since Post Handheld Screening had the lowest utilization on average for the shift, let us look at this station's 24-hour utilization.



Utilization of the Post Handheld Screening station remains consistent at approximately 63 percent over the course of the shift and several hours afterwards. Since there are no major increases or decreases, this station will need to remain staffed but could move a staff member to assist with Registration after the last person in line at Post Handheld Screening has been screened.

Tip: Removing a staff member at post handheld screening would also decrease the number of detectors being used. This would need to be reflected in additional CRC SimPLER throughput estimates where number of post handheld detectors would decrease, and number of registration lanes would increase.

Appendix 1 – Scenario Walk Throughs

To assist new users, this appendix provides step-by-step walk throughs for using CRC SimPLER using different scenarios. If you need assistance running specific scenarios contact simpler@cdc.gov .

Scenario 1

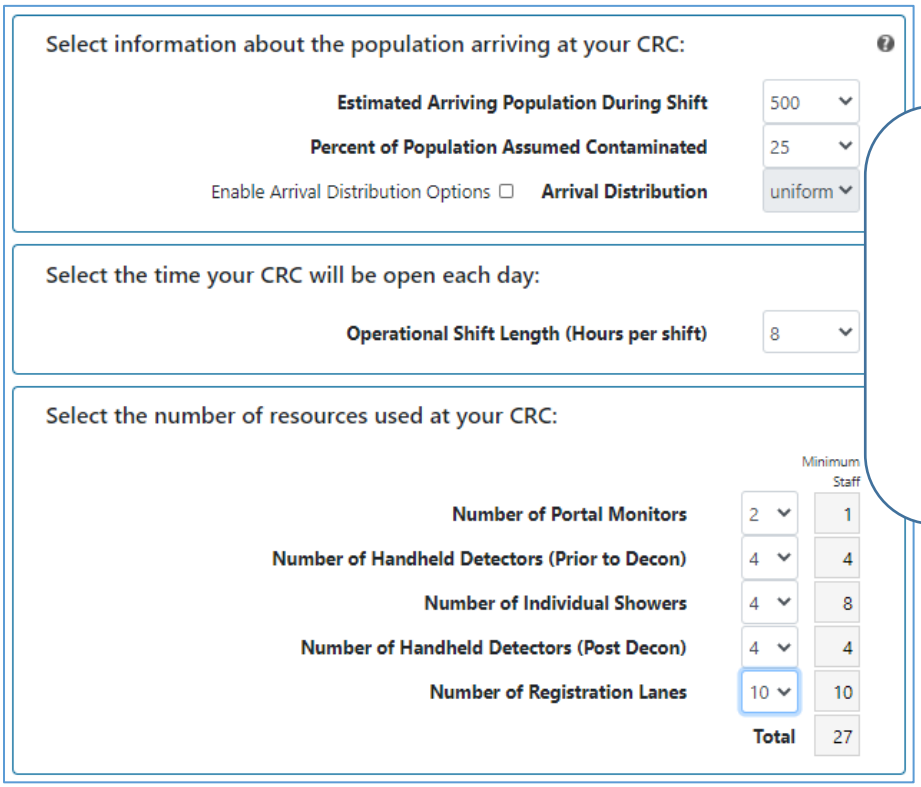
This scenario will start with basic inputs for CRC SimPLER based on a potentially high contamination event.

Narrative

A radioactive source is found at a waste site and the label has been removed. The waste site manager opens the source container and finds that the material inside is powder-like and has a bright, attractive color. Waste site manager takes the open source into the office and passes it around for staff to see and says they can take samples home to show their families. Several days later, several family members note that they are not feeling well. Fast forward to you getting a phone call from the state EOC and you have been tasked to set up a CRC to screen the families of waste site workers and their close neighbors for potential contamination.

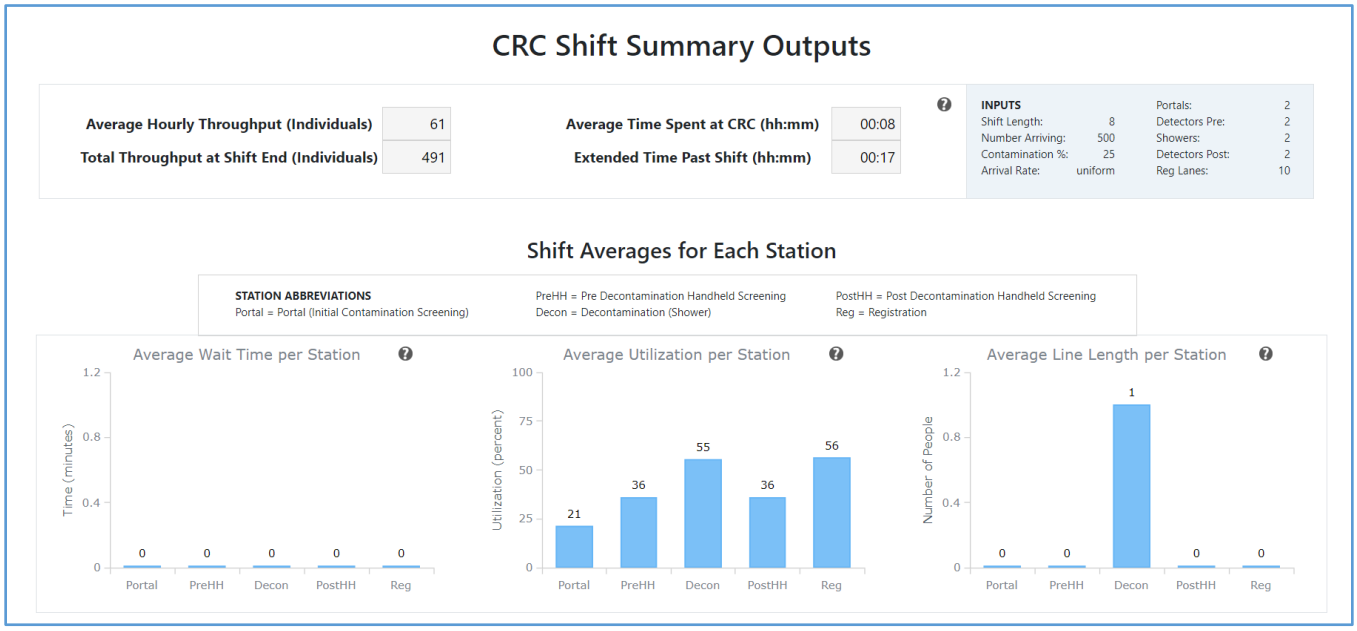
Including extended family members and neighbors, the anticipated population you will need to screen for contamination is approximately 500 individuals. After speaking with radiation control staff, they let you know that it is likely (25%) many individuals will be contaminated above the screening criteria they have set for the CRC. Your CRC will be set up at a local facility that has 4 showers. Two portal monitors (and staff), 8 handheld detectors (and staff) and 10 staff trained for registration are being deployed to your facility. You set an 8-hour shift for families to arrive. Will you be able to screen everyone in one eight-hour shift?

Given Inputs:



Shift length: 8 hours
# of people Arriving: 500
Percent Contaminated: 25%
Arrival Distribution: Uniform
# of Portals: 2
# of HH Pre Decon: 4
# of Showers: 4
# of HH Post Decon: 4
# of Registration Lanes: 10

Summary Output Screen



Takeaways from Summary Outputs

Looking at the Summary Outputs screen, we will walk through the questions from the "Using CRC SimPLER to Answer Specific Questions" section.

- Can I achieve my throughput goals?
  Yes, we can achieve our throughput goals with our current CRC setup and plans. **Total Throughput at Shift End** is 491. This is within 5-10% of our desired throughput of 500 individuals.

- How much longer will I need to stay open to process everyone at the CRC?
  The **Extended Time Past Shift** is 18 minutes. The CRC should be able to finish processing most individuals within their shift time and only extend for about 30-45 minutes. Note that CRC SimPLER provides estimates based on modelling and values should be taken as approximations.

- How long can individuals arriving at the CRC expect to be there?
  The **Average Time Spent at CRC** by an individual is approximately 8 minutes. Looking at the station shift average graphs, we see that there are on average no lines or wait times which means that the individuals are flowing quickly through the CRC. The average time spent at the CRC by individuals in this instance is solely dependent on each station's processing time.

- Which station is causing my bottlenecks?
  For this CRC SimPLER estimate, there aren't any stations that would be considered major bottlenecks. The station with the highest utilization is **Registration** but since on average there no lines, we assume there are no bottlenecks to address.

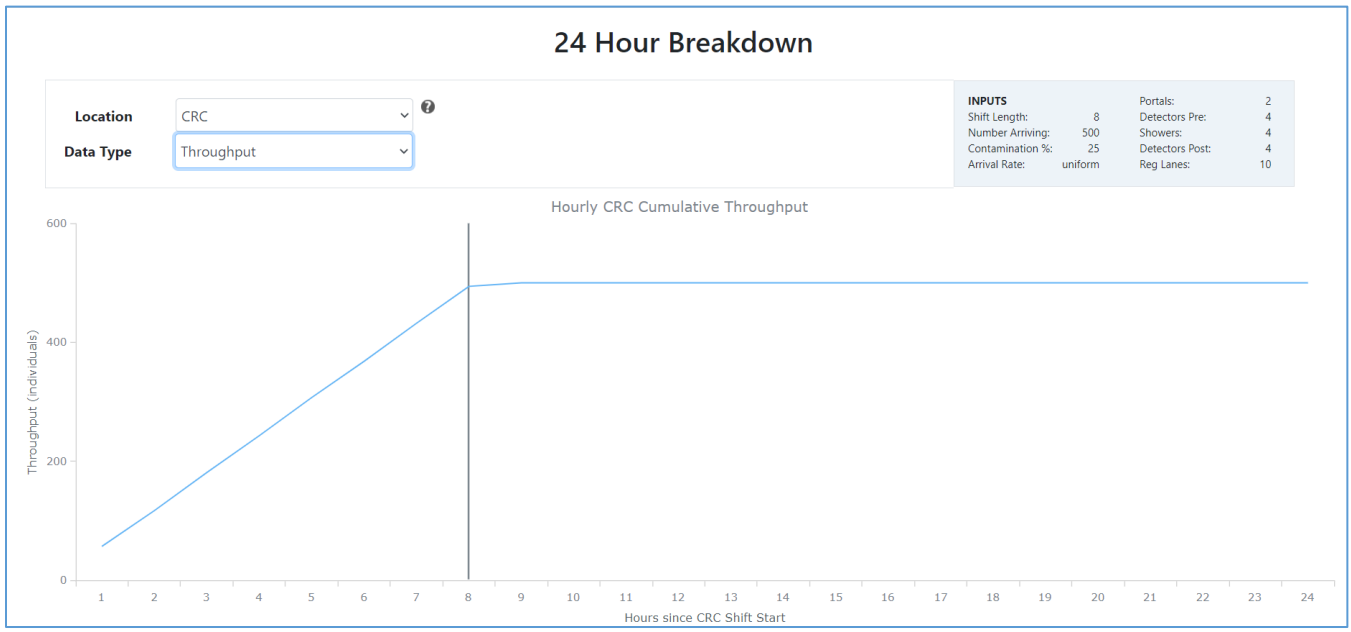
- How quickly do bottlenecks appear?
  Major bottlenecks do not appear in this CRC SimPLER Estimate.

- Do I have enough space for when bottlenecks occur?

Major bottlenecks do not appear in this CRC SimPLER Estimate so there should be enough space.

- <u>Where can I possibly pull additional resources?</u>
  Major bottlenecks do not appear in this CRC SimPLER Estimate but if we wanted to increase the Registration capacity, we would want to increase the number of lanes available at registration.

Hourly Output Screen



Key Takeaways from Hourly Output Screen

This CRC SimPLER estimate shows that our CRC had no major bottlenecks so we will check the 24 Hour Breakdown for the CRC Cumulative Throughput just to confirm that we complete processing of all individuals shortly after the end of the shift.

Suggested Actions

From looking at all information, we find that it is very possible that we will be able to process the arriving population with our current CRC plans and resources in an 8-hour shift. Other factors could come into play to slow down CRC processes but the utilization and wait times are low within CRC SimPLER so planners will have to adapt as the CRC is open and routinely maintain awareness of CRC operations.

Scenario 2

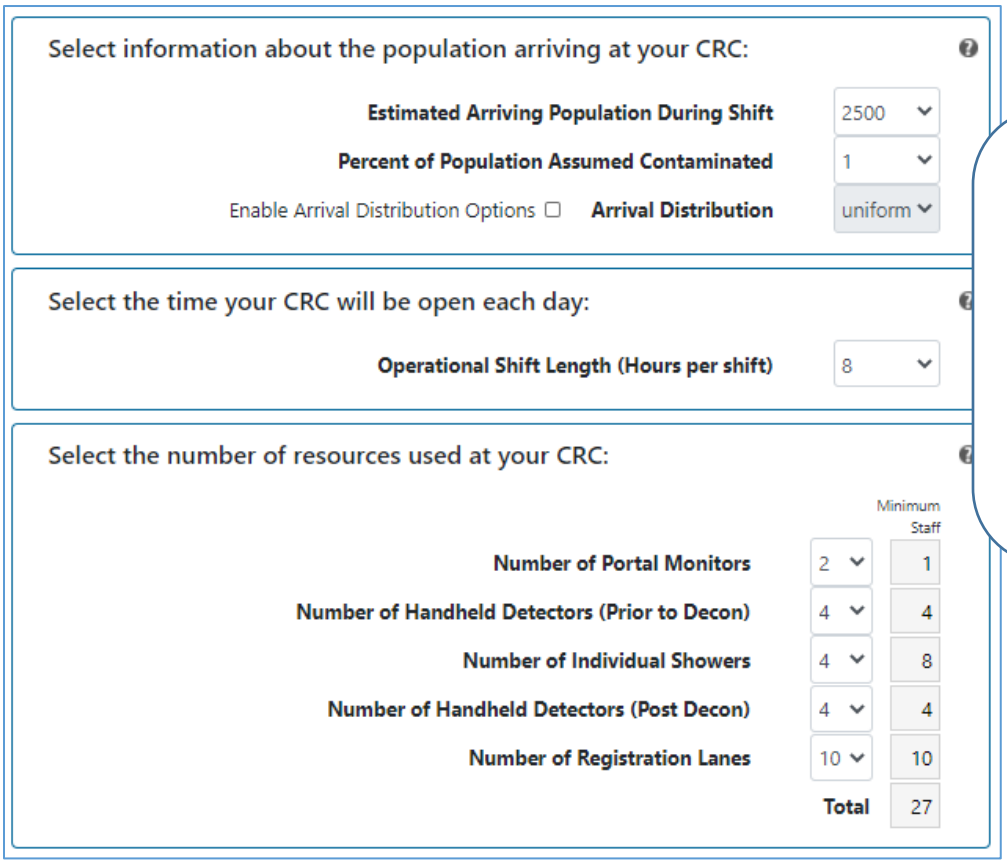
This scenario is the same scenario as above, but the population increases. At the direction of the Radiation Control Program, the CRC operator raises, the contamination screening criteria at the CRC, resulting in a decrease in the estimated percent of contaminated individuals. This is an example of how changing screening criteria for a CRC can impact the overall throughput of individuals.

Narrative

Several news media have reported on the contamination incident and individuals in many surrounding neighborhoods are concerned that they might have been contaminated. Based on the calls coming into the call center, you are informed that you should be prepared to receive approximately 2500 people but want to ensure you are prioritizing those who are very contaminated first. Working with your radiation program, you determine the screening criteria that will pull out highly contaminated individuals. You expect that since most individuals are coming from neighboring areas that were not contaminated, the likely percent of individuals that will be contaminated is 1%.

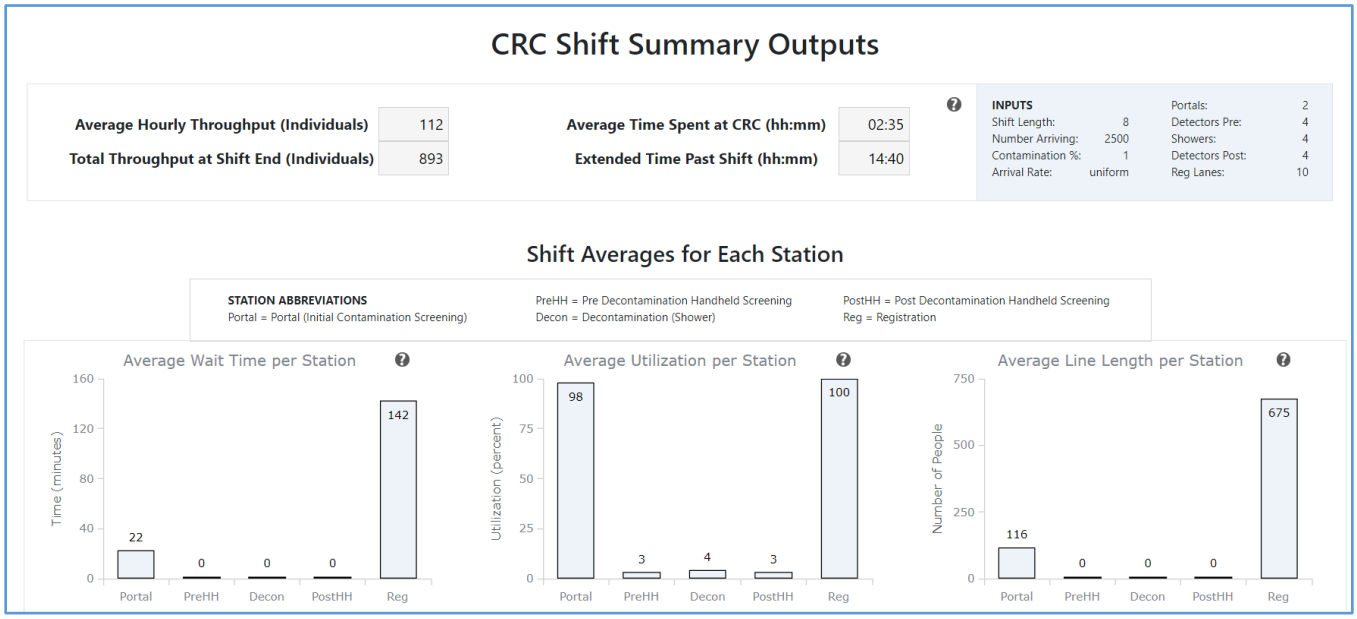
Your CRC will be set up at a local facility that has 4 showers. Two portal monitors (with staff), 8 handheld detectors (with staff) and 10 staff trained for registration are being deployed to your facility.

Given Inputs:



Shift length: 8 hours
# of people Arriving: 2500
Percent Contaminated: 1%
Arrival Distribution: Uniform
# of Portals: 2
# of HH Pre Decon: 4
# of Showers: 4
# of HH Post Decon: 4
# of Registration Lanes: 10

Summary Output Screen



Takeaways from Summary Outputs

Looking at this information, we initially notice that there are bottlenecks and we are not processing all individuals within our 8-hour shift. We will walk through the questions from the "Using CRC SimPLER to Answer Specific Questions" section.

- Can I achieve my throughput goals?
  No, we will not be able to achieve our throughput goal of 2500 individuals in 8-hours. The **Total Throughput at Shift End** is 893 individuals with is less than half of our throughput goal. This indicates there is at least one bottleneck in our CRC.

- How much longer will I need to stay open to process everyone at the CRC?
  The **Extended Time Past Shift** is 14 hours and 40 minutes. The CRC would need to stay open 1-2 additional shift lengths beyond the current shift to complete processing of all individuals. The CRC may not have the staffing capability to accomplish. Note that CRC SimPLER provides estimates based on modelling and values should be taken as approximations.

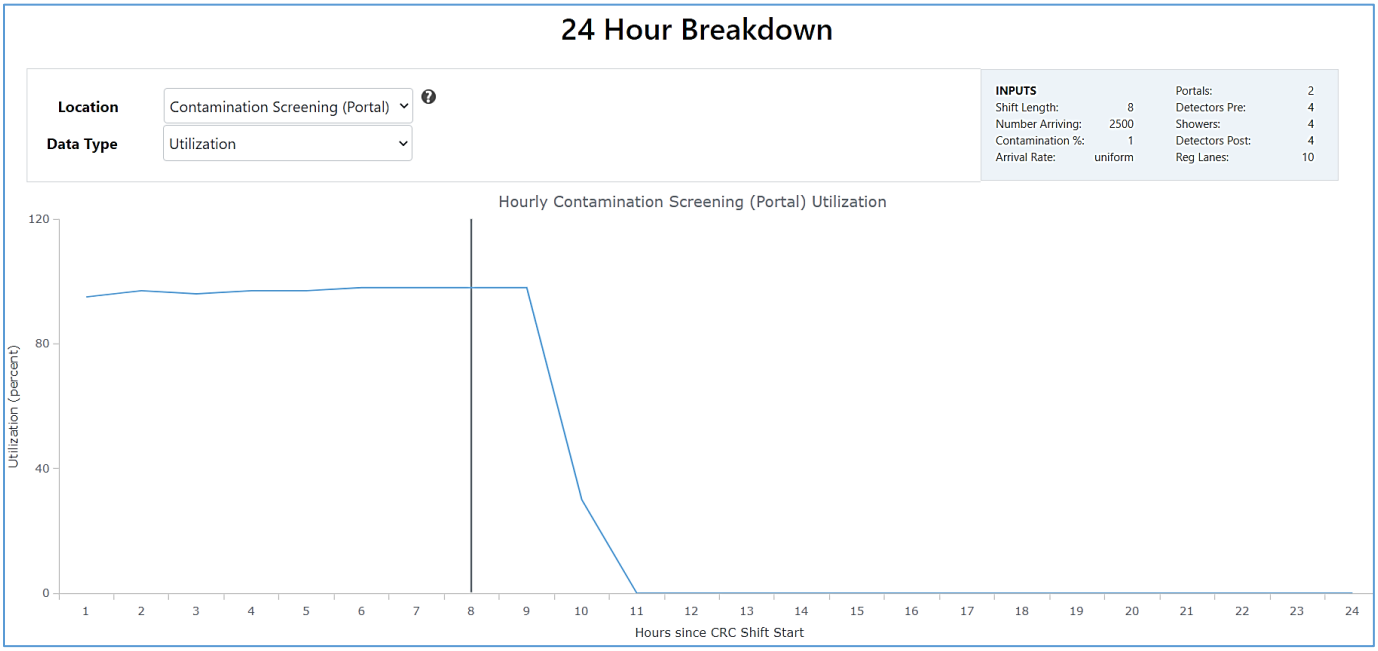
- How long can individuals arriving at the CRC expect to be there?
  The **Average Time Spent at CRC** by an individual is 2 hours and 35 minutes. For this example, we will say that we want individuals to be at the CRC less than an hour and a half. We will try to reduce bottlenecks and bring down the average individual processing time in additional CRC SimPLER estimates in this example.

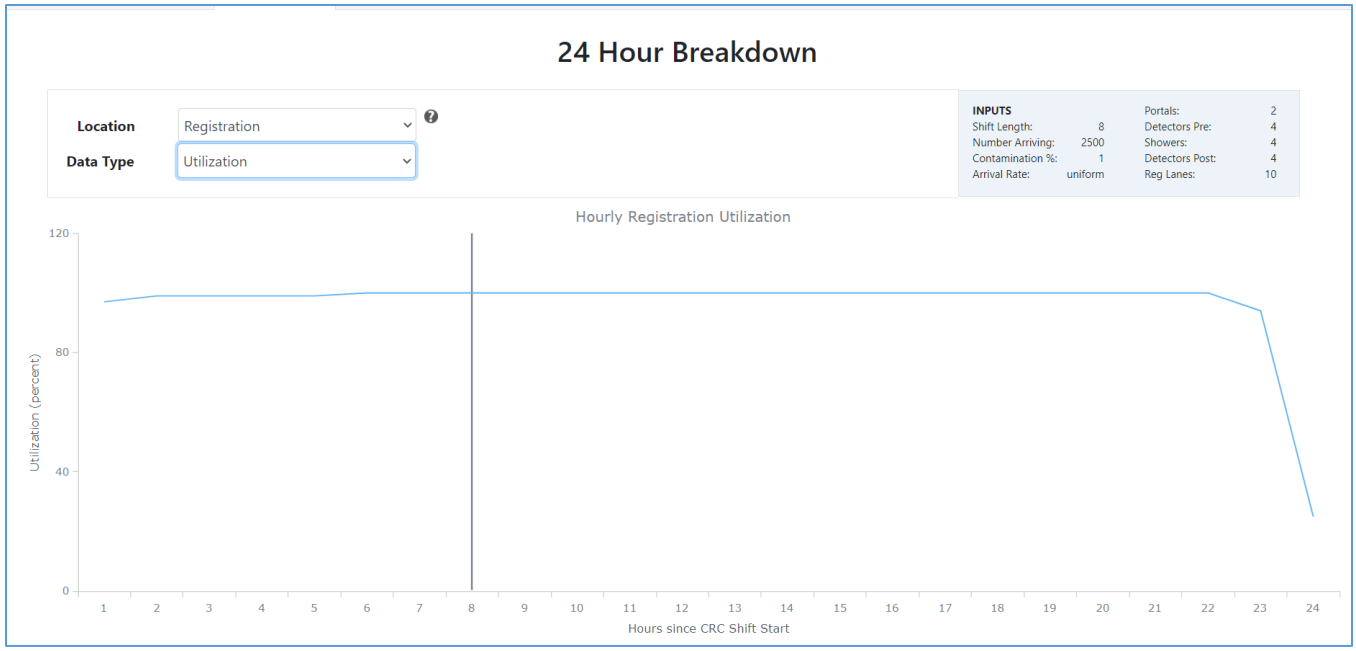
- Which station is causing my bottlenecks?
  Registration appears to be the main bottleneck with an average wait time of over 2 hours, average utilization of 100%, and average line length of 675 people. **Contamination Screening** has an average utilization of 98% which is also high. The wait time for Contamination Screening is about half an hour and has an average line length of 116 people. **Registration** is likely the station that if we add resources, we will see the greatest benefit.

- <u>Do I have enough space for when bottlenecks occur?</u>
  We do not have enough space for the bottleneck at **Registration.** The average line length for Registration during the shift is 675 people. Let us assume that the room that the Registration station is set up in has an occupancy of 500 people with chairs, standing room and tables to complete registration information. This would mean that we need to find a way to add resources or re-arrange resources to reduce the long lines building up at registration. We will check what the potential maximum line that Registration will grow to in the Hourly Output Screen Section to see how large we might expect the line to grow.
  We do have space for the line length of 116 individuals at **Contamination Screening** as the line can span through an open hallway and through other corridors in the building. We would want to keep an eye on the line length at this station since it is the first station in the CRC process and lines out the door could become a safety hazard due to weather or oncoming traffic.

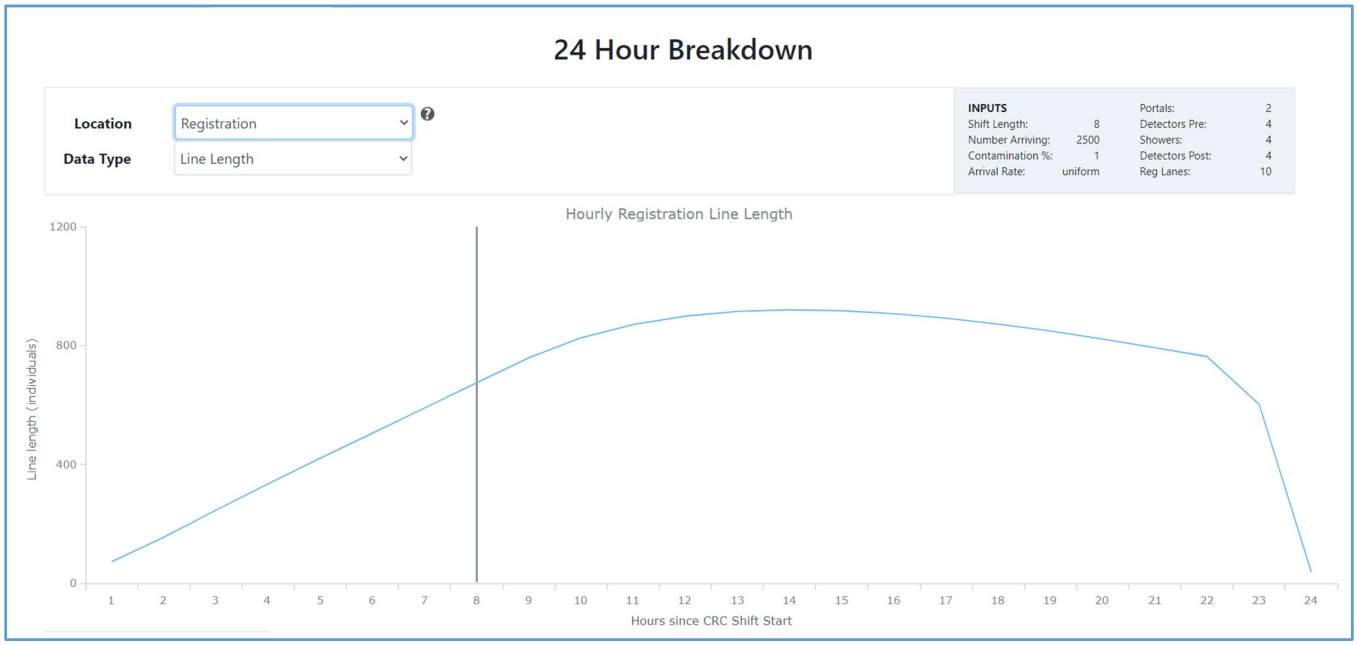
- <u>Where can I possibly pull additional resources?</u>
  Pre-Decon Handheld Screening, Decontamination (Showers) and Post-Decon Handheld screening all have very low utilization and no lines. These stations would be a potential place to move staff from to reduce the bottleneck at **Registration**. We can also see what the impact of

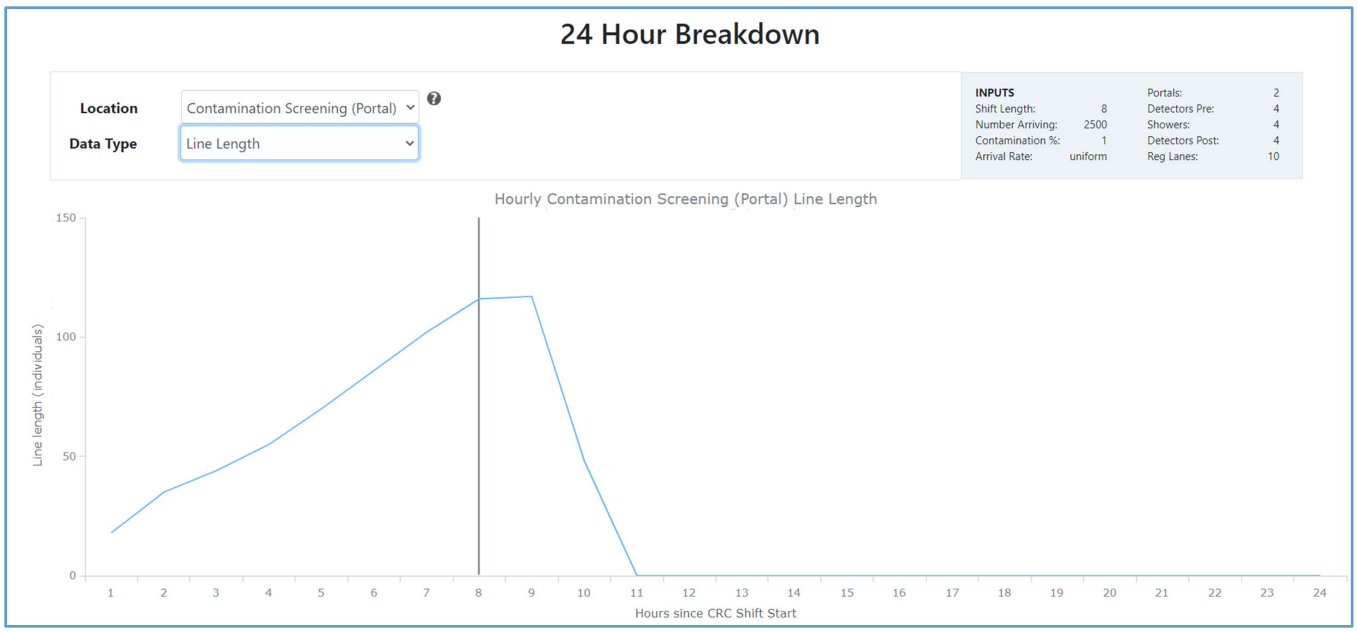
Hourly Output Screen





- <u>How quickly do bottlenecks appear?</u>
  Both **Contamination Screening** and **Registration** start with high utilization and stay at 90% or higher the entire shift. Registration continues to be 100% utilized until 14 hours after she shift end. Since both stations start with high utilization and are completely utilized the whole shift, these are both bottlenecks with Registration being a major limiting station for your CRC throughput.





- <u>Do I have enough space for when bottlenecks occur? Continued</u>
  We know that we do not have enough space for **Registration** and want to see how long the lines might grow while we continue to process all remaining individuals. The line length approaches 900 individuals after the shift end and does not begin to decrease until almost 8 hours after the shift end.
  Contamination Screening had an average line length of 116 individuals and does not grow much larger after the shift end. The line length dramatically decreases after an hour or so of the shift end.

Key Takeaways from Hourly Output Screen

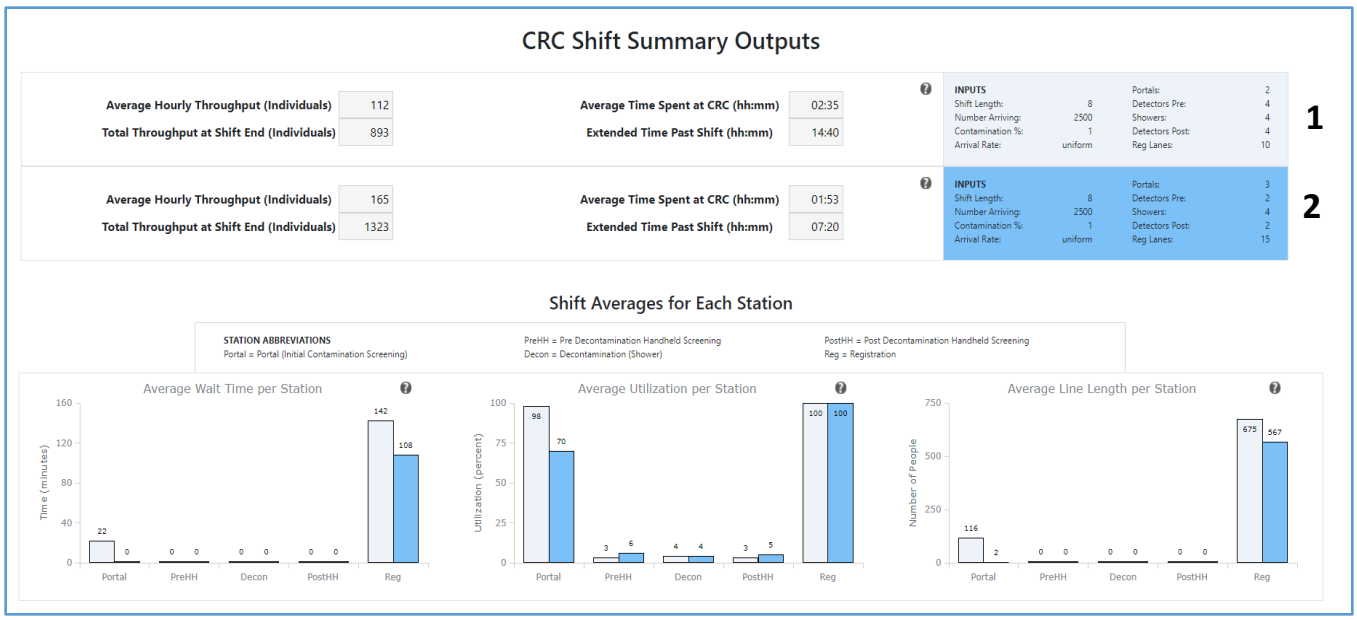
Registration is the largest bottleneck and **Contamination Screening** is the second largest bottleneck. We will run a few additional CRC SimPLER estimates in the next section to see what the impact of additional resources at each station would have on our throughput and total time needed to process all arriving individuals.

Suggested Actions

We will explore two CRC SimPLER estimates to evaluate the impact of additional resources at Registration and Contamination Screening.

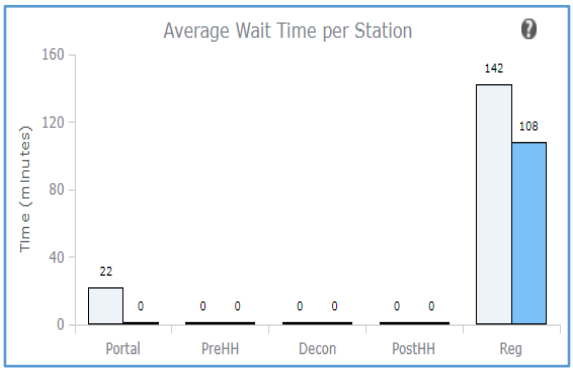
CRC Estimate with the addition of 1 portal monitor and 5 registration lanes

First, we will try a CRC setup where we move staff from Pre- and Post-Decon to help with Registration. We also borrow one additional portal monitor from a neighboring jurisdiction and can provide a staff member to use the new portal monitor. We have 3 portals, 4 handheld detectors (2 Pre- and 2 Post- Decon), 4 showers and 15 lanes of registration all with appropriate staff. Using the “Toggle Comparison Tool”, we will add this new set up to our other scenario which will allow us to do a side-by-side comparison. Our original scenario is lighter colored information which is the top row for the CRC Summary data and the bars on the left in each bar graph pairing. The new estimate is represented by the darker colored box and bar graphs which are on the right in each bar graph pairing. For reference, the original estimate will be labelled 1 and 2 in the CRC Shift Summary Output page below.

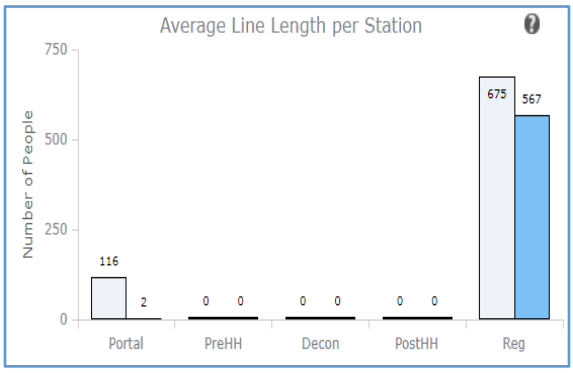


By moving 5 staff to Registration, increasing the available lanes from 10 to 15 and adding one portal monitor at Contamination Screening, we have increased our Total Throughput at Shift End to 1323 individuals which is a 50% increase from our original CRC set up. The Average Time Spent at the CRC by an individual has been reduced by half an hour and is now a little less than 2 hours. We now only need to stay open an additional 7-8 hours to finish processing individuals as opposed to the 15 hours. If we assume each shift for staff is 8 hours, this means we only need one additional shift of staff to assist with final monitoring and registering of those still in the CRC after closing.

Comparing the Average Wait Times per Station for Registration, we notice that we have decreased the wait time from over 2 hours to now a little over an hour and a half. This is still relatively long, and we will attempt to reduce this wait time even more in the next CRC SimPLER estimate.



Contamination Screening is no longer a bottleneck, and the average utilization has fallen to 70% which allows for occasional surges and flexibility. Adding portal monitors beyond the three in this estimate would likely not be of a benefit to the CRC throughput and additional costs and staff could be utilized elsewhere – most likely Registration.



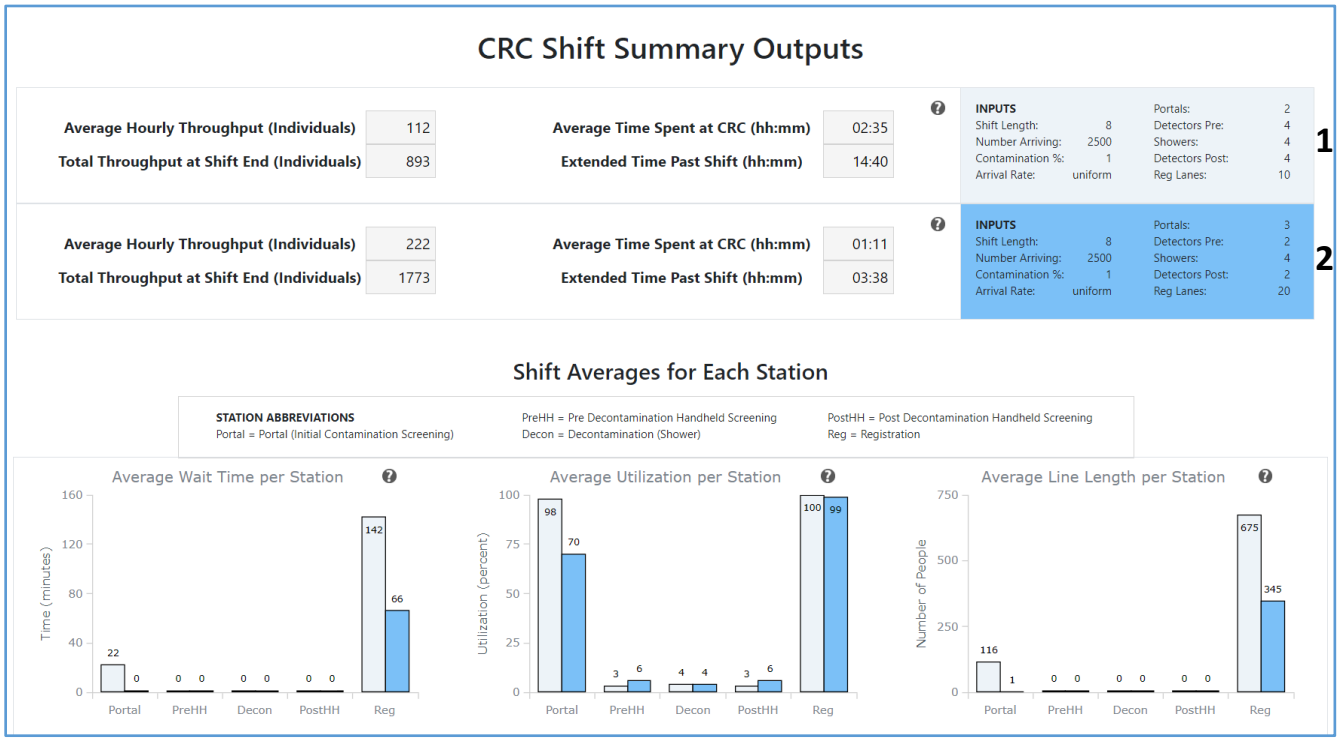
Comparing the Average Line Length per Station for Registration, we notice that we have decreased the line size from 675 individuals to 567. Decreasing the average line by 100 individuals is a huge improvement but due to space restrictions, we would like to decrease the size even more. Additional Registration lanes are needed to accomplish this.

CRC Estimate with the addition of 1 portal and 10 registration lanes

In addition to the staff, we were able to move from Pre- and Post-Decon to help with Registration, we can request 5 volunteer staff who will be given Just-In-Time training to help with Registration. We have borrowed one additional portal monitor from a neighboring jurisdiction and can provide a staff member to use the new portal monitor. We have 3 portals, 4 handheld detectors (2 Pre- and 2 Post- Decon), 4 showers and 20 lanes of registration all with appropriate staff. The original CRC Shift Summary Outputs are provided with the new scenario using the "Toggle Comparison Tool". The original CRC scenario will again be the lighter shade bar graphs on the left in each bar graph pairing and the top portion of information on output page. The new CRC setup will be the darker colored bar graphs on the right in each bar graph pairing and below the original CRC outputs on the top. For reference, the original estimate will be labelled 1 and 2 in the CRC Shift Summary Output page below. CRC SimPLER estimates where 15 Registration lanes were available is provided in boxes with dots (previous estimate).

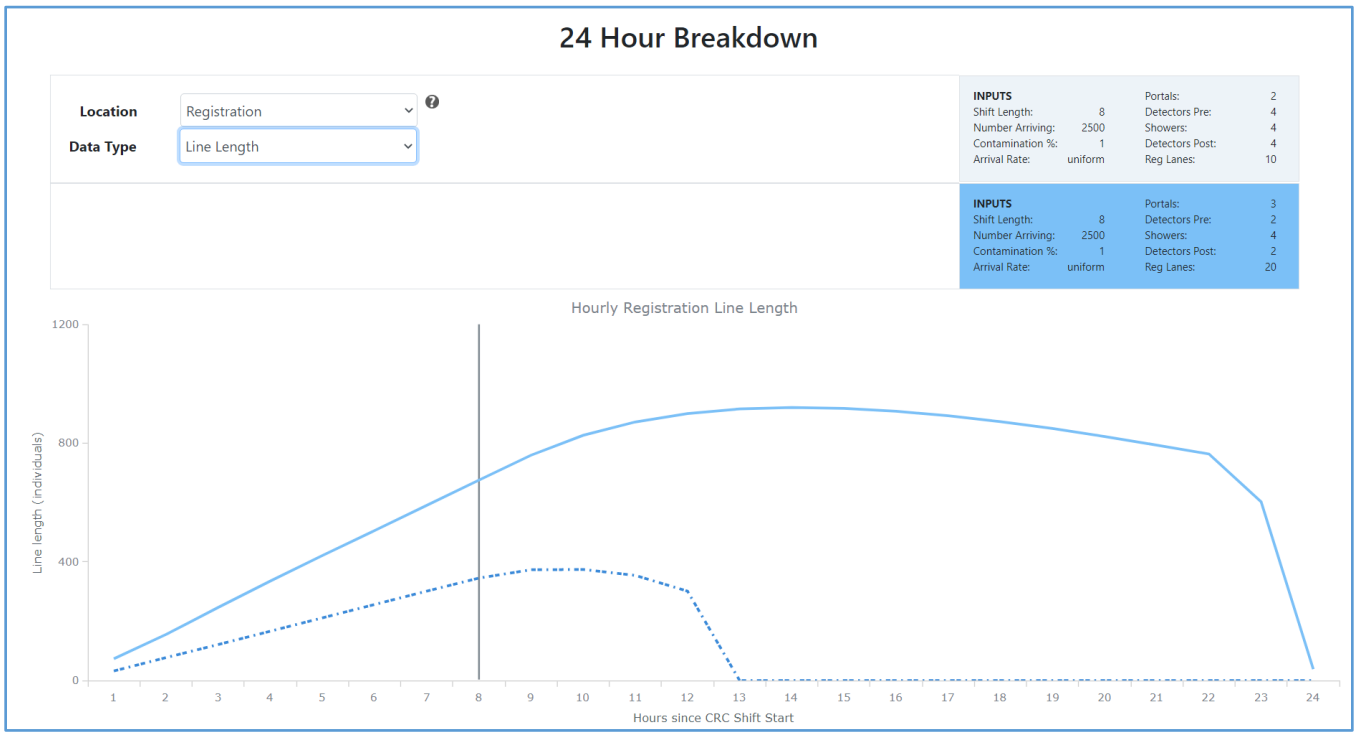
Average Hourly Throughput (Individuals)	165	Average Time Spent at CRC (hh:mm)	01:53
Total Throughput at Shift End (Individuals)	1323	Extended Time Past Shift (hh:mm)	07:20

INPUTS			
Shift Length:	8	Portals:	3
Number Arriving:	2500	Detectors Pre:	2
Contamination %:	1	Showers:	4
Arrival Rate:	uniform	Detectors Post:	2
		Reg Lanes:	15



By increasing the available lanes from 10 to 20 and adding one portal monitor at Contamination Screening, we have increased our Total Throughput at Shift End to 1773 individuals which is almost a 100% increase from our original CRC set up. The Average Time Spent at the CRC by an individual has been reduced to a little over an hour which is half of the original time an individual would be at the CRC. We now only need to stay open an additional 3-4 hours to finish processing individuals as opposed to the 15 hours in the original estimate or 7-8 hours in the estimate where we increased registration from 10 to 15 lanes. If we assume each shift for staff is 8 hours, this means we only need one additional shift of staff to assist with final monitoring and registering of those still in

the CRC after closing. This second shift staff could break down or reset the CRC setup with the left-over time in their shift since final processing will not take the entire 8 hours.



The original 24-Hour Breakdown for Registration Line Length (solid line) is overlayed over the new CRC setup (dashed line) with 20 lanes of registration. We can see how adding 10 lanes of registration not only decreased the total amount of time we would need to stay open to process all individuals from 24 hours to 13 hours, but also the size of the line that would be at registration. Remember that our largest line length at Registration was over 900 individuals developed after the shift end as individuals were arriving from other stations within the CRC. With the addition of 10 Registration lanes, we bring the maximum line length down to a little over 300 individuals. This new CRC setup with 20 lanes of Registration allows us to fall within our space constraints for the CRC location.

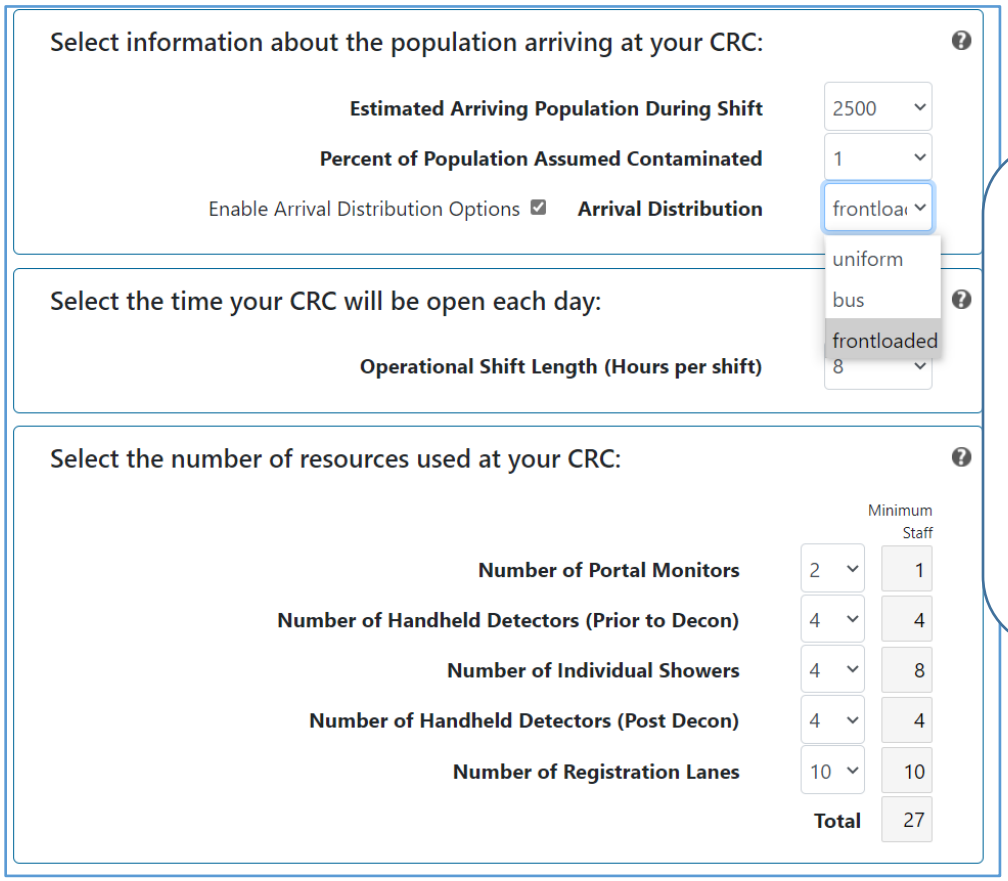
Scenario 3

This scenario shows how to use different types of arrival distributions for the same scenario we have been working through.

Narrative

The Joint Information Center has been pushing out notifications of where and when the CRC will be set up. Since you anticipate that people will be eager to be screened early, there is likely a line that will form before the facility opens. You want to evaluate your current resources and the impact a line at the start of the shift will have on your throughput. You are expecting 2500 individuals and a low possibility of contamination (1%). Your CRC is equipped with 2 portal monitors (with staff), 8 handheld detectors (with staff), 4 showers and 10 staff who will be running registration. Will your current set up be able to handle the initial surge from the long line at opening? If not, for which stations should you request additional resources?

Given Inputs:

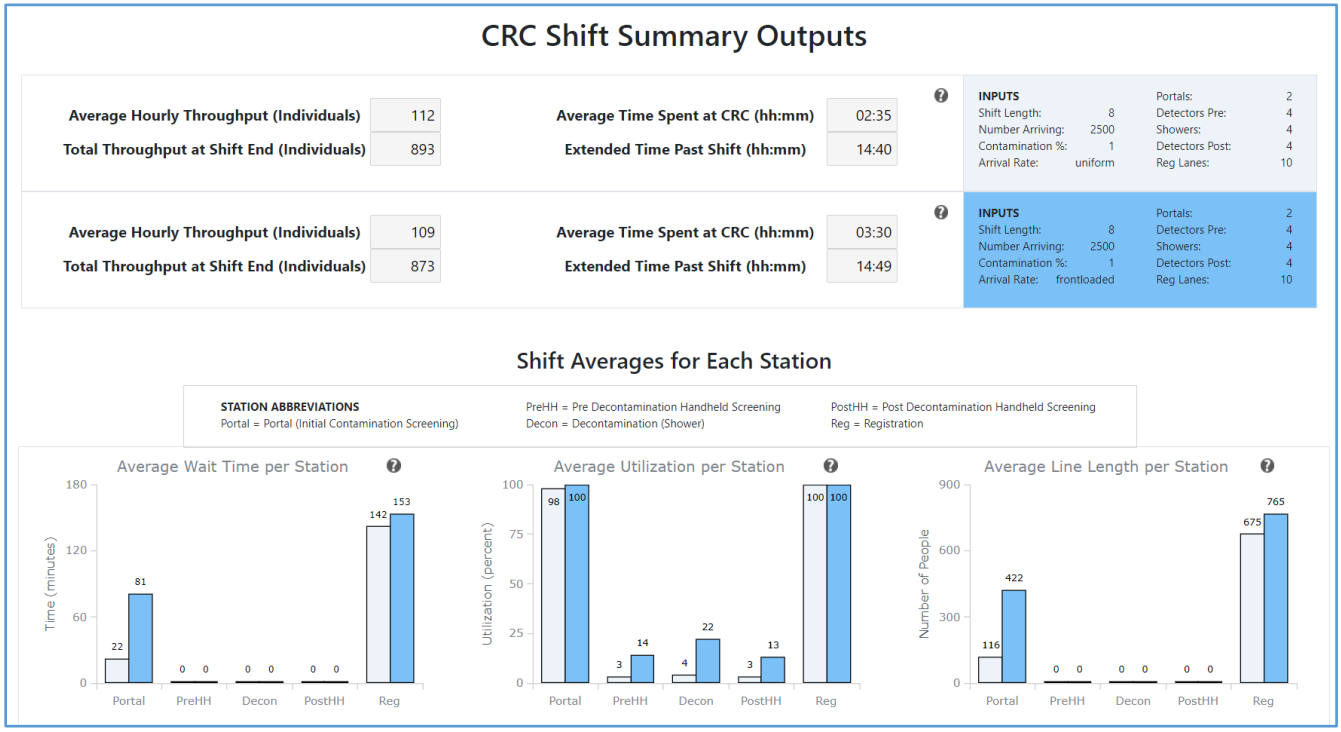


Shift length: 8 hours
# of people Arriving: 2500
Percent Contaminated: 1%
Arrival Distribution:
Front Loaded
# of Portals: 2
# of HH Pre Decon: 4
# of Showers: 4
# of HH Post Decon: 4
# of Registration Lanes: 10

Summary Output Screen

This example will focus on comparing how different arrival distributions may affect throughput.

CRC Shift Summary Outputs from the previous example using “Uniform” arrival distribution are provided alongside the “Front Loaded” arrival distribution to make it easier to compare new CRC SimPLER estimates. “Uniform” is shown in the lighter colored boxes on top and bars on the left labeled 1. “Front Loaded” is shown in the darker colored boxes on top and bars on the right labeled 2.

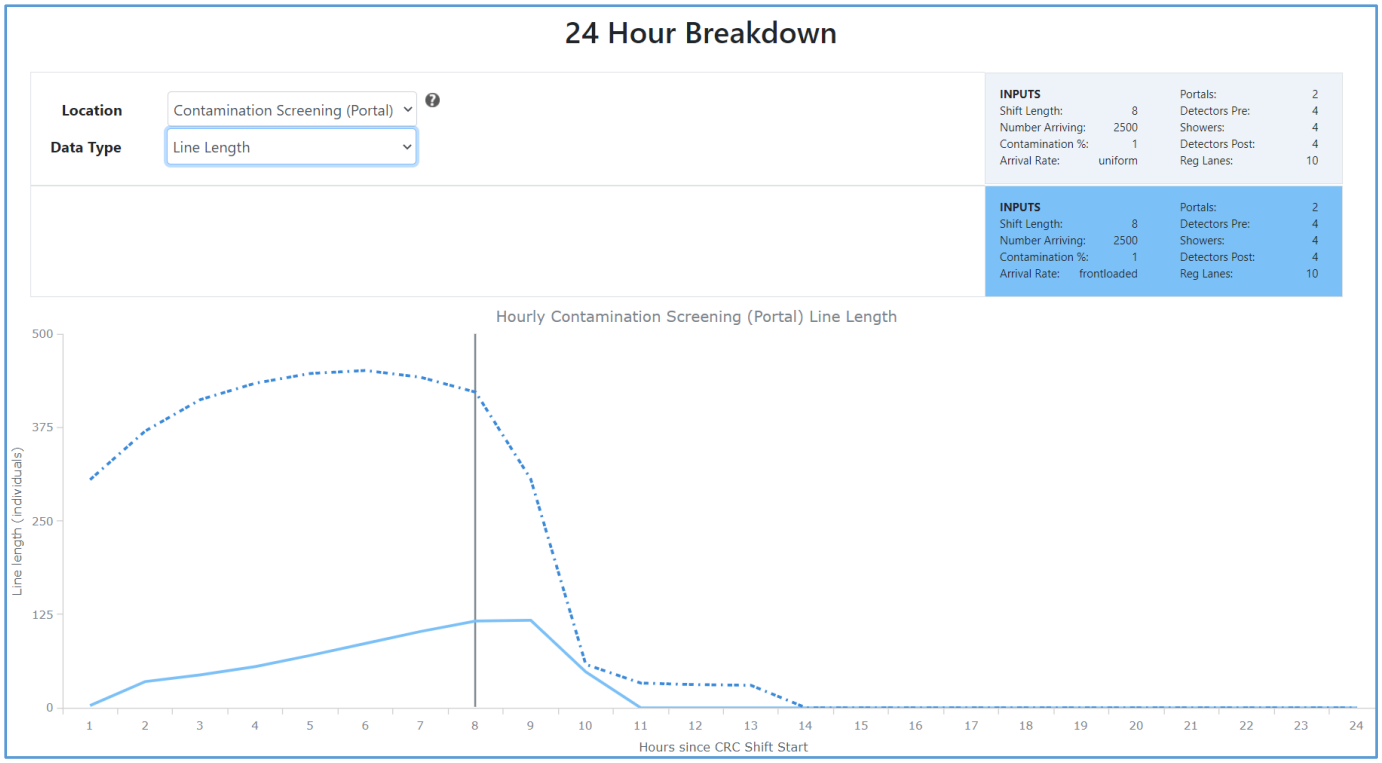


Takeaways from Summary Outputs

Looking at both Summary Outputs, we notice that the overall the **Total Throughput at Shift End** is approximately the same as well as the **Extended Time Past Shift**. The Station Averages for Each Station show that there is an increase in Average Wait Times and Line Lengths for both **Contamination Screening** and **Registration** with the initial surge of individuals arriving at the CRC. The station most impacted by the surge is **Contamination Screening**.

We will use the **Hourly Output Tab** to see how our CRC setup handles the initial surge of individuals arriving at the CRC.

Hourly Output Screen



Key Takeaways from Hourly Output Screen

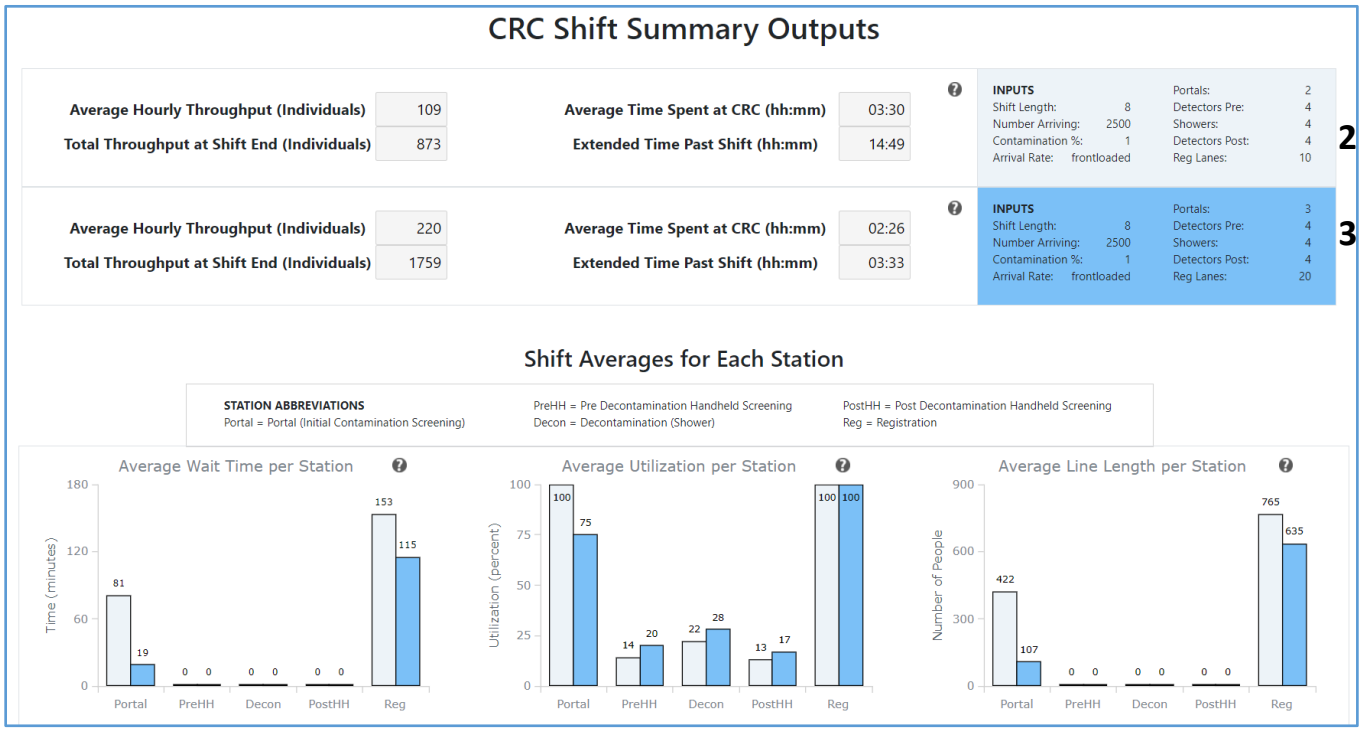
The Hourly Output Screen for Contamination Screening Line Length from the "Uniform" arrival distribution is presented with the "Front-Loaded" arrival distribution we chose for this scenario. "Uniform" arrival is shown with the solid line and "Front-Loaded" is shown with the dashed line. We see that the **Contamination Screening** station quickly has large lines from the initial surge and continues to have large lines until the shift end. The reason this did not happen in the "Uniform" scenario is because individuals were arriving at a rate that allowed lines to slowly develop versus the initial line and bottleneck that occurs with a "Front-Loaded" arrival.
As our CRC setup currently stands, we will not be able to handle the initial surge of arriving individuals.

Suggested Actions

We know that due to the initial surge in individuals arriving at the CRC, **Contamination Screening** becomes the main bottleneck. From Scenario 2, we also know that **Registration** tends to be a bottleneck. We will attempt to alleviate both bottlenecks with additional CRC SimPLER Estimates.

CRC Estimate with the addition of 1 portal monitor and 10 registration lanes

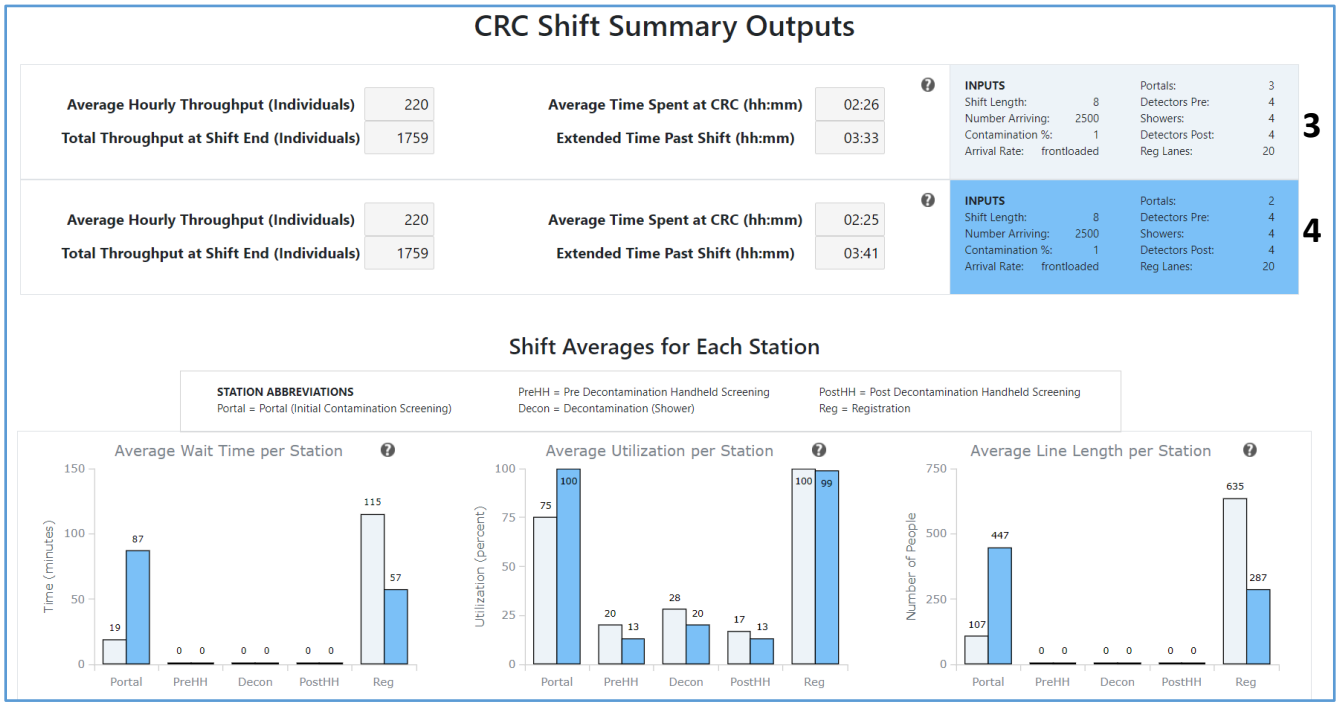
First, we will try a similar setup that alleviated our bottlenecks in Scenario 2, but we will keep staff at Pre- and Post-Decon. Additional staff will be provided for Registration and the portal monitor. We have 3 portal monitors, 8 handheld detectors, 4 showers, and 20 lanes of registration. The original estimate for this scenario is shown in the lighter colored bars and labeled 2. The new estimate is shown in the darker colored bars on the right and labeled 3.



By increasing the available lanes from 10 to 20 and adding one portal monitor at Contamination Screening, we have increased our Total Throughput at Shift End to 1689 individuals which is a 91% increase from our original CRC set up. The Average Time Spent at the CRC by an individual has been reduced by an hour and is now a little more than 2 hours. We now only need to stay open an additional 4 hours to finish processing individuals as opposed to the 15 hours. Registration is still a bottleneck at the Average Line Length is almost 600 individuals and Average Wait Time of almost 2 hours. Since Contamination Screening is the first station in the CRC, alleviating the bottleneck will allow more individuals to flow into Registration, which creates another bottleneck. We want to make sure we do not have too many individuals waiting at Registration such that we have more than the 500 allowed in our Registration space. In the next CRC SimPLER estimate, we will see how only adding additional lanes of registration may impact our CRC throughput.

CRC Estimate with the addition of only 10 registration lanes

Even though we added 10 lanes of registration, by adding the additional portal monitor to Contamination Screening, we saw minimal impact on the registration bottleneck and we are at our occupancy limits we had set for our registration room of 500 individuals. Let us look at how only increasing Registration lanes might affect our throughput. We have 2 portal monitors, 8 handheld detectors, 4 showers, and 20 lanes of registration. New CRC estimates for this set up are shown in the darker colored bar graphs on the right and labeled 4. The previous estimate for adding 1 portal monitor and 10 lanes of registration is shown in the lighter colored bars on the left and labeled 3.



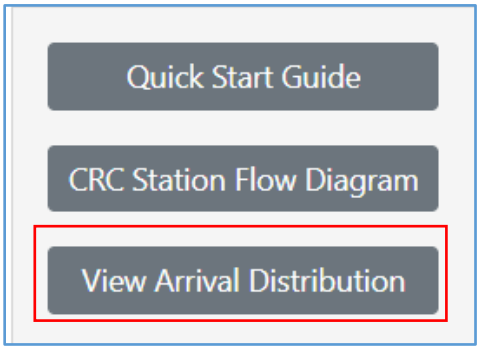
With the addition of only Registration lanes, we did not alleviate the bottleneck at Contamination screening, but we did achieve almost the same overall CRC throughput results. The Extended Time Past Shift is almost 4 hours in each new CRC setup and the Total Throughput at Shift End is slightly better for the CRC setup with no additional portal monitor. This CRC SimPLER estimate allows us to see the impact if we were unable to attain an attritional portal monitor but still wanted to improve our CRC Setup to accommodate a large surge in arrivals. It is important to see the impacts that alleviating one bottleneck might have on the rest of the CRC process.

Each CRC setup has its benefits and bottlenecks. Planners can use CRC SimPLER to visualize and decide which outcome is best for adapting their CRC plans. Looking at different CRC setups is important to determine which setup might be best for the scenario and location of the CRC.

Appendix 2 – Glossary

This section provides definitions for terms used throughout the CRC SimPLER user Guide.

Arrival Distribution The way in which individuals will arrive at the CRC for example in a steady, constant stream (Uniform) or in waves or large groups (Bus Loads). This considers the probability or likelihood that someone arrives within a set amount of time. For information arrival distributions and when to use each option, see the Distribution Description document found on the Input screen or Appendix 3 in this document.



Bottleneck Station within CRC that is processing arriving individuals too slowly, causing long lines or wait times. This can happen when there are not enough resources, staffing and other variables.

Comparison Tool Option to look at two CRC SimPLER estimates in a side-by-side comparison. This feature can be toggled on and off.

Contamination Presence of radioactive material on or inside an individual that should not be.

Contaminated Individual An individual with contamination levels higher than the established screening criteria. For example, if the screening criterion is XX cpm (counts per minute), and the contamination on the individual is measured to be higher than XX cpm, that individual is considered contaminated.

Contamination Percent Value used in CRC SimPLER to calculate how many individuals from the arriving population will require additional screening and decontamination. Factors that affect contamination percent: type of radiation event; ability to self-decontaminate prior to arriving at the CRC; arrival of additional populations from outside the event area that are not contaminated; how long it has been since the event occurred; and screening criteria set by the radiation control program. Consulting with your state radiation control program is the best way to determine which contamination percent is most likely to apply to your scenario.

Post Decon Station directly following the decontamination (decon) station where additional screening will take place to make sure contamination was removed.

Prior Decon Station directly before the decontamination (decon) station where additional screening will take place to identify the specific areas where contamination is located.

Screening Criteria (also called Screening Level) Contamination level or radiation detection instrument readings that are established by a radiation control program or other radiation safety authority. These values may be

specific to the type of radiation and detectors being used and may be adjusted depending on circumstances of the incident.

Service time (Also called processing time) Amount of time required to provide services such as contamination screening or decontamination to an individual.

Shift Length of time, in hours, that your CRC will be open each day. This does not include the time to set up your CRC, change over staff, demobilize your CRC, or finishing processing remaining individuals in the CRC after the CRC has officially closed.

Throughput Number of individuals that have completed processing at the CRC.

Utilization The percent of time during a complete shift that the station is being used. Think of this as the percent of time that the station is busy.

Wait time Amount of time an individual spends waiting in line before receiving service at each station.

Appendix 3 – Arrival Distribution Descriptions

Overview

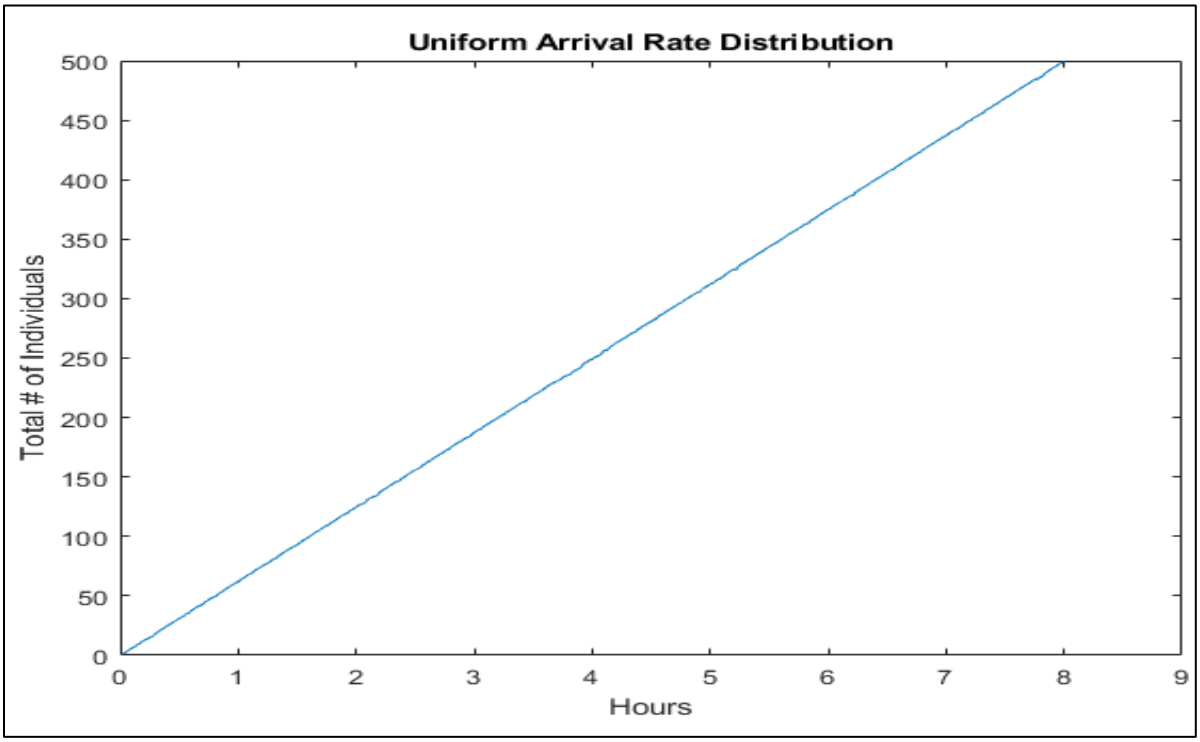
This document will go through each of the arrival distribution options providing an example of when they should be used. Currently Uniform is the only option but others will be added in the future.

- Uniform
- Poisson
- Front loaded
- Stair Stepped

Uniform (Constant) *Default*

The default arrival distribution is a **Uniform** distribution. Using a Uniform arrival rate is a good starting point when estimating throughput capacity. Think of this as a steady rate of people over the course of your shift.

An example of how a Uniform arrival would look over the course of a shift is shown below.



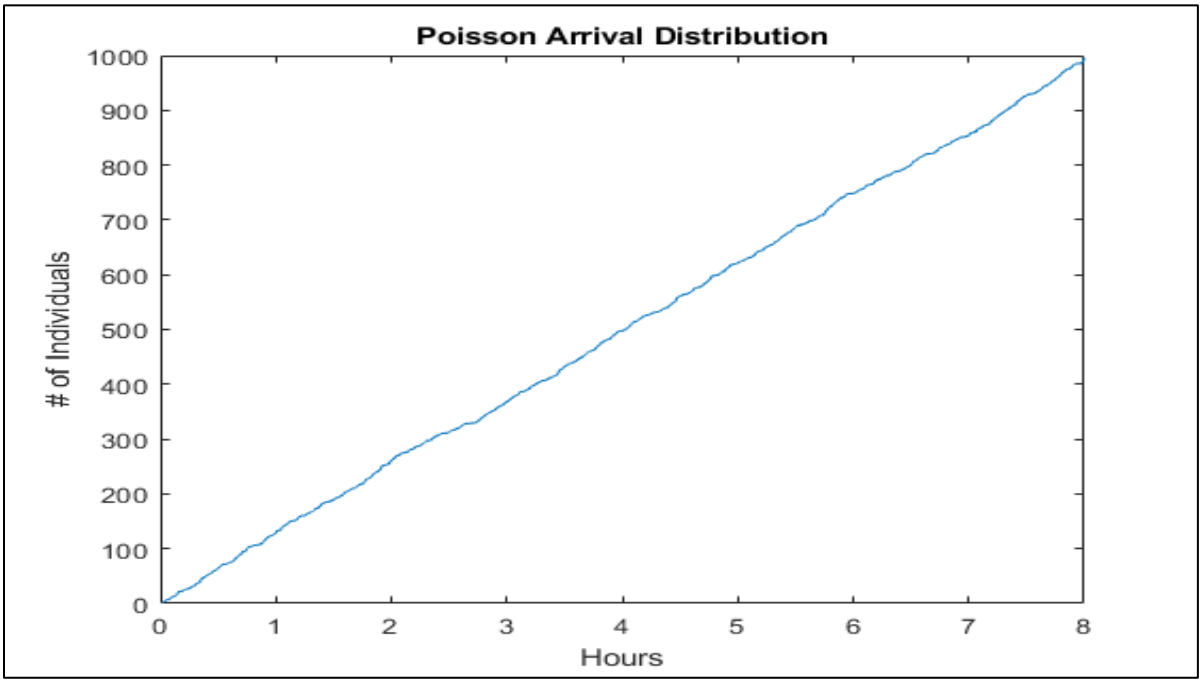
<u>An example of how to calculate this arrival rate is:</u>

Over an 8-hour shift, 1000 people are set to arrive. This means that each hour, we would anticipate 125 people to arrive. 2-3 people will arrive about every minute.

Poisson (Statistical Standard)

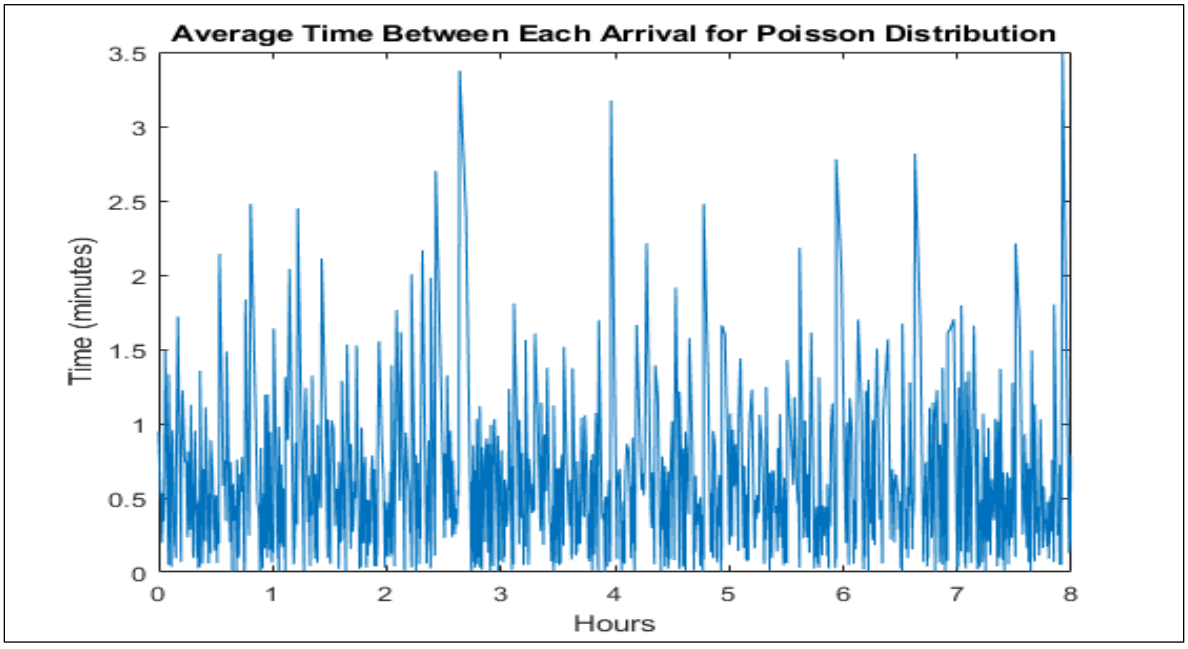
Poisson is a common distribution used when modeling arrival rates. This distribution predicts the likelihood of a person arriving over a certain period given that we know an average arrival rate. Individuals are most likely to arrive around the average arrival time.

An example of how a Poisson arrival would look over the course of a shift is shown below.



An example of how to calculate this arrival rate is:

Over an 8-hour shift, 1000 people are set to arrive. This means that each hour, we would anticipate 125 people to arrive. On average, we expect one person to arrive every 30 seconds. Some individuals may arrive within 15 seconds of each other while others may arrive within 1-2 minutes of the other. This range of arrival time accounts for the randomness of how individuals may arrive at a CRC.



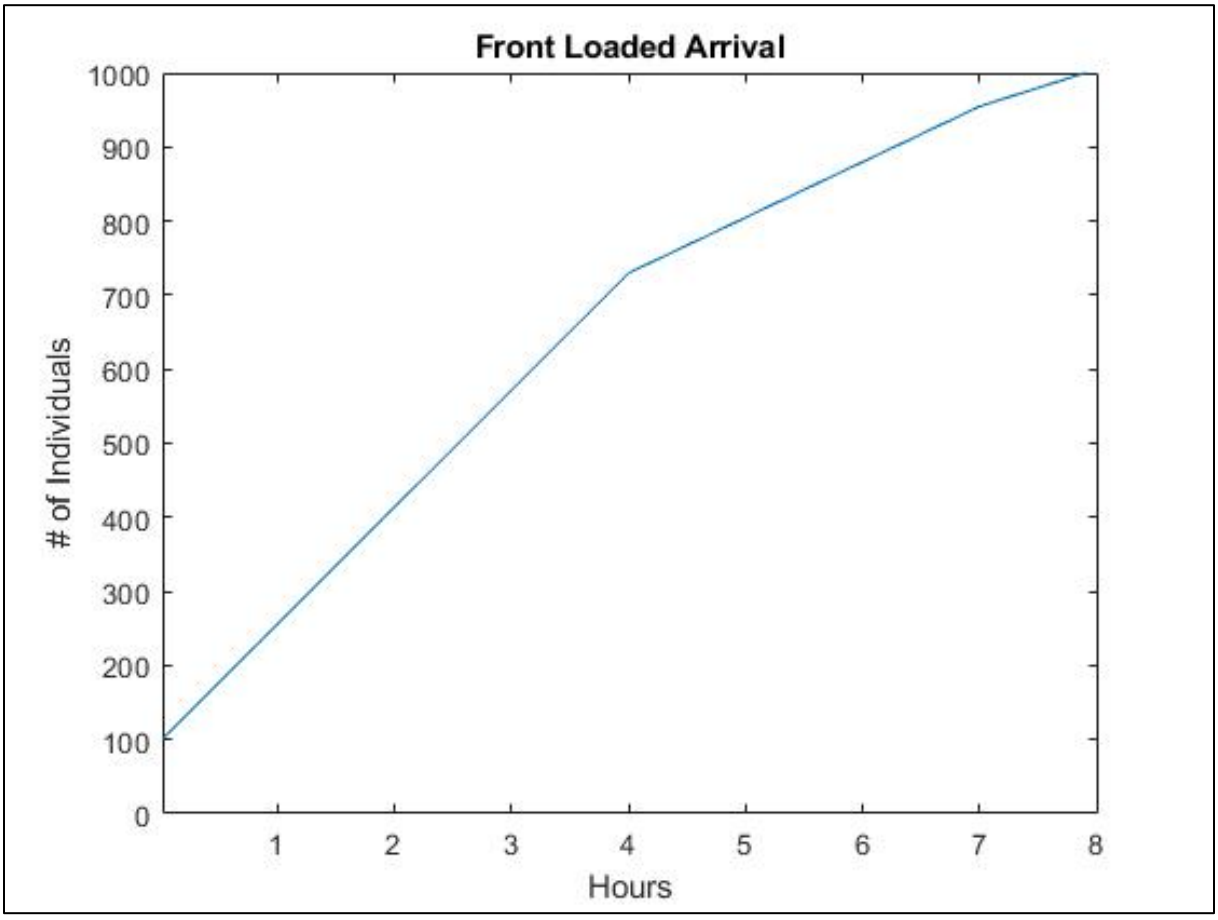
Front Loaded (Opening Line)

A **front-loaded** arrival distribution starts with a certain number of people already at the door at the opening of the CRC. As the CRC remains open, people continue to arrive but less and less as the end of the shift grows near.

Think of it like this like a ticket sale booth where people arrive before the opening of sales so that they are more likely to get a ticket.

When would you use this arrival distribution option? If plans are in place for pre-communication or early messaging about where and when the CRC will open, it is possible that a line will build prior to the CRC opening.

An example of how a Front-Loaded arrival would look over the course of a shift is shown below.



An example of how to calculate this arrival rate is:

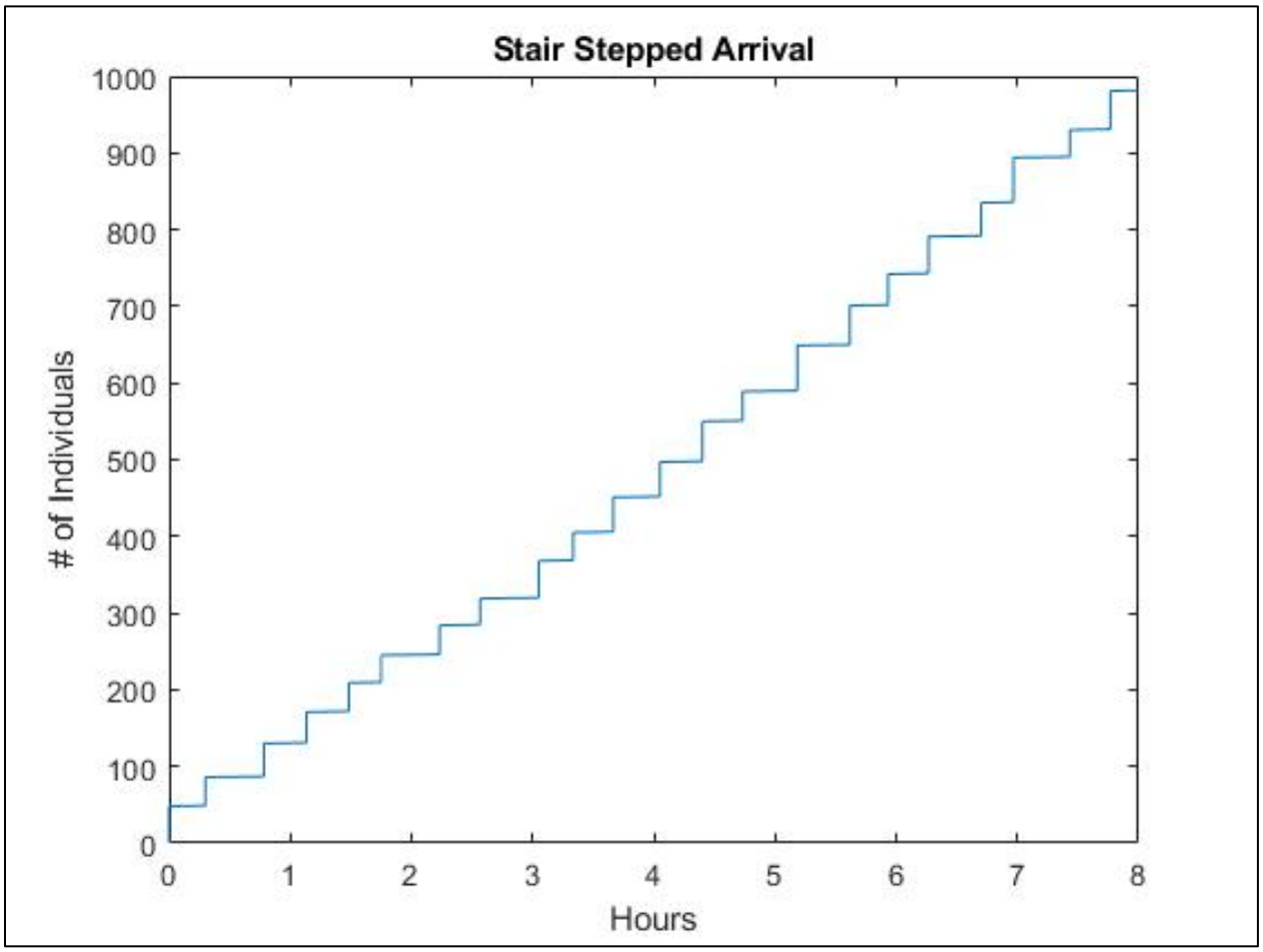
Over an 8-hour shift where we anticipate 1000 people to arrive, we will assume that 100 or 10% of the total population will be in line at the beginning of the shift. As the shift progresses, less and less individuals will arrive.

Stair Stepped (Bus Loads)

A **stair stepped** arrival distribution represents a situation where people are being directed from other areas and transported in groups via bus loads. Another way to use this distribution would be if CRCs had plans in place for individuals to schedule appointment slots where people would be expected at certain times throughout the shift.

When would you use this arrival distribution option? If the anticipated response would involve scheduling appointment times to arrive at the CRC or if people were being evacuated by bus loads from other areas.

An example of how a stair stepped arrival would look over the course of a shift is shown below.



An example of how to calculate this arrival rate is:

Over an 8-hour shift where we anticipate 1000 people to arrive, we will assume that each bus load can have between 30-60 individuals and 1-3 bus loads may arrive within the same hour. This means that 30-180 individuals could arrive each hour.