CRC-STEP User Manual

**Centers for Disease Control and Prevention –
Community Reception Center Simulation User's Guide**

Files required: CDC – Community Reception Center Simulation.doe
                                  CDC – Community Reception Center Sim Interface.xls
Software required: Rockwell Automation Arena® 12.00 or newer
                                  Microsoft® Excel 2002 or newer

Purpose: This document is to be used as a reference tool to help with setting up scenarios using the CDC – Community Reception Center Simulation. It walks-through and describes the key worksheets for setting up a simulation scenario in the CDC Community Reception Center Simulation Interface, the animation screens in the simulation model, and the results worksheets in the interface.

Model description: The CDC – Community Reception Center Simulation supports the analysis of arrivals through a Community Reception Center. This tool is designed to help reception center managers determine the best process flow, equipment utilization, and staffing for their reception centers during a radiological response. Community Reception Center planners can configure, run, and analyze simulation scenarios by varying patient flows, processing delays, equipment, and staffing. The simulation model links to a Microsoft Excel interface spreadsheet (CDC – Community Reception Center Sim Interface.xls) to facilitate the entry of key input parameters for various reception center configurations.

Contact Information: For additional help using this reception center simulation planning tool, please email **rsb@cdc.gov**. We would also appreciate any comments or suggestions as to how we could improve this tool.

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1. *Installing Arena & the CDC – Community Reception Center Simulation*

Insert the Rockwell Automation Arena Version 12.00.00 (or newer) installation CD. Follow the prompts to install Arena. If you need help installing Arena, the CD includes installation notes.

To install the CDC – Community Reception Center Simulation model, create a folder on your computer's hard-drive or shared network drive to store the required simulation files. It is recommended that you use your computer's hard-drive for running the simulation. Copy or Unzip (if the files are included in a ZIP file) the CDC – Community Reception Center Simulation's files to your new folder.
        Your New Folder \ CDC – Community Reception Center Simulation.doe
        Your New Folder \ CDC – Community Reception Center Sim Interface.xls
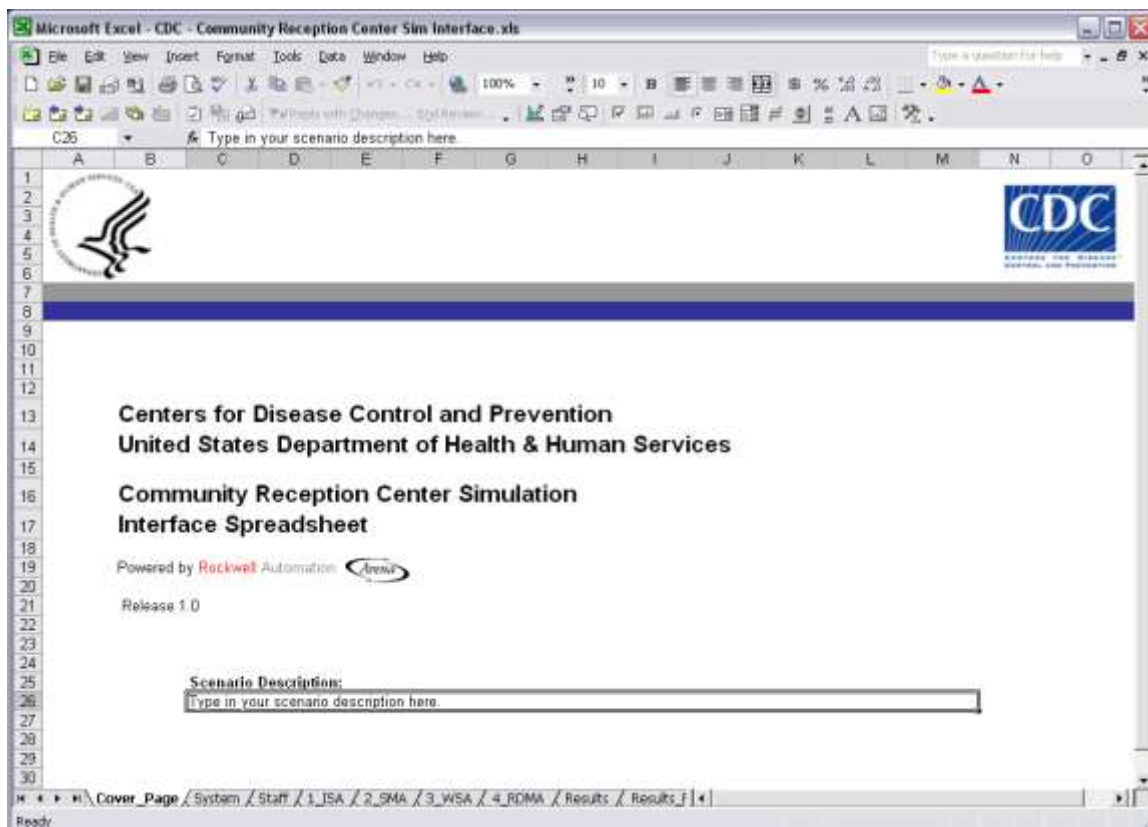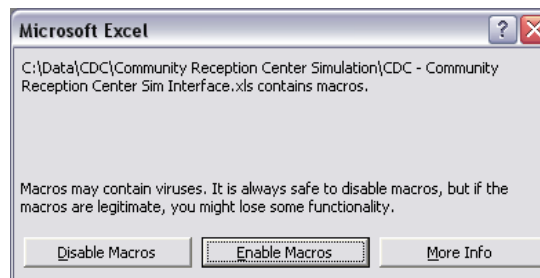   Your New Folder \ CDC – Community Reception Center Sim Users Guide.pdf

2. *Opening the Simulation Interface Spreadsheet*

Open the interface spreadsheet in Microsoft Excel by double-clicking on **CDC – Community Reception Center Sim Interface.xls** file in Your New Folder or by clicking on the Open button or choosing the menu File -> Open in Microsoft Excel.

CDC - Community Reception
Center Sim Interface.xls
Microsoft Excel Worksheet

If you are prompted about the spreadsheet's use of macros, choose the **Enable Macros** button.

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3. *Setting up a Simulation Scenario*

To setup a simulation scenario, you are going to have to enter the scenario data parameters in to the interface's input worksheets. The green highlighted inputs are the basic model run inputs that every reception center manager/planner must consider. This user's guide bolds all basic inputs. In addition, the remaining inputs allow advanced users to modify the simulation scenario in greater detail. Default values for advanced inputs have been included in the program.

3.1 System Tab

At the System tab you will enter the system and arrival inputs. These inputs include scenario run length, warm-up period, number of replications, average patient arrival rate, and gender percentages.
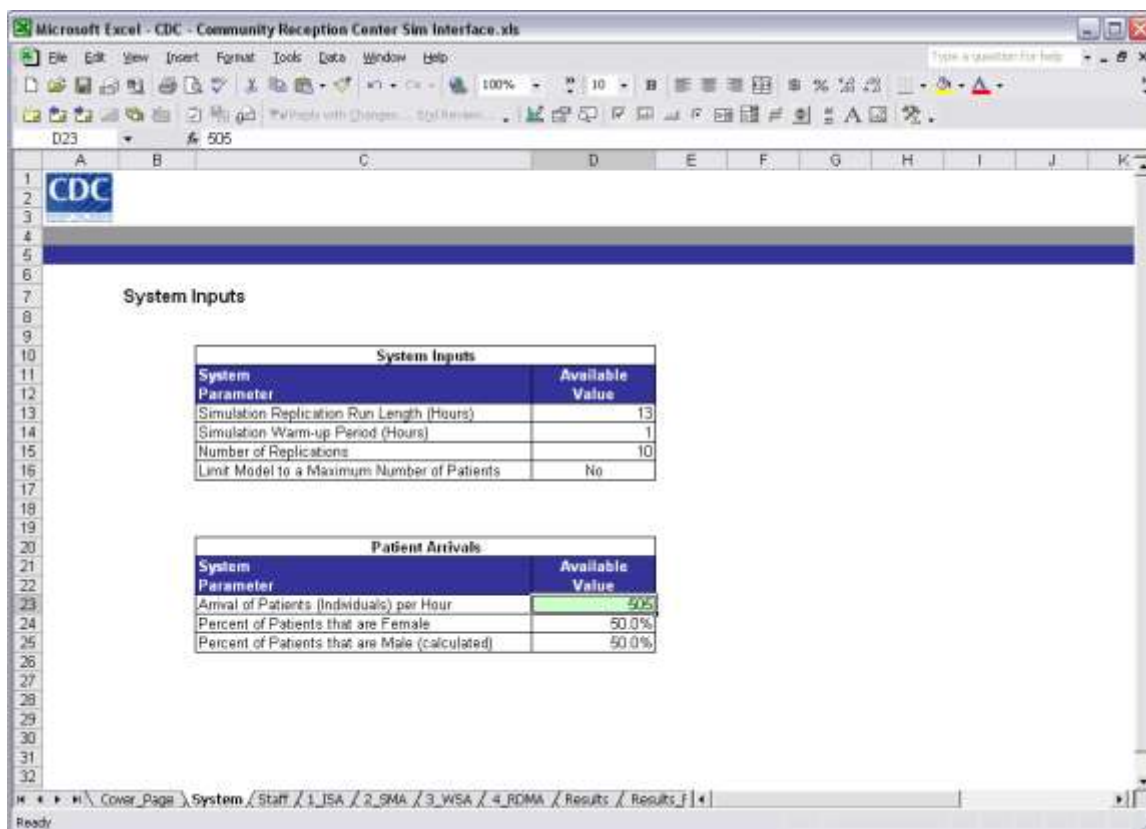
You will need to enter the estimated arrival rate for your center. In addition, you can choose to run the default system parameters or modify your run length and/or limit the number of total individuals through the reception center. The top table stores the simulation scenario system inputs and the bottom table stores the patient arrival rate and gender percentages.

System Inputs:
- Simulation Replication Run Length (Hours) – the total run length of each replication in hours. The run length must be greater than the warm-up period.
- Simulation Warm-up Period (Hours) – the warm-up period is a time used to ramp up the system before the statistics are reset to begin collection for the simulation replication. This simulation model works best with a 1 hour warm-up period.
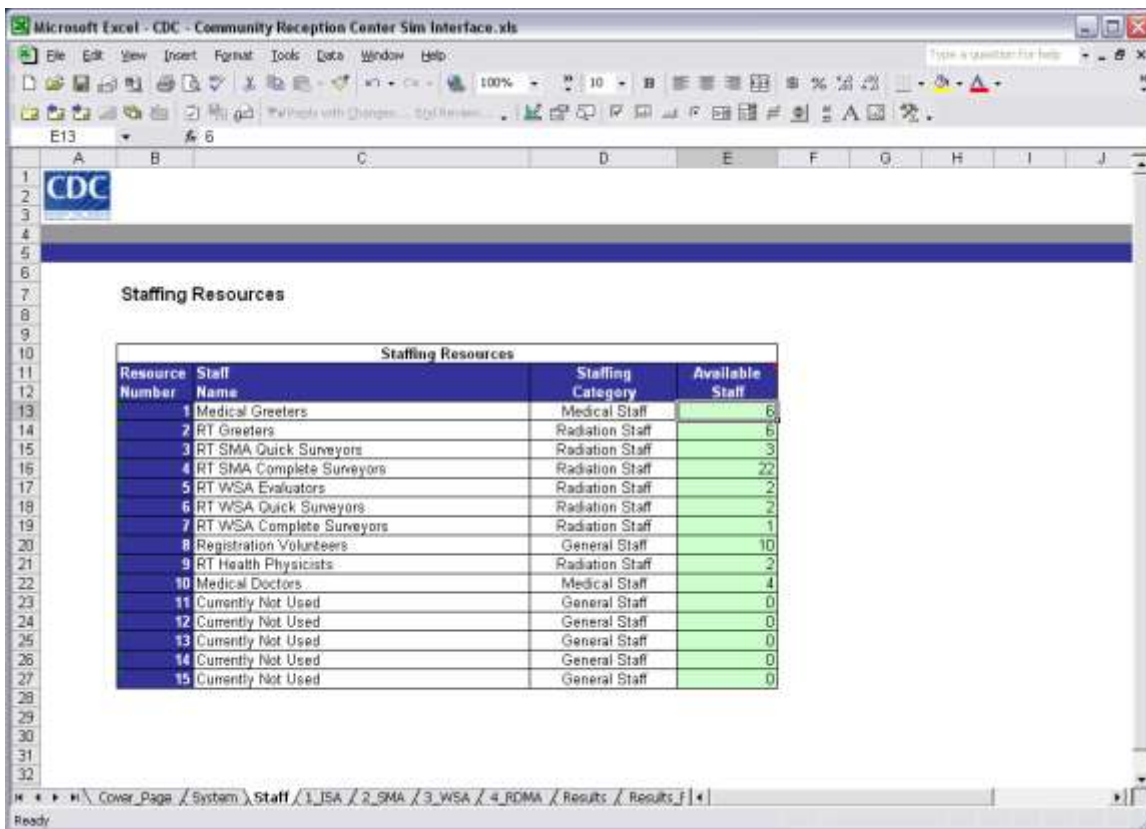
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- Number of Replications – the number of replications is the number of times that the simulation runs to collect output statistics. The outputs are calculated based on all of the replications run. It is recommended that you run at least 10 replications to get a good sampling for the output results.
- Limit Model to Maximum Number of Patients (Yes/No) – the model allows for the simulation to automatically end when the maximum number of patients has been processed. Setting this option to *Yes* turns on this functionality. The default is *No*.
- Total Number of People to Process – the maximum number of arrivals to process at the reception center. After this number of patients has been processed, the simulation model ends the replication. The model then outputs the total time to process this number of people in the results spreadsheet. This input is only available when the Limit Model to Maximum Number of Arrivals is set to *Yes*.

Arrivals:
- **Arrivals (People) per Hour** – the mean (average) number of people arriving at the reception center per hour.
- Percent of Arrivals that are Female – the percentage of people (0-100%) arriving to the reception center that are female.
- Percent of Arrivals that are Male – the percentage of people (0-100%) arriving to the reception center that are male. This is calculated based on the percent female.

3.2 Staff Tab

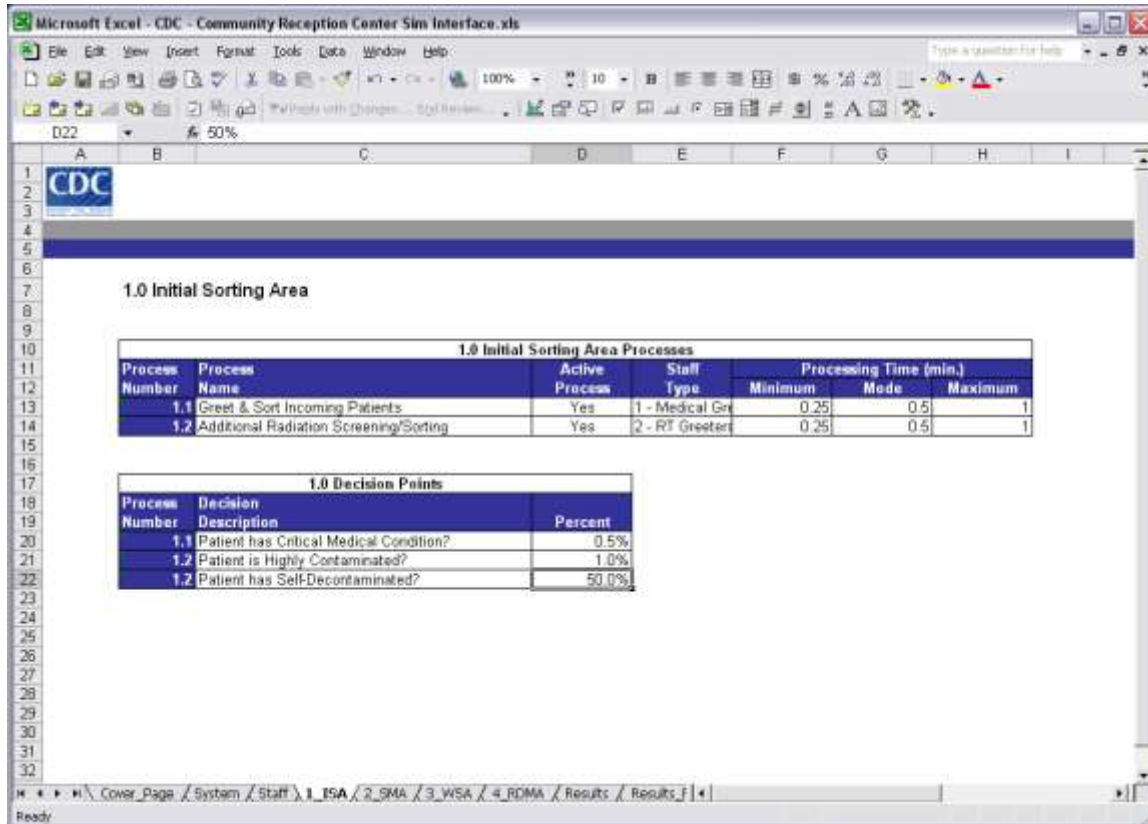At this tab you will enter the number of staffing resources available.

You will need to enter the estimated number of each type of resource available. The simulation model also allows you to edit/add staffing resources and set staffing categories.

Staffing Resources Parameters:
- Staff Name – the name of the staffing resource. This is used to identify the staffing resource throughout the interface and in the simulation animation.
- Staffing Category – the staffing resource's specialty or training requirements. This is used to identify the type of staff required to fill the role.
- **Available Staff** – the number of each resource available in the simulation model. At minimum you must enter at least 1 available staff for any staffing type used to perform a process in the simulation model.

3.3 Initial Sorting Tab

At this tab you will enter the parameters for equipment, processing delays, and decision points for Initial Sorting (1.0).

There are no basic inputs in 1.0 Initial Sorting, but you have the flexibility to turn on/off processes, change staffing types, edit processing delays, and change decision percentages.

Process Parameters:
- Process Name – the name for the process. These can be modified, but initially are set to the process names defined by the CDC when designing this simulation model.
- Active Process (Yes/No) – sets the process on/off in the simulation run. If your reception center does not perform a certain process, you can set Active Process to *No*. The simulation will then ignore that process when running.
- Staff Type – the resource staff used to perform the process (activity). Choose the resource staff from the dropdown list. The same staff can be used to perform multiple processes within a process area (example: Medical Doctors at the Registration and Radiation Dose Assessment Station). If you are not modeling staff for a process, then choose 0 – No Resource Defined.
- Processing Time – the time in minutes to perform a process (activity). The model uses a triangular distribution to randomly set the processing time for each patient. The triangular distribution uses a Minimum, Mode (Most Common), and Maximum time to calculate the distribution. The average for the distribution is the sum of the Minimum, Mode, and Maximum divided by 3.

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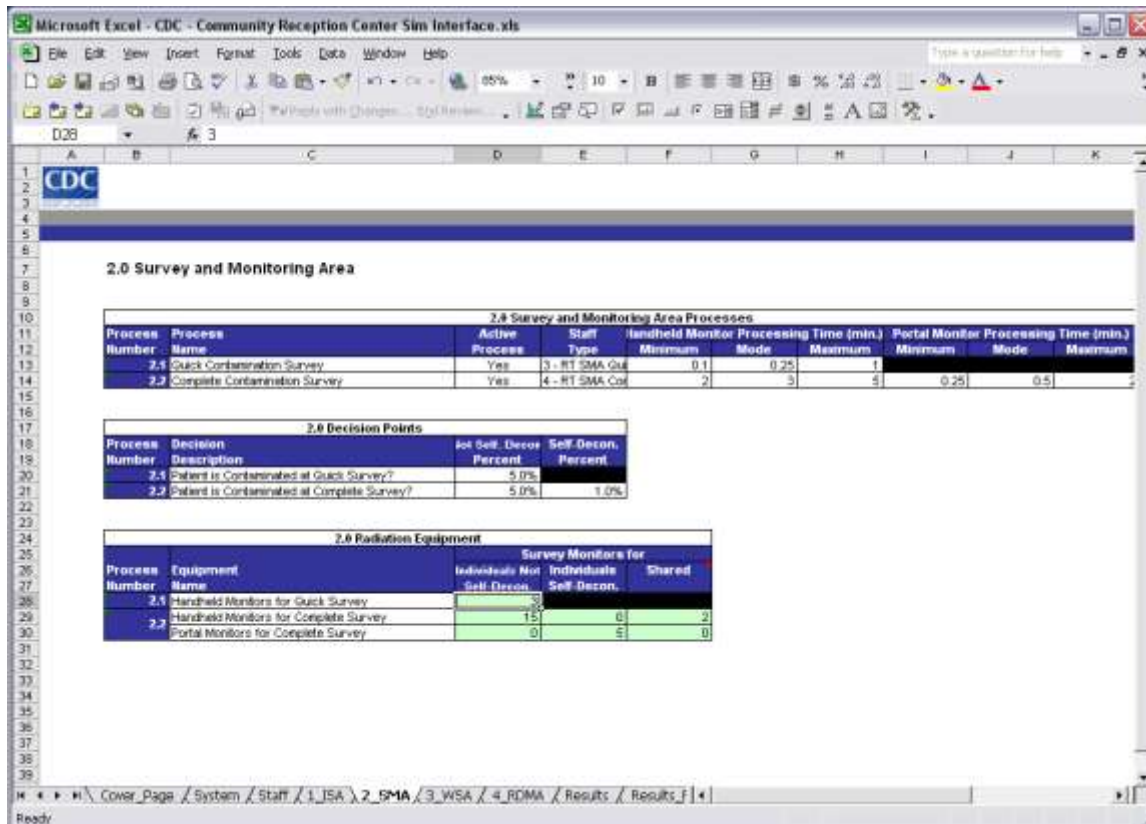
Decision Points:

- Arrival has Urgent Medical Need – the percentage of people arriving to the reception center with an urgent medical need that requires immediate attention. These people are sent directly to the First Aid Station or are transported to a medical facility for advanced treatment.
- Arrival is Highly Contaminated – the percentage of arrivals that are highly contaminated. These people are sent directly to the Wash Station for decontamination.
- Arrival has Prior Decon – the percentage of arrivals that have already attempted self-decontamination before coming to the reception center.

3.4 Contamination Screening Tab

At this tab you will enter the parameters for equipment, processing delays, and decision points for Contamination Screening (2.0).

In 2.0 Contamination Screening, you will need to enter the number of handheld and/or portal monitors available to survey patients. In addition, you have the flexibility to turn on/off processes, change staffing types, edit processing delays, and change decision percentages.

Process Parameters:
- Process Name – the name for the process. These can be modified, but initially are set to the process names defined by the CDC when designing this simulation model.
- Active Process (Yes/No) – sets the process on/off in the simulation run. If your reception center does not perform a certain process, you can set Active Process to *No*. The simulation will then ignore that process when running.
- Staff Type – the resource staff used to perform the process (activity). Choose the resource staff from the dropdown list. The same staff can be used to perform multiple processes within a process area (example: Medical Doctors at the Registration and Radiation Dose Assessment Station). If you are not modeling staff for a process, then choose 0 – No Resource Defined.
- Handheld Monitor Processing Time – the time in minutes to perform a quick or complete survey using a handheld monitor. The model uses a triangular distribution to randomly set the processing time for each patient. The triangular distribution uses a Minimum, Mode (Most Common), and Maximum time to calculate the distribution. The average for the distribution is the sum of the Minimum, Mode, and Maximum divided by 3.

- Portal Monitor Processing Time – the time in minutes to perform a complete survey using a portal monitor.

Decision Points:
- Arrival is Contaminated at Partial-Body Contamination Screening – the percentage of arrivals determined to be contaminated after undergoing a partial-body screening. These people are directed to the Wash Station for evaluation and decontamination.
- Arrival is Contaminated at Full-Body Contamination Screening – the percentage of arrivals determined to be contaminated after undergoing a full-body screening. These people are directed to the Wash Station for evaluation and decontamination. Resources for conducting full-body screenings may be divided into two categories - those for people who self-decontaminated and those for people that have not self-decontaminated before arriving at the reception center).
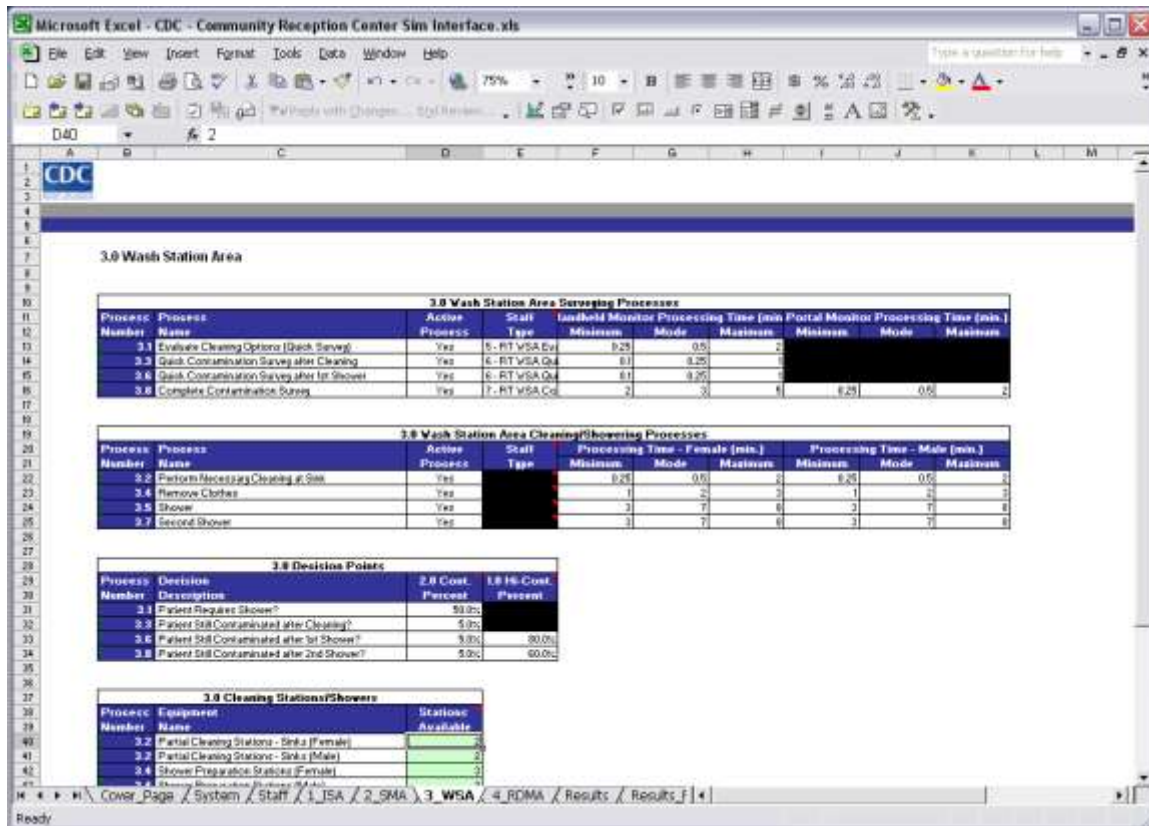
Radiation Equipment Parameters:
- **Handheld Monitors for Partial-Body Screening** – the number of handheld monitors available for partial-body screening. This needs to be greater than or equal to 1 if Process 2.1 is active.
- **Handheld Monitors for Full-Body Screening** – the number of handheld monitors available for complete survey. There are three types of handheld monitors for full-body screening: monitors only used on those that have not self-decontaminated, monitors only used on those that have self-decontaminated, and monitors used on either pool of patients (shared). This allows for thesegroups to be separated or merged after sorting.
- **Portal Monitors for Full-Body Screening** – the number of portal monitors available for full-body screening. There are three types of portal monitors for complete survey: monitors only used on those that have not self-decontaminated, monitors only used on those that have self-decontaminated, and monitors used on either pool of patients (shared). This allows for thesegroups to be separated or merged after sorting.

3.5 Wash Station Tab

At this tab you will enter the parameters for facilities, equipment, processing delays, and decision points for the Wash Station (3.0).

In the 3.0 Wash Station, you will need to enter the number of cleaning stations, showers, and handheld and/or portal monitors available to survey patients. In addition, you have the flexibility to turn on/off processes, change staffing types, edit processing delays, and change decision percentages.

Process Parameters:
- Process Name – the name for the process. These can be modified, but initially are set to the process names defined by the CDC when designing this simulation model.
- Active Process (Yes/No) – sets the process on/off in the simulation run. If your reception center does not perform a certain process, you can set Active Process to *No*. The simulation will then ignore that process when running.
- Staff Type – the resource staff used to perform the process (activity). Choose the resource staff from the dropdown list. The same staff can be used to perform multiple processes within a process area (example: Medical Doctors at the Registration and Radiation Dose Assessment Station). If you are not modeling staff for a process, then choose 0 – No Resource Defined.
- Processing Time – the time in minutes to perform a process (activity). Activities can have separate times based on radiation equipment available or gender. The model uses a triangular distribution to randomly set the processing time for each patient. The triangular distribution uses a Minimum, Mode (Most Common), and Maximum time to

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calculate the distribution. The average for the distribution is the sum of the Minimum, Mode, and Maximum divided by 3.

Decision Points:
- Arrival Requires a Shower – the percentage of arrivals undergoing the evaluation quick survey that are determined to need a shower. These people are directed to the shower preparation process and showers. Only contaminated persons from Survey and Monitoring undergo the evaluation.
- Arrival Still Contaminated after Cleaning – the percentage of arrivals determined to be contaminated after undergoing a quick survey after cleaning at a sink. These people are directed to the shower preparation process and showers. Only contaminated persons from Survey and Monitoring undergo the evaluation.
- Arrival Still Contaminated after 1st Shower – the percentage of arrivals determined to be contaminated after undergoing a quick survey after the first shower. These people are directed to take a second shower. The percent still contaminated is dependent on the arrival path to the Wash Station: People with Contaminated Readings from Survey and Monitoring and People with Highly Contaminated Readings from Initial Sorting.
- Arrival Still Contaminated after 2nd Shower – the percentage of arrivals determined to be contaminated after undergoing a complete survey after the second shower. These patients are suspected to be internally contamination. The percent still contaminated is dependent on arrival path to the Wash Station: People determined to be contaminated from Survey and Monitoring and people determined to be highly contaminated from Initial Sorting.

Cleaning Stations/Shower Parameters:
- **Partial Cleaning Stations – Sinks (gender specific)** – the number of sinks available for female and male arrivals to wash off contamination from hands/arms. This needs to be greater than or equal to 1 for both males and femaled if Process 3.2 is active.
- **Shower Preparation Stations (gender specific)** – the number of lockers/changing stations for a female and male arrivals to undress for a shower. This needs to be greater than or equal to 1 for both males and females if Process 3.4 is active.
- **Showers (gender specific)** – the number of showers available for female and male arrivals. This needs to be greater than or equal to 1 for both males and females if Processes 3.5 and/or 3.7 are active.
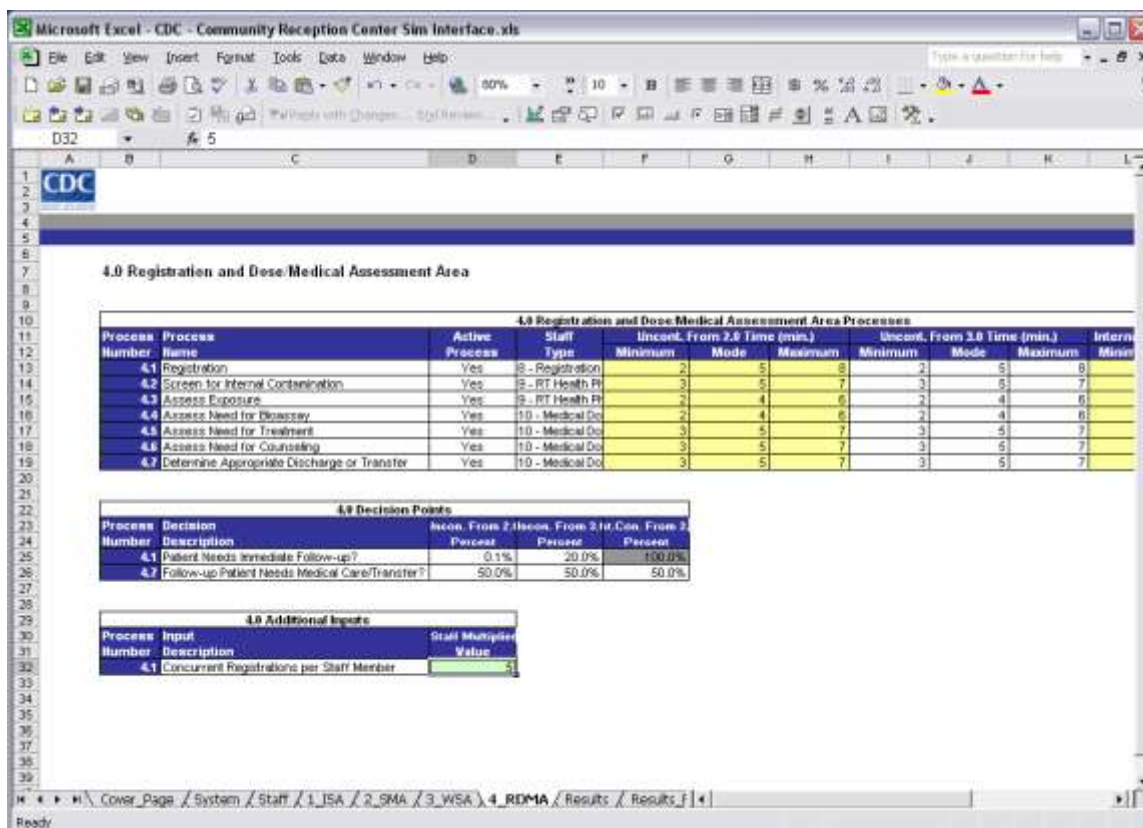
Radiation Equipment Parameters:
- Handheld Monitors Shared for All Surveys – the number of handheld monitors available to perform every survey in the Wash Station. If there are not sufficient monitors or staff for each of the individual surveys in the Wash Station, this monitor can be used to perform the quick and the complete surveys.
- **Handheld Monitors for Evaluation** – the number of handheld monitors available for the initial evaluation. This needs to be greater than or equal to 1 if Process 3.1 is active. For each of the monitors, you can define specific monitors for each gender or shared monitors if the facility requires it.
- **Handheld Monitors for Partial-Body Screening** – the number of handheld monitors available for partial-body screening. This needs to be greater than or equal to 1 if Processes 3.3 and/or 3.6 are active. For each of the monitors, you can define specific monitors for each gender or shared monitors if the facility requires it.
- **Handheld Monitors for Full-Body Screening** – the number of handheld monitors available for full-body screening. Either the handheld or portal monitors for complete survey needs to be greater than or equal to 1 if Process 3.8 is active.
- **Portal Monitors for Full-Body Screening** – the number of portal monitors available for full-body screening. Either the handheld or portal monitors for complete survey needs to be greater than or equal to 1 if Process 3.8 is active.

3.5 Registration and Radiation Dosel Assessment Tab

At this tab you will enter the parameters for registration, processing delays, and decision points for Registration and Radiation Dose Assessment (4.0).

In 4.0 Registration and Radiation Dose Assessment, you will need to enter the number of concurrent registrations that each staff member can perform. In addition, you have the flexibility to turn on/off processes, change staffing types, edit processing delays, and change decision percentages.

Process Parameters:
- Process Name – the name for the process. These can be modified, but initially are set to the process names defined by the CDC when designing this simulation model.
- Active Process (Yes/No) – sets the process on/off in the simulation run. If your reception center does not perform a certain process, you can set Active Process to *No*. The simulation will then ignore that process when running.
- Staff Type – the resource staff used to perform the process (activity). Choose the resource staff from the dropdown list. The same staff can be used to perform multiple processes within a process area (example: Medical Doctors at the Registration and Radiation Dose Assessment Station). If you are not modeling staff for a process, then choose 0 – No Resource Defined.
- Processing Time – the time in minutes to perform a process (activity). Activities can have separate times based on an individual's path through the system. The categories are: Uncontaminated from Survey and Monitoring (those that have never had a contaminated reading), Uncontaminated after exiting the Wash Station, and Individuals Suspected to be Internally Contamination.

Decision Points:

- Individual Needs Immediate Follow-up – the percentage of arrivals requiring attention from the Health Physicists and Medical Doctors. The percentage is based on arrival categories: Uncontaminated Arrivals from the Survey and Monitoring (those that have never had a contaminated reading), Uncontaminated Arrivals from the Wash Station, and Arrivals Suspected of Internal Contamination.
- Follou-up Patient Needs Medical Care/Transfer – the percentage of people at this step requiring referral or transfer from the reception center to another facility for continued treatment and follow-up. The percentage is based on the following categories: Uncontaminated from Survey and Monitoring (those that have never had a contaminated reading), Uncontaminated after exiting the Wash Station, and Individuals Suspected to be Internally Contamination.

Additional Inputs:

- **Concurrent Registrations per Staff Member** – a multiplier for the number of people that can be assisted by a staff member while filling out the necessary registration paperwork. This allows for each staff to assist more than one individual with the registration process.

It is recommended that you save your scenario with a different file name before continuing.

4. *Saving and Closing the Interface Spreadsheet*

To save the simulation scenario inputs to a different file name, click on File -> Save As. Then, enter the name of the scenario file name.

To close the interface spreadsheet, click on the Close button in the top right corner of the window, or click on File -> Exit.

If you have not saved the scenario run already, click on the **Yes** button when prompted to save changes.
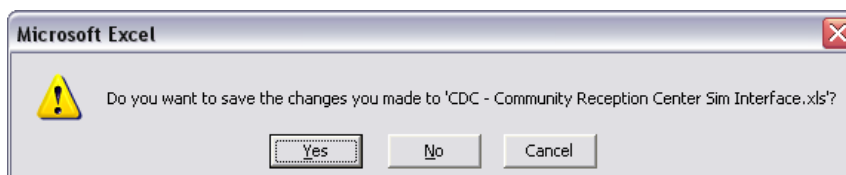
5. *Opening and Running the Simulation Model*

Open the CDC – Community Reception Center Simulation model in Rockwell Software Arena by double-clicking on **CDC – Community Reception Center Simulation.doe** file in Your New Folder or by clicking on the Open button or choosing the menu File -> Open in Arena.

CDC - Community Reception
Center Simulation.doe
Arena Model Document

The simulation will open.
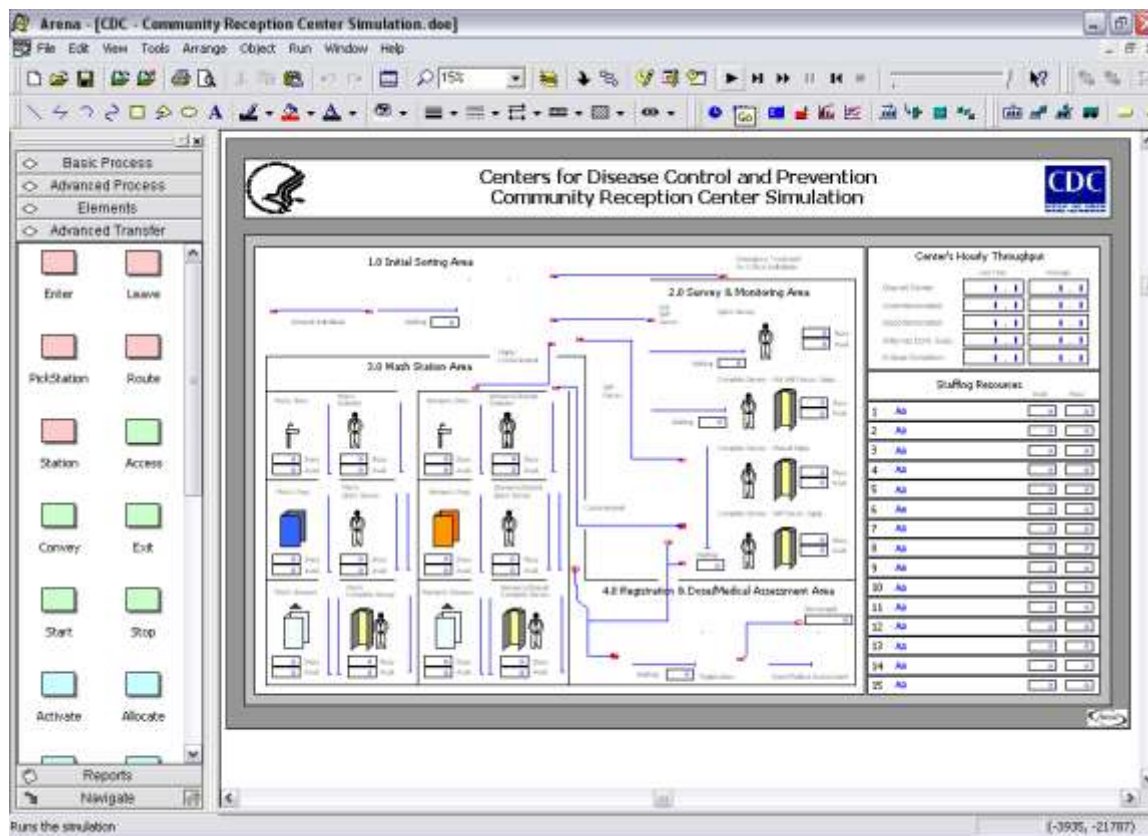
If you get prompted for the file not being found, click the **OK** button. This is a known bug in Arena 12.00.00 and it does not interfere with the simulation model.

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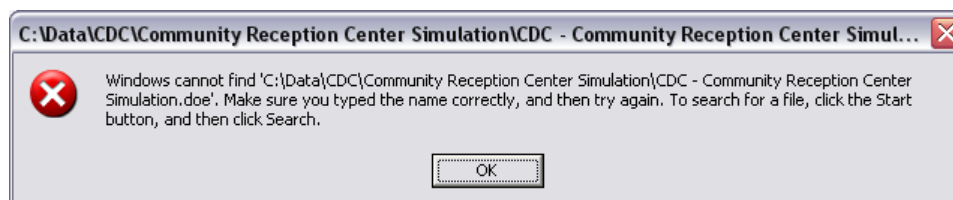
When you are ready to run the simulation model, click on the Go button (►), Run -> Go, or the F5 key.
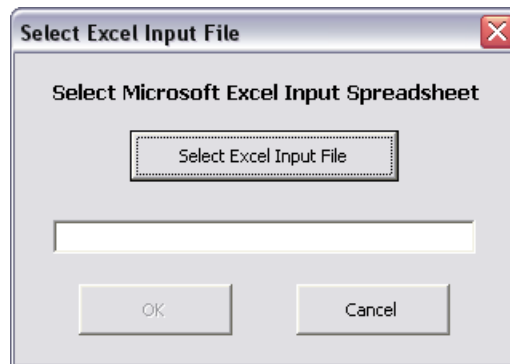
You will be prompted to select the Microsoft Excel Input Spreadsheet file. Click on the **Select Excel Input File** button and choose the scenario interface spreadsheet that you saved earlier. Then, click the **Open** Button.
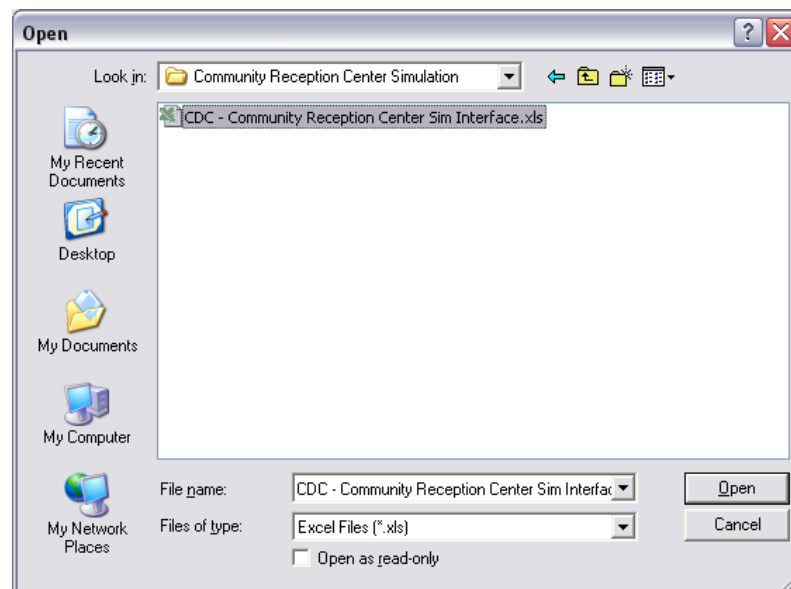
Click on the **Okay** button on the Select Excel Input File window after you have selected your interface spreadsheet. Arena will open the interface spreadsheet. You have the option to make and save any last minute scenario changes to the inputs.

Before the simulation starts running, you will need to choose whether or not you want the model to run with animation. To run the simulation faster, choose **No Animation**.
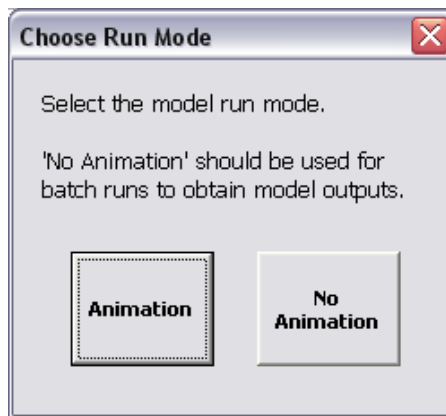
The simulation animation depicts arrivals moving through the proposed Community Reception Center.
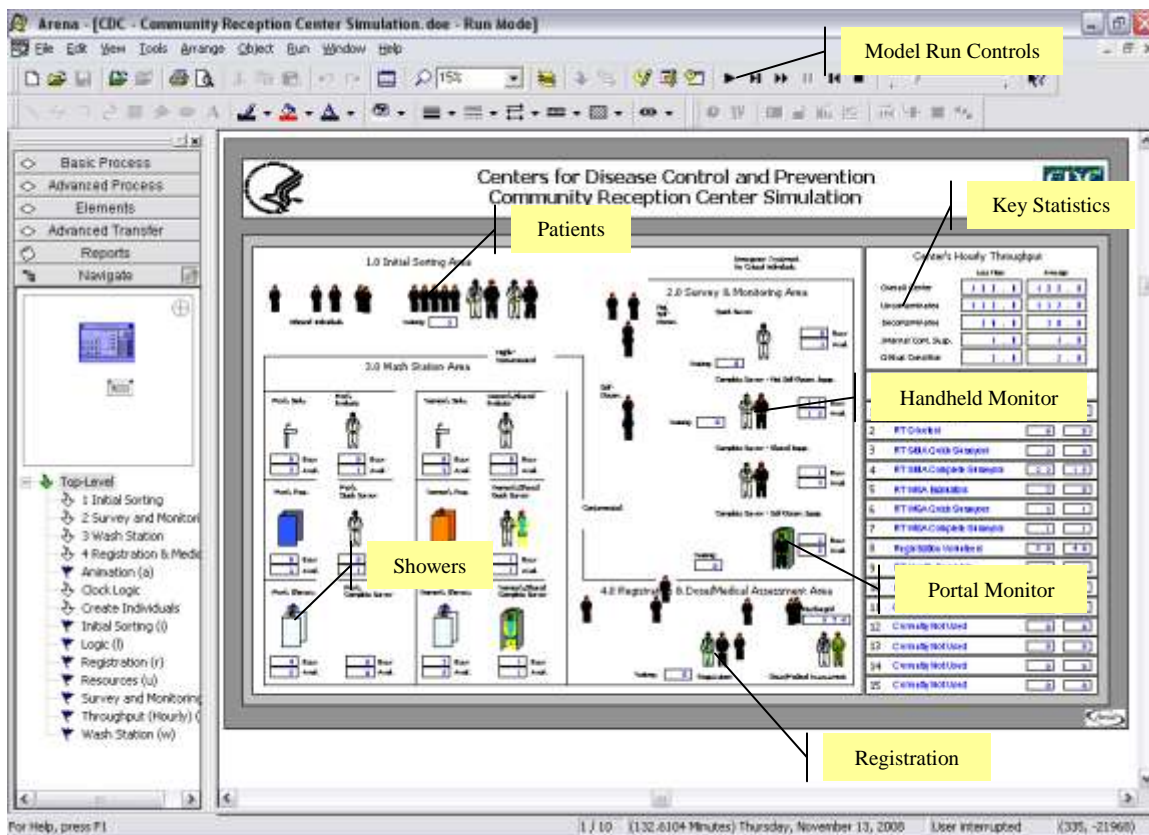
You can use the following hotkeys to navigate through the animation:
- A – Overall Animation with Statistics
- I – Initial Sorting Area
- S – Survey and Monitoring Area
- W – Wash Station Area
- R – Registration and Dose/Medical Assessment Area

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- T – Throughput Statistics
- U – Resource Usage (Number Available and Number Busy)

Once the simulation model has completed running (Replication Number will be N/N and an *End of run* will appear in the System Status), you may be prompted to examine the simulation results in Crystal Reports. It is recommended that you press **No** button. These standard reports are not formatted for easy analysis. The key performance indicators from the simulation have been copied and saved to the Results worksheets of the interface spreadsheet for easier analysis.
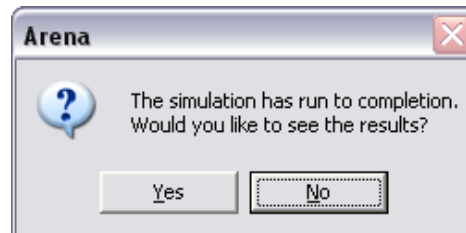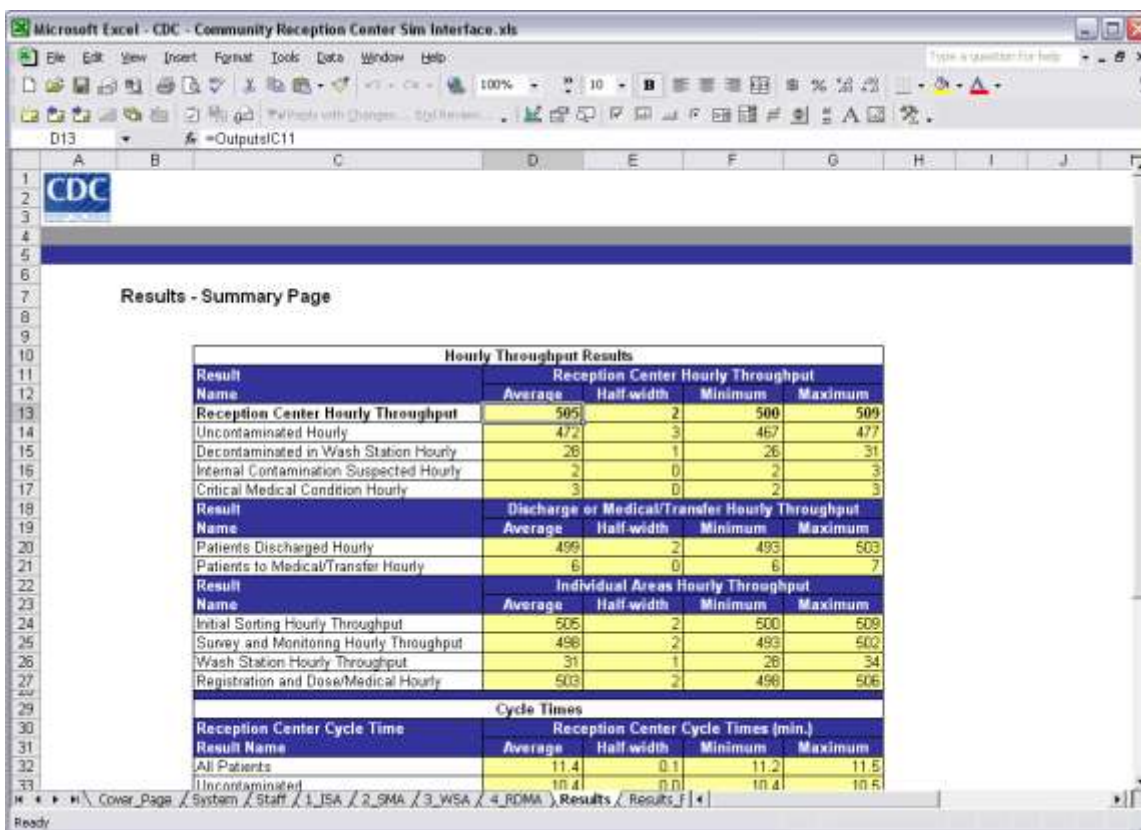
Close Arena and return to your interface spreadsheet. If prompted, it is recommended that you do not need to save any changes in Arena.
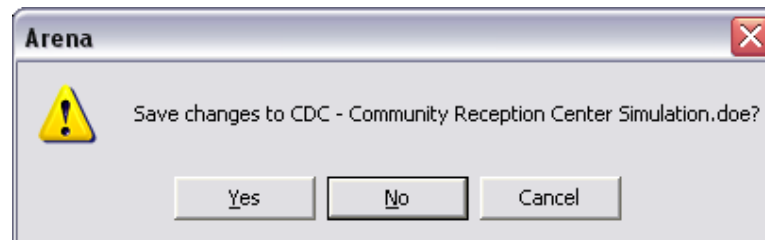
6. *Reviewing the Simulation Scenario Results*

6.1 Results - Summary Tab

When you return to your scenario interface spreadsheet, all of the Results worksheets will be populated with simulation run's results.

The main Results worksheet has the overall hourly throughput statistics and the cycle times for arrivals. All outputs report an average, half-width for the 95% confidence interval, minimum replication value, and maximum replication value. The half-width allows you to estimate the variance around the average reported by the simulation model.

Hourly Throughput Results:
- Reception Center Hourly Throughput – the average, half-width, minimum, and maximum number of people processed through the reception center. The simulation outputs an average for all arrivals and averages for each arrival type through the center (Uncontaminated, Decontaminated, Internal Contamination Suspected, and Urgent Medical Patients).
- Discharge or Medical/Transfer Hourly Throughput – the average number of people processed through the reception center by type of discharge.
- Individual Areas Hourly Throughput – the average number of people processed through each area of the reception center.

Cycle Time Statistics:
- Reception Center Cycle Times – the average cycle time (time in system) in minutes for people going through the reception center. The simulation outputs an average for all

arrivals and averages for each arrival type through the center (Uncontaminated, Decontaminated, Internal Contamination Suspected, and Urgent Medical Patients).

- Individual Areas Cycle Times - the average cycle time (time in system) in minutes for people processed through each area of the reception Center.
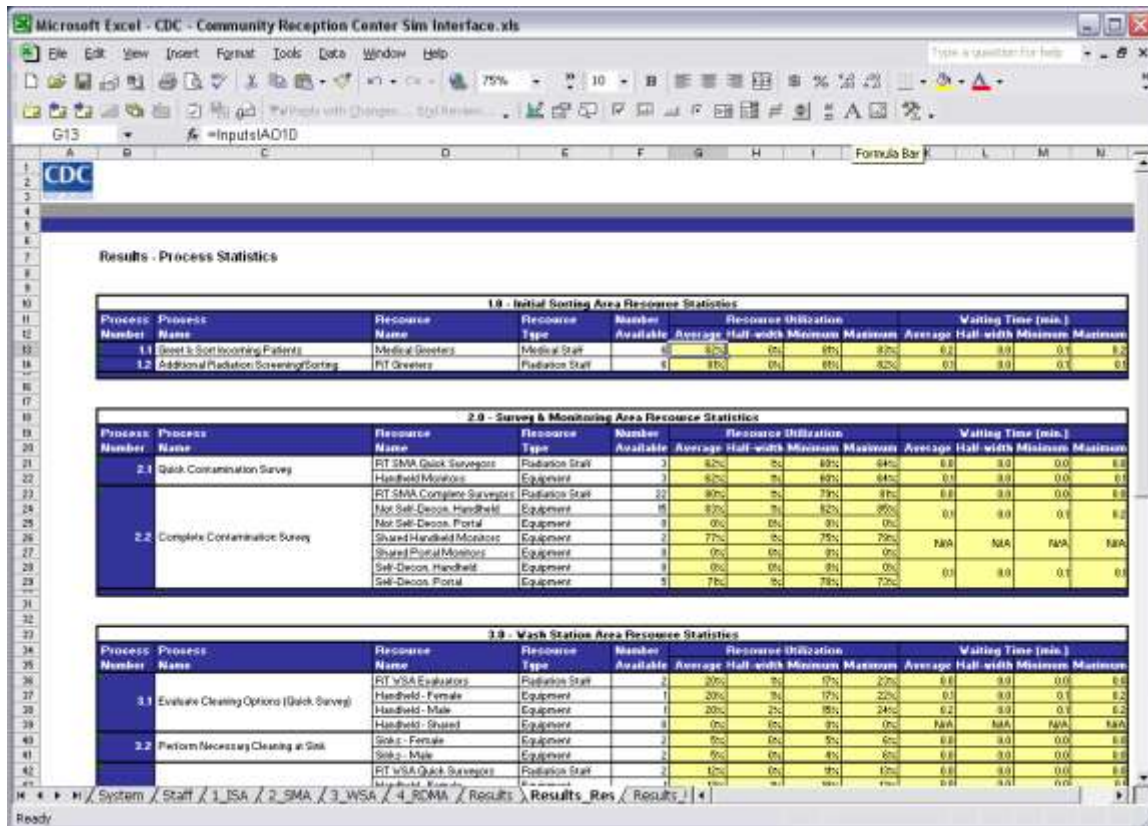
Other Statistics:

- Last Arrival's Time Exiting the Center – the average time in hours that it takes to process all of the arrivals through the reception center. This statistic is only reported when the simulation is set to limit the model to maximum number of arrivals.

6.2 Results – Process Statistics Tab

The second results worksheet focuses on utilization of resources and wait times for the patients for each process in the model.

The second results worksheet is the Process Statistics worksheet. It outputs the utilization for each resource and the average wait time associated with a process. All outputs report an average, half-width for the 95% confidence interval, minimum replication value, and maximum replication value. The half-width allows you to estimate the variance around the average reported by the simulation model.

Resource Statistics:
- Resource Utilization – the average percent of time that a resource is busy during the model run. A very high utilization (>95%) may signal the need for additional resources (staff or equipment) to help the patients. Resource utilizations between less than 90% are usually recommended to minimize waiting time. Check the Waiting Times for the patients in the corresponding queues (lines). If that waiting time seems high, it is recommended to reallocate or add additional resources to the process.
- Waiting time – the average waiting time for a person before that individual begins the process (activity). This can be used to help evaluate whether additional resources are required for a process.

7. *Closing the Interface Spreadsheet*

To close the interface spreadsheet, click on the Close button in the top right corner of the window, or click on File -> Exit.

If you have not saved the scenario run already, it is recommended that you click on the **Yes** button when prompted to save changes. This will allow you to review your scenario's results again without re-running the model.