In section 12 we will examine source attribution methods. We will start with the simplest approach, that is, counting particle to trajectories from the dispersion simulations. When we did individual trajectories, we had methods for analyzing multiple trajectories, which included frequency plots or cluster analysis. However given the uncertainty associated with a single trajectory, these kind of approaches we're not appropriate, or would not be appropriate, when analyzing short duration, single event situations. They would be more appropriate for longer duration events that involved multiple samples. However the concentration simulations can be configured in a way to give us a similar result by using the multiple particle approach, that is, associated with the dispersion calculation.

To configure the model to do a particle count, let's start by doing a reset, and then loading the original CAPTEX configuration for the surface concentrations. And that would be, well let’s do a browse just to ensure that would be captex_control.txt, and in the advanced menu, setup. The next step is let's not do such a long simulation, we just need to do enough to demonstrate this as an example case. So 19 hours would be sufficient, that gives us 6 three hour samples, complete six frames. And also let's go to the name list and let's look at the particle release number, and I'm going to make that an even 10000 particles, we’re going to release 10000 particles over the 3 hour duration of the simulation.

And then we need to go to the concentration grid packing

method menu number eight. And we're going to change the output units here from concentration, mass per cubic meter, to just mass. So that means as the particle mass is being summed in the concentration array, the gridded array, it will not be divided by the grid cell volume. And that is enough for this menu.

We need to go back to the configuration menu, the setup menu that is, and change one other thing, that is the pollutant emissions. Instead of 67,000 units of mass, we're going to release 3333.333. So the reason for doing this is that after three hours we will have released 10,000 units of mass, and we will have released 10,000 particles. That means there would be one mass unit per particle. So then as the model is computing the concentration as the particles pass through the grid, they will be a value of one accumulated for each particle that passes through the grid cell per time step. At this point we can run the model.

However, before we do the display, let's make sure that the labels on the graphic are correct. And to do this we want to go to file edit, in the advanced menu, and go to border labels. If you recall the display program, the contour display program, only gives you an option to change the mass units, the mass unit label. However, this particular menu lets you change other labels, and we should change, for instance, the map type should be something like particle number, not air concentration, and the units could be particles, and the volume, there is no volume here, and we'll just leave this alone as well, and

save. And now we can open the display menu, contours, and the only thing we would need to change is, let's do some user units here, and what's since we released 10,000 particles, the 1000 would be a good upper contour, 500, 200, 100, 50, 20, 10, 5, 2, 1, and then execute.

And you can see that after the first time period we have 720 particles in this red grid cell, that's just downwind of the source. I should not have clicked on that red button. And as we go downstream to the last time period, you can see we have 60 particles here, and the outer contour is the one particle contour. So that means for instance in this outer contour that we had at least one particle in that grid cell over the three hour period. However, you know in the 60 particle maximum area, here, that means we could've had 60 particles over a time step or we could've had a few particles every time step and after three hours it would've added up to 60 particles. So if you want finer time resolution, you would need to reduce the output averaging period. Or even create a snapshot map. And if you divide by the total number of particles you can get a percentage or probability of the trajectory from the source being over a particular location. So this is a little more consistent way of doing source attribution or downwind receptor probabilities for a single event by using multiple trajectories.

The advantage of this approach over the pure trajectory calculation is that in the dispersion calculation the particles also include the effects of dispersion in that a random motion component is added to each particle trajectory.

And as I noted this can be applied in both the forward or the backward direction.

And this concludes the discussion of the particle trajectory approach for source attribution.