Scenario:

A local facility stores Hydrochloric Acid 42% in an outdoor 5000 gallon tank. The facility is reporting the tank is releasing product from a 2 inch valve located about 6 feet from the tank bottom. The tank has containment of approximately 30 feet by 10 feet. The amount of product in the tank at the beginning of the incident is unknown; you will assume the tank was 80% full when the leak started.

Current weather conditions are:

Wind: 12 miles/hour from South at 10 meters

Ground Roughness: open country	Cloud Cover: 0 tenths
Air Temperature: 55° F	Stability Class: D
No Inversion Height	Relative Humidity: 25%

However, NWS reports a cold front is expected to move through the area in about 60 minutes. Wind direction will be moving from South to Southwest and then to West. Temperature is expected to remain fairly constant over the next 2 to 3 hours, then drop into the low 40s. Wind speed will be increasing to 35 mph.

CAMEO Chemicals:

Find the following information for Vinyl Chloride using CAMEO Chemicals.

1. ERG-suggested Initial Isolation Zone _____
2. Usual physical state of chemical (solid, liquid, gas) _____
3. NFPA Hazard Codes for chemical _____
4. IDLH _____
5. AEGL 1, 2, and 3 _____
6. Summarize hazards of chemical _____
7. Summarize any Reactive Hazards _____

MARPLOT:

Determine an address in your area where this incident (or an incident similar to this) could occur. On the MARPLOT map, do the following:

1. Mark the “release point” with the MARPLOT Symbol tool
2. Draw a circle around the tank to represent the ERG Initial Isolation Zone

ALOHA:

Use ALOHA to predict downwind concentrations.

1. Select Hydrochloric Acid Solution as the ALOHA Chemical
2. Enter the weather conditions as given above
3. Select the ALOHA Puddle Source model and enter the contianment information as given above.
4. Create the Toxic Threat Zone and display it on MARPLOT

Your initial ALOHA Text Summary will read as follows:

SITE DATA:
Location: KANSAS CITY, KANSAS
Building Air Exchanges Per Hour: 0.50 (enclosed office)
Time: January 21, 2021 0931 hours CST (using computer's clock)

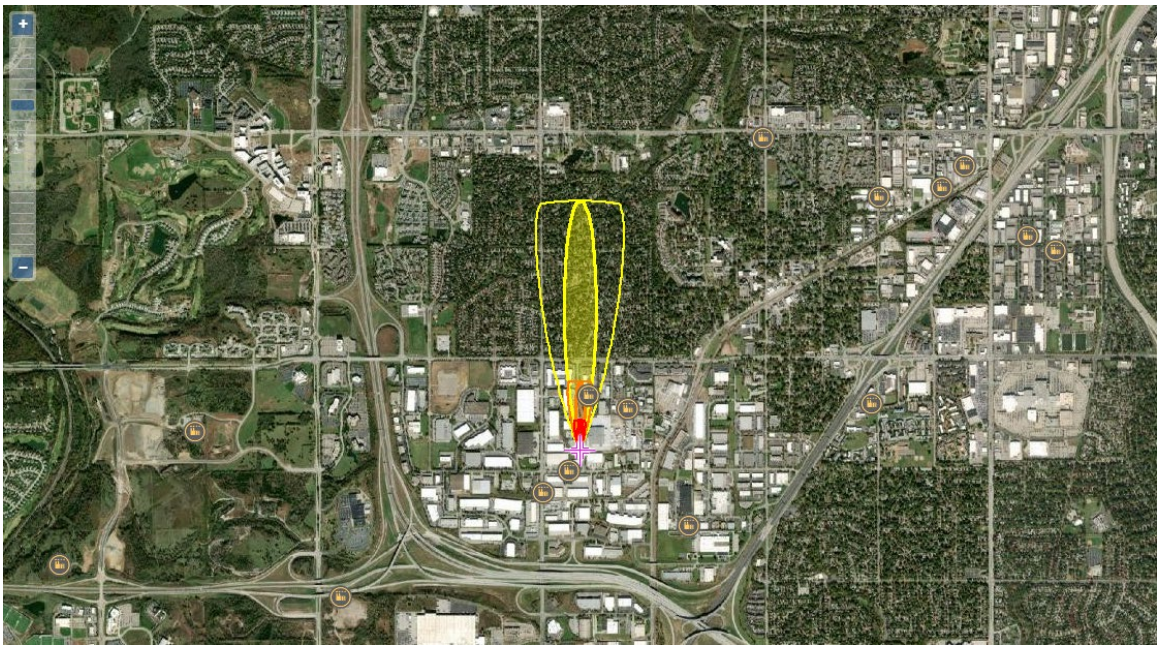
CHEMICAL DATA:
Chemical Name: HYDROCHLORIC ACID
Solution Strength: 42% (by weight)
Ambient Boiling Point: 69.5° F
Partial Pressure at Ambient Temperature: 0.66 atm
Ambient Saturation Concentration: 674,553 ppm or 67.5%
Hazardous Component: HYDROGEN CHLORIDE
CAS Number: 7647-1-0 Molecular Weight: 36.46 g/mol
AEGL-1 (60 min): 1.8 ppm AEGL-2 (60 min): 22 ppm AEGL-3 (60 min): 100 ppm
IDLH: 50 ppm

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 12 miles/hour from s at 10 meters
Ground Roughness: open country Cloud Cover: 0 tenths
Air Temperature: 55° F Stability Class: D
No Inversion Height Relative Humidity: 25%

SOURCE STRENGTH:
Evaporating Puddle
Puddle Area: 90 square feet Puddle Volume: 5000 gallons
Ground Type: Concrete Ground Temperature: 55° F
Initial Puddle Temperature: 69.5° F
Release Duration: ALOHA limited the duration to 1 hour
Max Average Sustained Release Rate: 53 pounds/min
(averaged over a minute or more)
Total Amount Hazardous Component Released: 948 pounds

THREAT ZONE:
Model Run: Gaussian
Red : 236 yards --- (100 ppm = AEGL-3 [60 min])
Orange: 542 yards --- (22 ppm = AEGL-2 [60 min])
Yellow: 1.1 miles --- (1.8 ppm = AEGL-1 [60 min])

Your initial Threat Zone on MARPLOT might look something like this:



QUESTION 1: Is this initial ALOHA Threat Zone adequate for this incident?

QUESTION 2: Will the product stop producing vapors before the coming wind direction change occurs? If not, the what is your estimate of the time until the product stops releasing vapors?

QUESTION 3: Will a change in the wind direction and the wind speed impact the Threat Zone display on MARPLOT? How will you operate ALOHA to account for the upcoming weather changes?

All HazMat events are different. In this exercise, I present one approach to using ALOHA for this specific Hydrochloric Acid release. There are other approaches that could be employed as well.

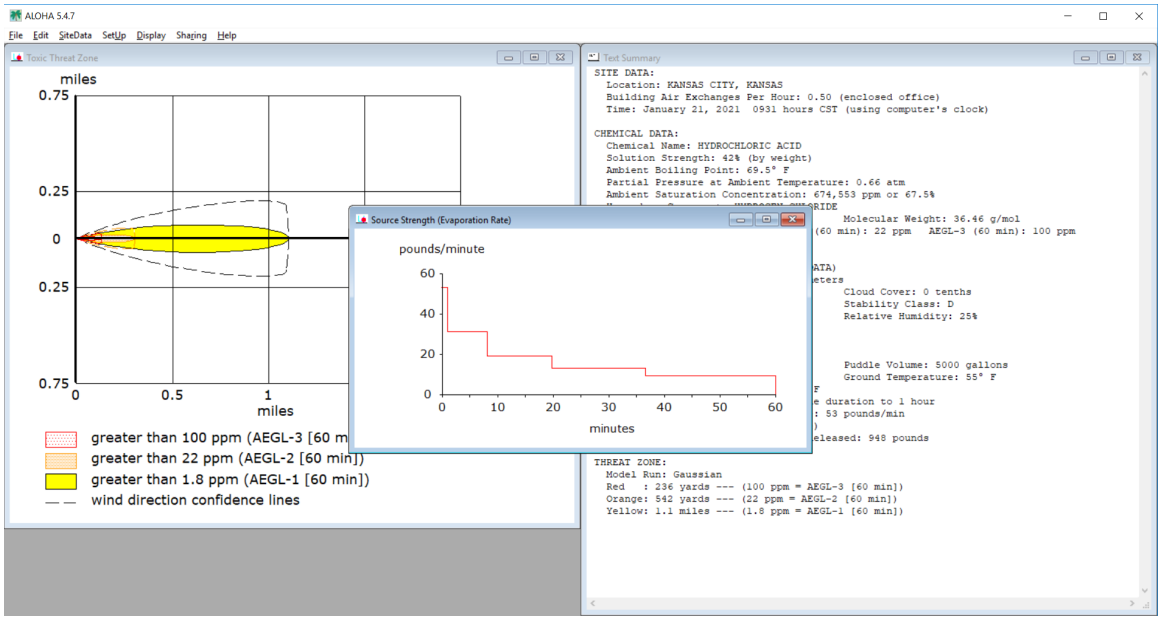
QUESTION 1: Obviously, the initial ALOHA Threat Zone will be adequate for this incident ONLY if the release ends within the 60 minutes before the weather changes. ALOHA predicts that this release will last beyond the 1 hour ALOHA limitation.

However, ALOHA does produce a "Release Rate" as part of the Source Strength Text Summary. In my case, the predicted Release Rate is 53 pounds per minute or 948 pounds per hour.

QUESTION 2: ALOHA is computing the release rate based on our entry of 5000 gallons with 90 square feet of surface area. In the first hour of the incident, ALOHA predicts that 948 pounds of vapor were released into the atmosphere. Assuming the HCl weights about 10 ppounds per gallons, we can convert the 5000 gallons into 50,000 pounds. Using those numbers, we can estimate that 50000 lbs / 948 lbs per hour = 52.74 hours…or basically we would expect the release to continue for about 2 days or more, all other things being equal.

Therefore, we cannot depend on the original Threat Zone for accuracy, because the weather conditions will be changing before the release is over.

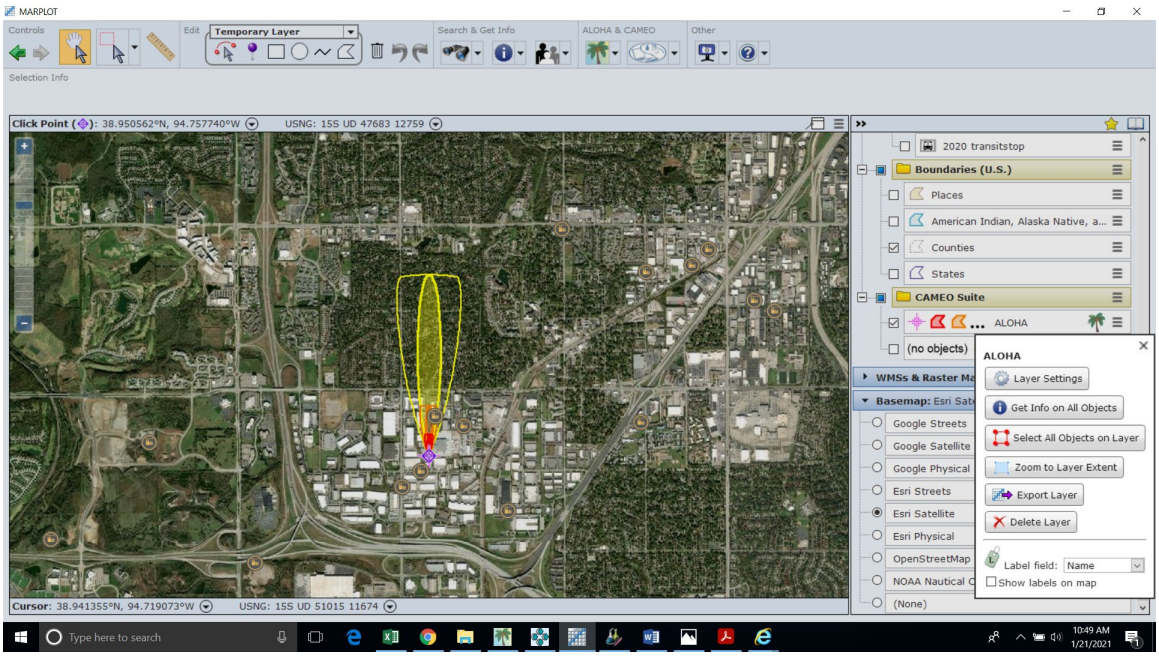
QUESTION 3: Also, we would expect the release rate to lessen somewhat as the amount of material in the tank diminishes. Let's review the ALOHA Source Strength graph to see what ALOHA predicts the release rate to be over the first hour.



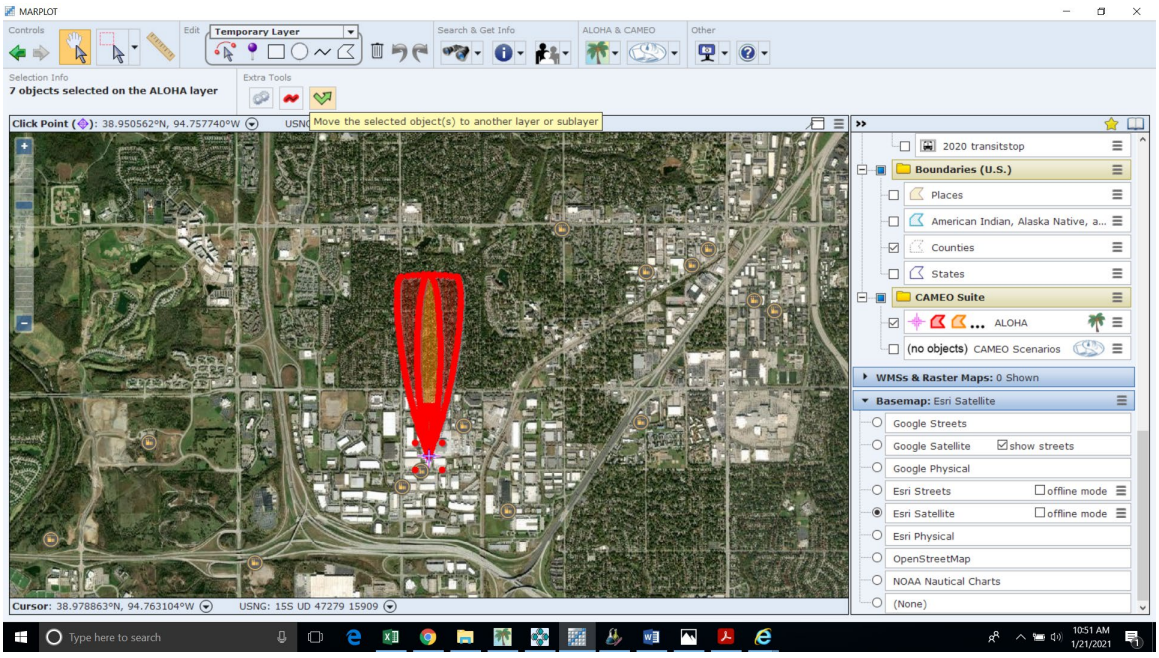
In this case, ALOHA predicts the release rate will not be constant over the first hour of the release. However, we will use the original ALOHA-predicted release rate of approximately 50 pounds per minute to evaluate the Threat Zone for several future time periods with differing weather conditions.

However, we will want to save or preserve our original Threat Zone displays on MARPLOT before we alter any ALOHA conditions.

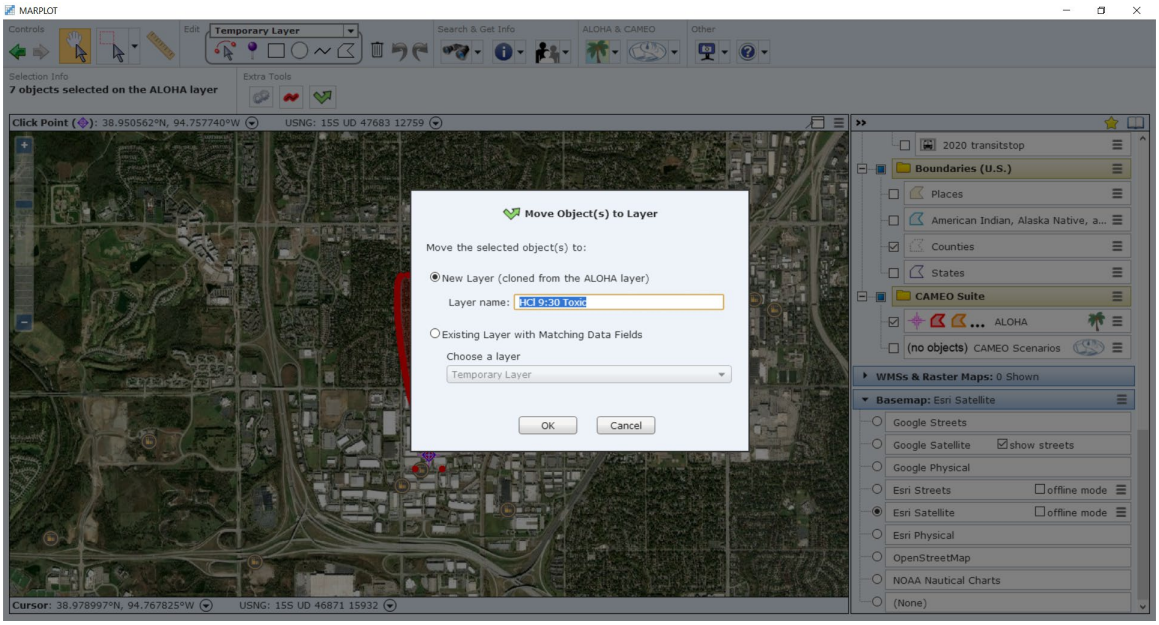
1. Active MARPLOT
2. Select the ALOHA Layer Options menu



3. Choose the Select All Objects on Layer button
4. From your top Extra Tools section, choose the “crooked green arrow”



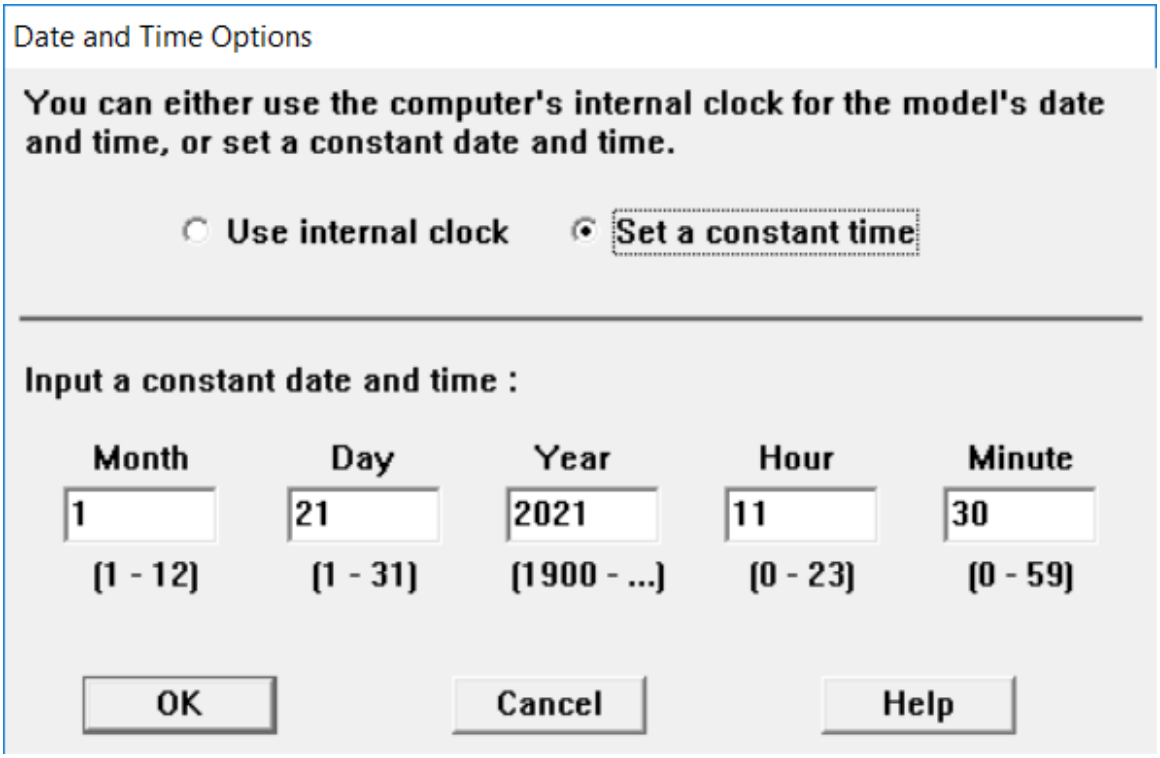
5. Name the new Layer onto which you will move the existing Threat Zone objects. I named mine “HCl 9:30 Toxic”, but you can name yours what ever you want.



6. Select the OK button, your current ALOHA Threat Zone objects have now been copied to a new MARPLOT layer

Now, we can alter the ALOHA conditions without deleting our original Threat Zone displays.

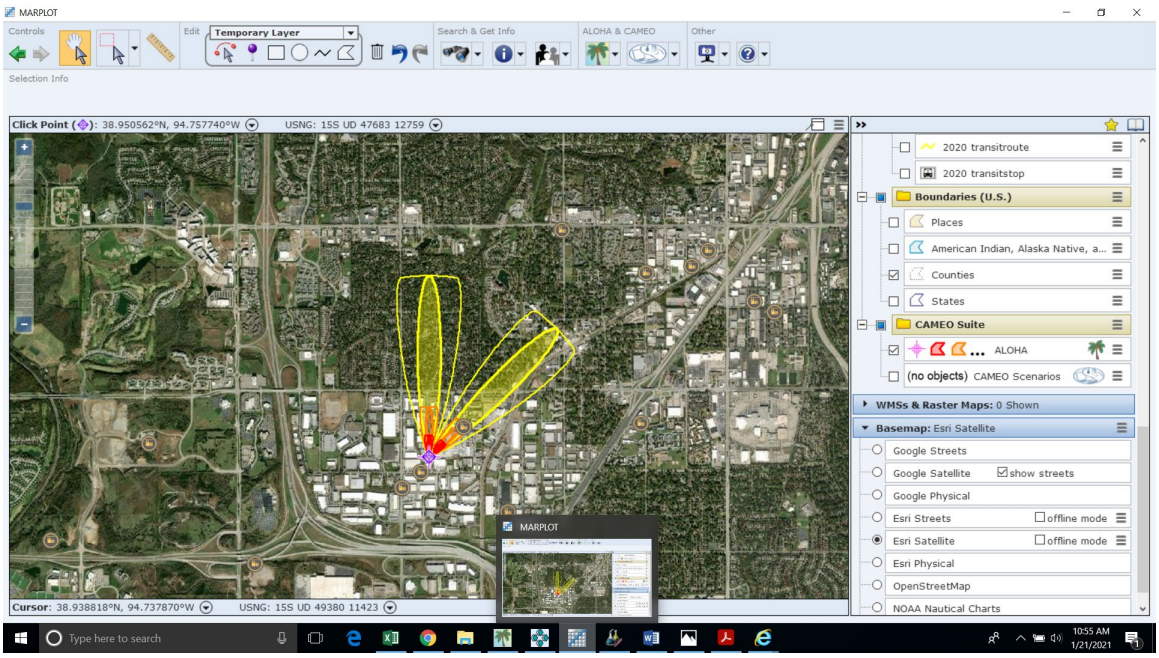
1. Return to ALOHA and select the Site Data / Date and Time menu
2. Select Set a Constant Time and enter a time 2 hours from your original incident time; in my case that will be 11:30 am



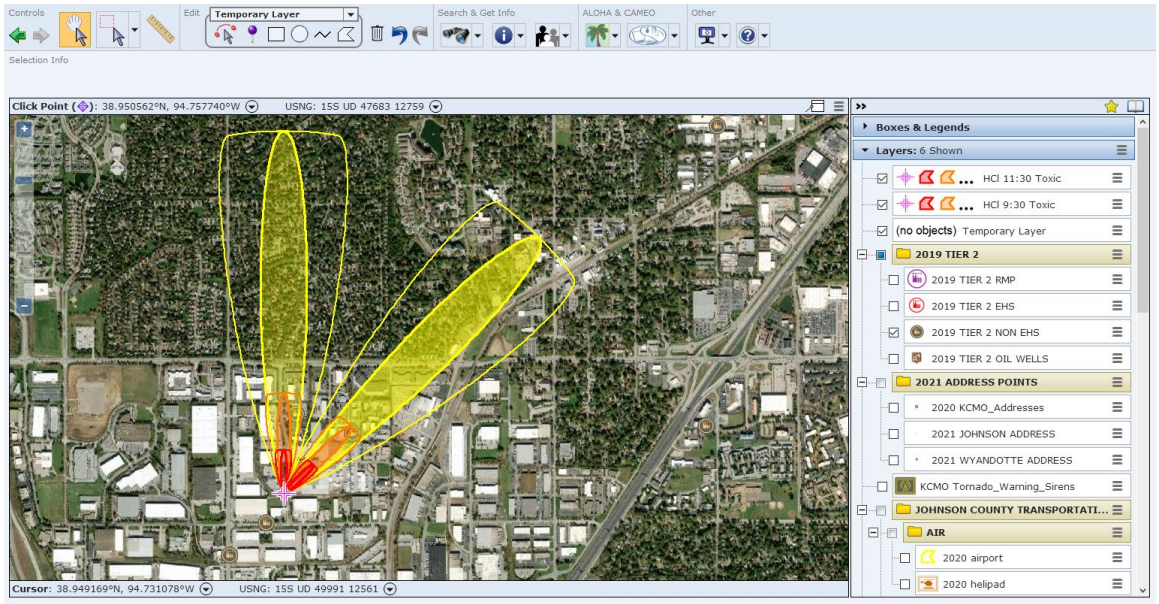
3. Obtain the weather conditions predicted for the 11:30 time from NWS. In my case, I am entering the following atmospheric conditions to ALOHA.

   ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 18 miles/hour from sw at 10 meters
   Ground Roughness: open country Cloud Cover: 3 tenths
   Air Temperature: 62° F Stability Class: D
   No Inversion Height Relative Humidity: 25%

4. Select the Display / Threat Zone menu
5. Return to MARPLOT; you should now have both Threat Zone predictions displayed



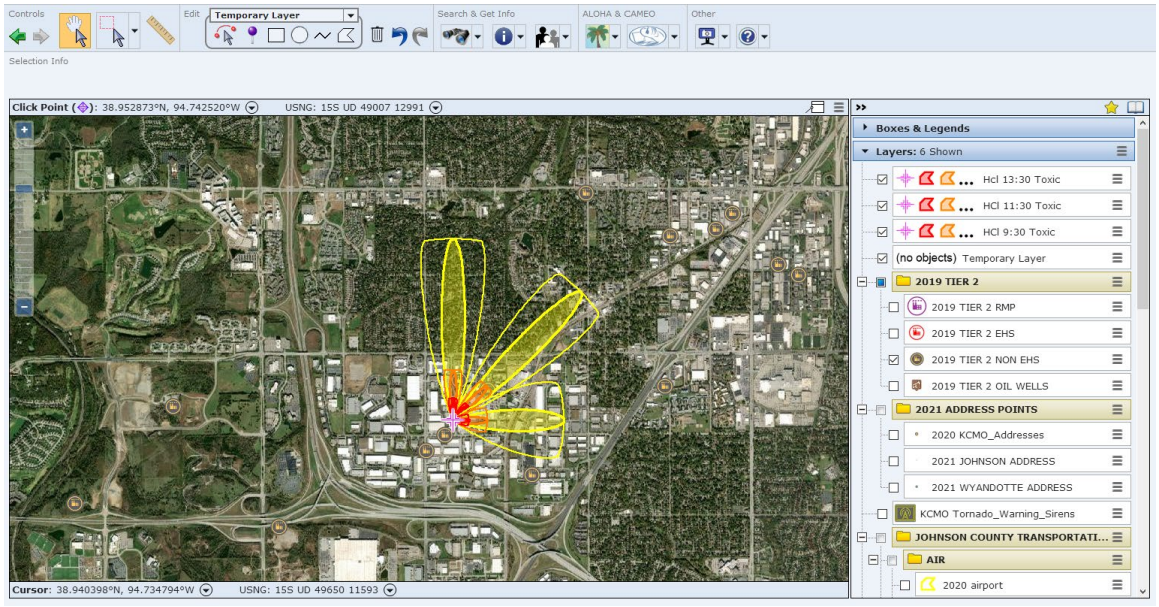
6. Use the ALOHA Layer menu to Select All Objects on Layer and use the Move Objects green arrow to copy the Threat Zone objects to another MARPLOT Layer as you did above. I named my new Layer "HCl 11:30 Toxic"



Assume that by 1:30 pm, the weather conditions will be an 8 mile per hour wind from the west, with a temperature of 68 degrees and 50% cloud cover. Using the steps from above

1. Change the Time to 13:30
2. Change the Atmospheric Conditions as listed
3. View the resulting changes on MARPLOT
4. Move the new Threat Zone objects to a new Layer

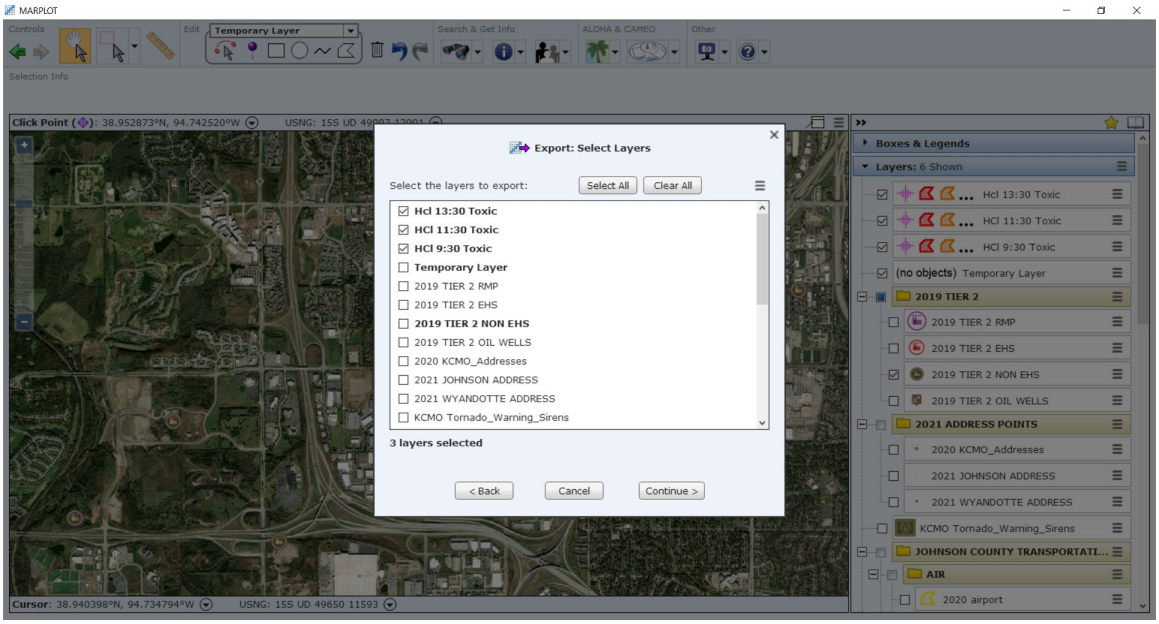
Your MARPLOT might now look something like this



Of course, you may wish to continue this process until the release is mitigated or resolved.

TRANSFERRING ALL THE THREAT ZONES TO GOOLE EARTH

1. Select any of the threat zone layers Layer Options menu
2. Select Export Layer
3. Set to kmz file choice
4. Select the desired Layers to export



5. Name and Save the kmz file; I named mine HCl ALOHA Threat Zones.kmz
6. Find and open the HCl ALOHA Threat Zones.kmz file; this should launch Google Earth and display all the Threat Zones