Understanding Dispersion Models Using Computer Technology

Project Title: Understanding Dispersion Models Using Computer Technology
Name/Grade: Grade 9-12

Subject/Topics: Environmental Science, Earth Science, Meteorology
Objectives:

- Analyze dispersion models
- Use computer models to predict outcomes of various scenarios

9-12 NSES Standards:

- Standard A: Inquiry - Abilities necessary to do scientific inquiry and Understanding about scientific inquiry
- Standard E: Science and Technology - Abilities of technological design and Understanding about science and technology
- Standard F: Science in Personal and Social Perspectives - Personal and community health, Population growth, Natural resources, Environmental quality, Natural and human-induced hazards, Science and technology in local, national, and global challenges

Materials:

- 100 biodegradable helium balloons
- Helium to fill balloons
- Snazzy laminated balloon tags
- Computer Lab with Internet Access to run Hysplit online
- Google Earth (free download) installed on each computer
- CAMEO, ALOHA, and MARPLOT (free downloads) installed on each computer

Prior Knowledge:

- 7 Criteria Pollutants and their relationship to the NAAQS
- Health effects of different pollutants

Engage: Give students a copy of a newspaper article that deals with a chemical spill. Have the students discuss possible consequences of the accident. Who would be impacted? How would they be impacted? Other pictures or examples of incidents could be shown to show how not all spills are the same or have the same impact.

Explore: *(If it is not possible to launch balloons, approach this as a hypothetical situation)* Students will begin modeling dispersion by launching 100 helium balloons. Each balloon should be biodegradable and have a snazzy laminated tag attached that reads as follows: ***This balloon was launched on _____(date)_____ by students as part of a school research project. If found please return this tag to _____(your address)_____***

At the time of the launch have students ready to observe where the balloons go using binoculars, compasses, and other assorted measuring instruments.

See attached Explore example

Explain: The following day the students will use the Hysplit model to make predictions about where they think their balloons will end up.

Go to the website http://www.arl.noaa.gov/ready/hysplit4.html

Underneath the Hysplit-Web click on Run with Archived Data

We will be running a trajectory model. Click on Compute Trajectories

Click on GDAS (global, 2005-present)

Since you want data from the previous school day, click on the current seven days

Choose one trajectory starting location

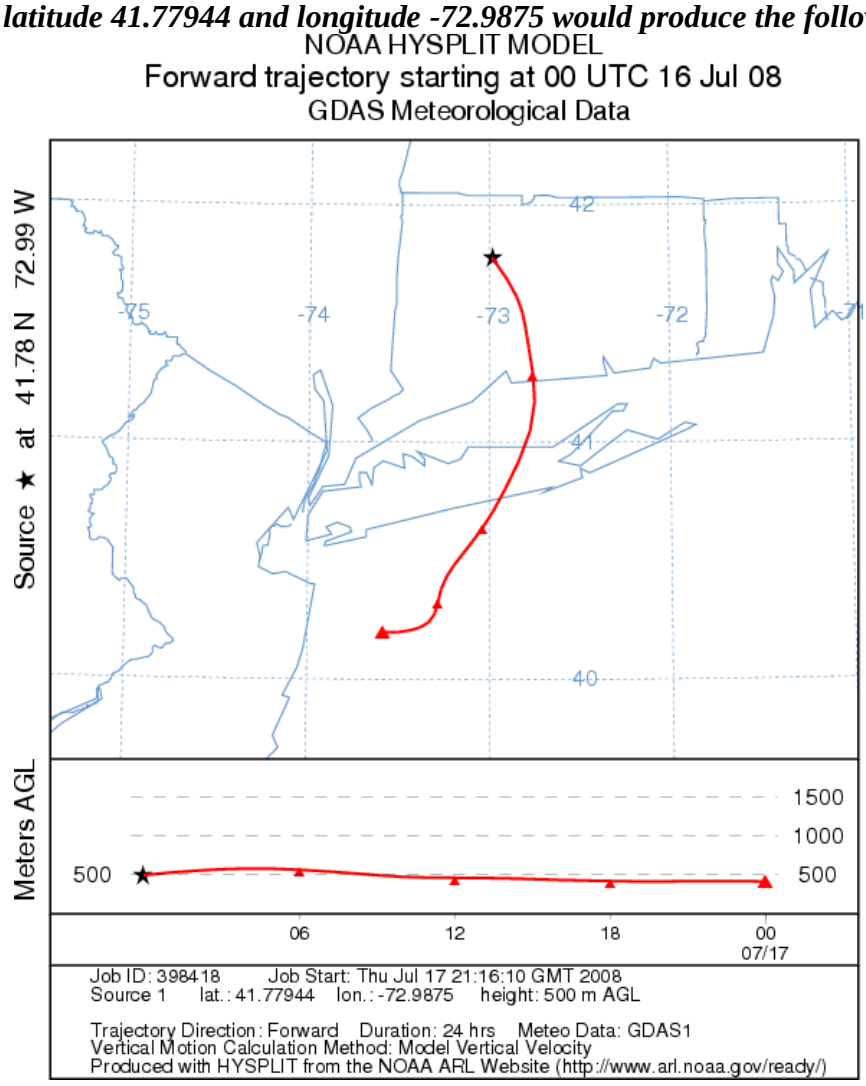
Enter the starting site ID or Latitude and Longitude (to find your latitude and longitude, use http://www.lat-long.com/). Be sure to determine your latitude and longitude decimally as Hysplit prefers that format.

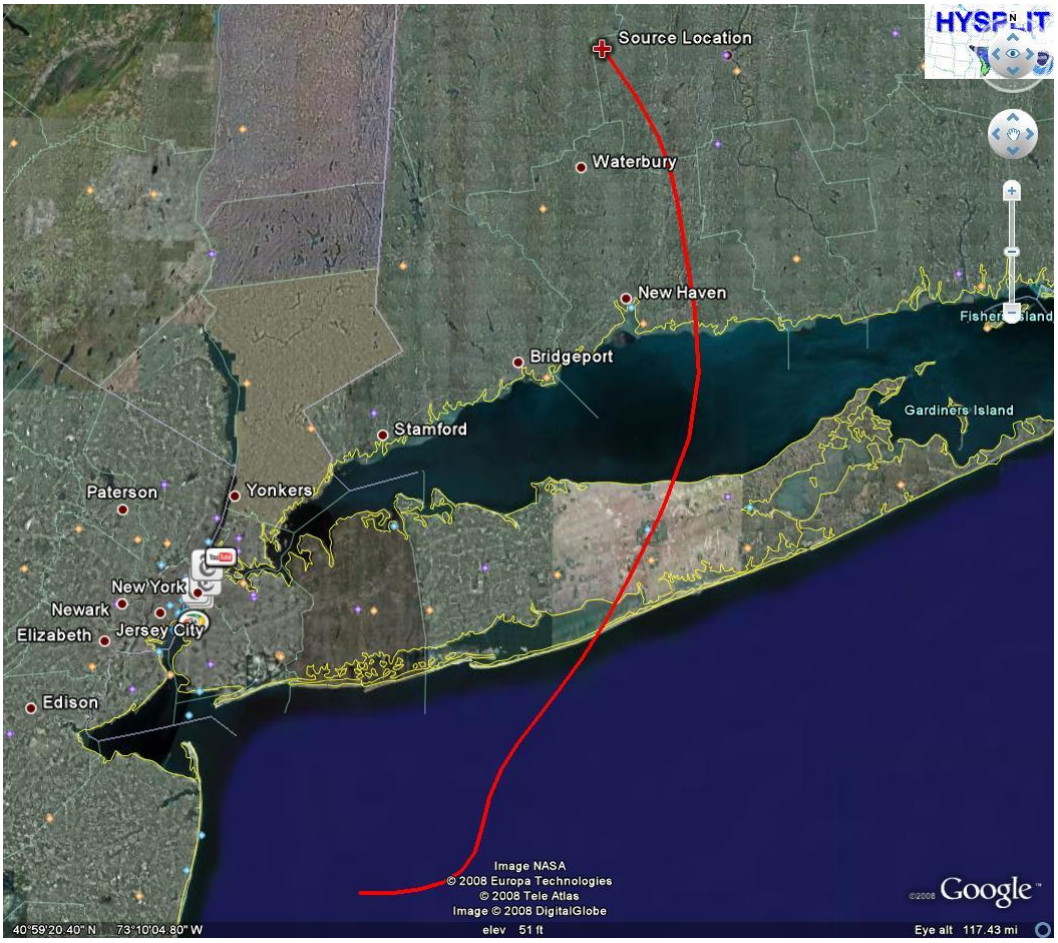
Change the date to the previous day and the hour to the time released. The time must be in UTC time. If you need help converting your local time to UTC click on the "What is UTC Time?" button at the top of the page. Under display options, you may choose Google Earth. Click request trajectory at the bottom of the page.

Click on the Hysplit Run Results

Click on Your Trajectory Plot. This will give you a model of where your balloon may have traveled in the past 24 hours. You may also check your trajectory path clicking the Google Earth file and choose to open it. Google Earth (if installed on your PC) will automatically open and your trajectory will be displayed.

Using the latitude 41.77944 and longitude -72.9875 would produce the following plots:





Hysplit Plot and import into Google Earth

The teacher should then relate this model to how pollution from this area would be distributed. An additional model using Hysplit will demonstrate dispersion of a chemical. This could be done by the students, or prepared ahead of time for a demonstration by the teacher.

See Hysplit example for classroom use [Explain.pdf].

Extend: Your task is now to design a plan of action for our area in the case of an accidental release of a particular chemical. You will determine the specifics of the accident including the chemical type and the location of release. You will run a simulation of the accident using the CAMEO, ALOHA, and MARPLOT software to evaluate how the chemical will disperse in your area. An emergency plan of action for your community will be generated based on your results.

It would be ideal if before this task you could have a guest speaker. Some options could be emergency responders such as firemen, emergency management coordinator, chemical producers, Department of Natural Resources, or Environmental Protection Agency representatives.

Students will complete the following tasks:

- Describe the scenario, being as specific as possible, including weather, type of chemical, location, amount, etc.
- Generate a dispersion model using CAMEO and ALOHA software.
- Develop an emergency management plan. (Now that we know where the chemical has been released, and where it might go, what should we do?) Students should be able to explain the reasoning why they chose this plan of action.
- Present the situation and plan to the class.

See Extension example for classroom use [Extend.pdf].

See tutorial for using CAMEO [CAMEO tutorial.pdf].

Evaluate: Students will be formatively assessed on their class discussion and participation. The rubric below is for assessment of their final model of a chemical spill and an emergency management plan.

Teacher notes: During this part of the activity, bring in a member of the administration, someone from the plant you are using in the simulation, and a member of the public, or another teacher to be the judges. The groups will present their projects to the class. They will need to be professional. The winning group gets to use their plan in a mock disaster. For the mock disaster, contact the emergency manager in your area and ask them if they can come out and help out your class!

1. Each group will need to present their emergency response plan to the group of supervisors determining the most effective plan. Each group needs to be dressed in an appropriate manner to share their findings with the group!

2. After the winning group has been selected, that groups plan will be enacted in a mock disaster at your school. Each person will have a job that helps out with the disaster simulation!

3. The final grade for this unit is based on the emergency response plan submitted by the groups.

The RUBRIC!

	10 points	7 points	5 points	3 points
Content	All group members show a complete understanding of their plan	All group members show a good understanding of the plan.	Some group members are lacking in understanding of their plan.	Only one group member has a clear understanding of the emergency response plan.
Human and animal affect	The effects on humans and animals now and in the future are completely explained and well thought out	The effects are missing key points and are hard to follow.	The effects are incomplete and do not explain what may happen in the future.	The effects are very incomplete and do not cover any present or future implications of the chemical spill.
Environmental Impact	The impact on the environment now and in the future is completely explained and easy to understand.	The impact on the environment is missing pieces and hard to follow.	The impact on the environment is incomplete and does not explain future hazards this chemical may cause.	The impact on the environment is very incomplete and does not cover the effects of the chemical spill.
Chemical Descriptions	Complete description of the chemical and the hazards the chemical can cause.	The chemical is description was hard to understand and does not explain its hazards.	The chemical description was incomplete. No chemical hazards were described.	The chemical description was very incomplete and the presenter did not have a clear understanding of the chemical that was released
Maps	All maps were complete and labeled with cloud cover and includes 5 MAJOR buildings (schools, hospital, etc)	Maps were not 100% complete. Missing buildings or cloud cover. Buildings are not major attractions.	Maps were only half completed and had very few buildings and cloud cover.	Maps were severely incomplete. No cloud cover was labeled and no buildings were labeled.
Oral Presentation	Interesting and well rehearsed. Holds the audiences attention.	Relatively interesting and fairly rehearsed. Holds the audiences attentions	Not well rehearsed and hard to follow. Some audience attention.	Very poorly rehearsed and not interesting. Did not hold the audiences attention.
Paper	Typed paper with correct grammar and follows lay out.	Paper is typed but has grammatical errors.	Paper is typed but has grammatical errors and does not follow the lay out.	The paper is not typed, has grammatical errors and does not follow the correct lay out.
Attire	Business attire, very professional looking. No jeans or tennis shoes!	Casual business attire	Casual business attire, but had tennis shoes on and was all wrinkly	Attire very inappropriate for the presentation. Jeans, shorts, sneakers, etc.
Group Grade – to be determined by the group				

Evacuation follows chemical spill

Compiled by Anne Gregory

The Journal Gazette

The Fort Wayne Fire Department Hazardous Materials Team was asked to respond by New Haven Adams Township Fire Department to a report of a chemical spill at Brenntag Corp., 1615 Estella Ave., shortly before noon Monday.

Everyone inside the building was safely evacuated.

Brenntag employees had found that a pallet at the bottom of a stack of pallets stacked three-high with three 55-gallon drums per skid has broken causing the stack to topple, spilling a chemical.

The company and fire departments identified the chemical as hydrofluoric acid, manufactured in Germany, and with one-half of 1 percent solution.

It was determined that little acid had spilled and there was minimal risk to the public.

Brenntag will hire a company to conduct the cleanup, the Fort Wayne department said.

KENLY, N.C. -- HazMat crews working at a chemical leak from a tractor trailer near the TA Truck Stop off of I-95 in Johnston County are now bringing in another truck to release pressure from the leaking trailer and have pushed back media another quarter mile in case some particles are released into the air. Evacuations are taking place as the cloud of smoke moves, said the Johnston County Sheriff's Office. However, the office cannot confirm the location of the evacuations or how many people are being evacuated.

Officials were called to TA Truck Stop off of Interstate 95 around 3:35 a.m. due to a chemical leak.

The driver of the truck noticed a smell emitting from his tractor trailer and decided to pull over, said officials. It was determined that the chemical leaking from the tractor trailer was silicon tetrafluoride.

Truckstop Rd from I-95 is closed. Officials advise to use U.S. 301 or I-95 as detours and to avoid the area if possible.

I-40 reopens after tanker spill

News Sentinel staff
Tuesday, July 15, 2008

CRAB ORCHARD, Tenn. - Interstate 40 through Cumberland County was reopened Monday morning, nearly two days after an overturned tanker truck loaded with a dangerous chemical led to residential evacuations and epic traffic snarls, according to Gary L. Howard, spokesman for the Cumberland County Emergency Management Agency.

A 10-mile section of the interstate had been shut down during the clean-up efforts, prompting authorities to divert traffic onto Interstate 75 South and U.S. Highway 70.

The tanker ran off the road near Crab Orchard, at the 331 mile marker between Rockwood and Crossville, just after 2:30 p.m. Saturday.

Nine people were taken to the hospital after the multivehicle wreck.

Authorities haven't released the victims' names, and their conditions were unavailable.

A Tennessee Highway Patrol dispatcher said Monday there were no fatalities in the crash.

State officials evacuated people from a two-mile radius around the wreck scene and closed the interstate because the tanker was loaded with 3,200 gallons of titanium tetrachloride, a chemical that can irritate the eyes, skin, mucous membranes and lungs.

Titanium tetrachloride is used to create naval smoke screens.

Emergency crews worked to move the toxic chemical into a new tanker truck that arrived at the wreck scene just before 7:30 a.m. Sunday.

Also Sunday night, residents of nearby communities who had been forced to evacuate were allowed to return to their homes.

The Baytown Sun

Hazmat spill shuts down Bayway

By Tara Sullivan
The Baytown Sun
Published July 10, 2008

A tanker truck carrying Molten Naphthalene (a coal-derivative) slowed for a stoplight at the intersection of Bayway and Decker Drives Wednesday morning. A “good Samaritan” who had been tailing the tanker pulled next to the driver, letting him know that the dome lid on top of the truck had come loose. Between 3 to 5 gallons of the flammable chemical substance had been trailing behind the truck.

The driver immediately pulled to the side of Bayway and called local Hazardous Material specialists. Minutes after the spill, the Naphthalene left a solidified streak along the road and a mothball-smell permeated the air.

First to arrive on the scene were workers from Advanced Aromatics, a local company that produces and disposes of Naphthalene.

Shortly thereafter, state troopers and the Baytown Fire Department’s Hazmat team set up shop.

The crews coordinated their efforts, laying traffic cones and redirecting traffic away from the substance. Passers-by traveling the opposite side of the road craned their necks to follow the chalky-white line that stretched about five car-lengths down the northbound lane of Bayway.

Advanced Aromatics employee Phillip Sprague said the Naphthalene was not an immediate danger, as it solidifies when not under extreme heating conditions. The substance is most flammable at 174 degrees, so even the Texan sun was not a threat.

“You could light a match to this stuff and it wouldn’t catch fire,” he said.

The mothball smell, which Sprague also said is not harmful, is characteristic of Naphthalene, the main ingredient in mothball manufacturing. The substance is also used in leather tanning and the Kodak print process.

The main concern for the Hazmat teams was the Naphthalene trail’s proximity to a manhole cover near the roadway.

Firefighters were quick to notice the hazard and covered the largest spill area with large white absorbent towels.

Though the local response was fast and efficient, the actual clean-up came quite slowly.

At noon - three hours after the spill - a clean-up crew from Environmental Earth-Wise (EEW) arrived.

Sprague, who had been pacing the site for hours, said the wait was one of the longest response times he had ever experienced. Even with all the responders on site, the clean-up effort was at the mercy of a specially certified team to transport the substance after pickup.

Fred Dohmann, the vice president of Advanced Aromatics, said the delay was a fluke.

“The delay came because most of their equipment was tied up,” he said. “Unfortunately this happened at a time when there wasn’t anyone out there.”

Dohmann also said because the spill was contained and nobody was in danger, the delay was mainly an inconvenience.

City Manager Garry Brumback said the city had performed to the best of their ability during the clean-up effort. Advanced Aromatics employees commended that effort.

“The local authorities responded very quickly and contained it,” said Dohmann.

Still, the three-hour clean-up delay was frustrating to many, prompting questions as to the efficiency of third party clean-ups.

“I thought there are emergency clean up crews,” said Sprague in the midst of the wait. Environmental Earth-Wise, the company that arrived at noon, was actually the second phone call Sprague had made. He said other companies had directed him to voicemail or told him there simply was nobody available to help.

The Environmental Protection Agency agreed that the response time was slow, but had no further information on the lag. Because the spill was less than 12 gallons, EPA, TCEQ and other authorities were not overseeing the clean-up effort.

At around 2 p.m., the solidified substance had been sand blasted, sucked into a tank and hauled away for destruction.

The tanker involved had been taken in for repair and will likely return to the road soon.

Clean-up crews said the small scale of the mess was thanks to the Good Samaritan who took the time to alert the truck driver of the problem.

“I am just so glad it’s contained to this area,” said Sprague.

If ever a potentially hazardous spill is spotted, authorities urge you to contact the Baytown Fire Department at 281-422-2311.


CAMBRIDGE
ENG 1 INE

Explore

Launching helium balloons

- Each class of students launches approximately 25 biodegradable balloons.
- Each balloon has a laminated tag attached with the following information.

O

This balloon was launched on Today's date by students as part of a school research project. Please return this tag to: Science Department; Anytown High School, Anytown, NY 11111 or email to scienceteacher@anytown.org and be sure to include your zip code.

Thanks for your participation in this project

- Students will:
  - make observations using binoculars, stop watches and compasses.
  - record approximate distances traveled in time observed.
  - calculate average speed and directions.
  - record all data for later analysis.

Explain

Using Hysplit to Determine Dispersion Patterns of a Proposed Coal Burning Power Plant

1. Go to the website http://www.arl.noaa.gov/ready/hysplit4.html

2. Underneath the Hysplit-Web click on Run with Archived Data

3. We will be running a dispersion model. Click on Compute Concentrations.

4. Click on GDAS (global, 2005-present)

5. Since you want data from the previous school day, click on the current seven days

6. Our proposed site is the former Buell Airport in Ralls County Missouri. The latitude is 39.3625 and the longitude is -91.60833. Enter that data on the next page and click next.

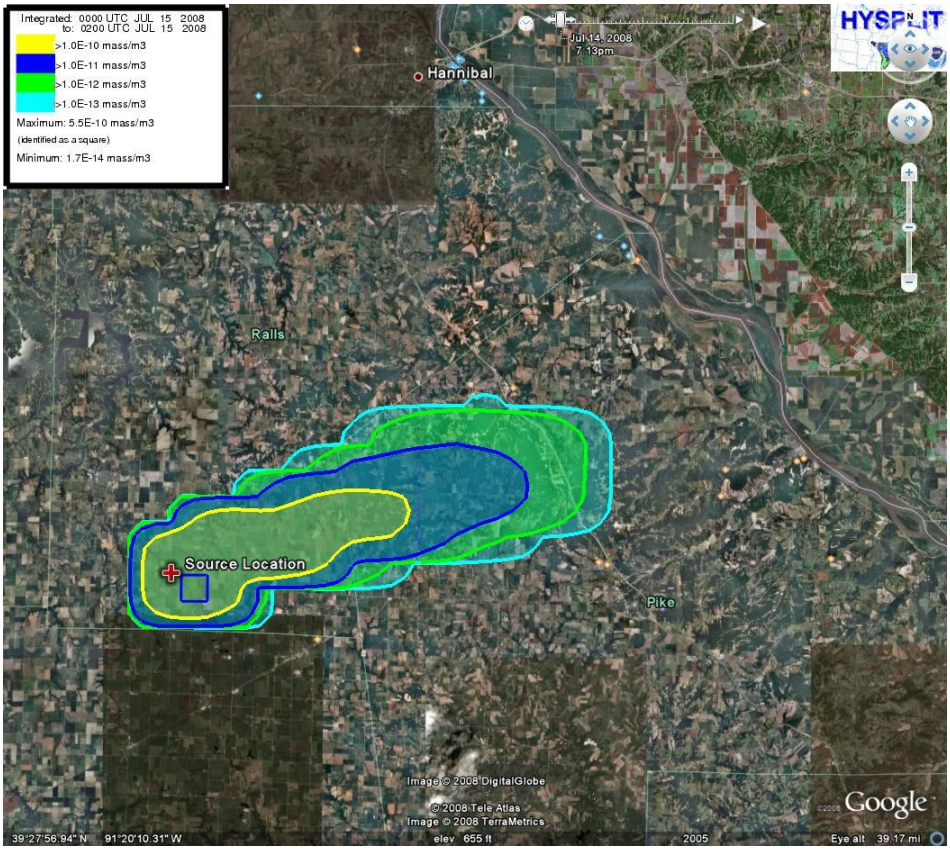
7. All of the options listed on this page can be defaulted except the source top height and bottom height which will both be listed at 100 meters (the smoke stack on the proposed plant will be 100 m) and the emission rate will be 20.0 mass units per hour (calculated previously). Under display options, you may choose Google Earth. Request Run Dispersion.

8. Click on the Hysplit Run Results. This will take some time to process so please be patient.

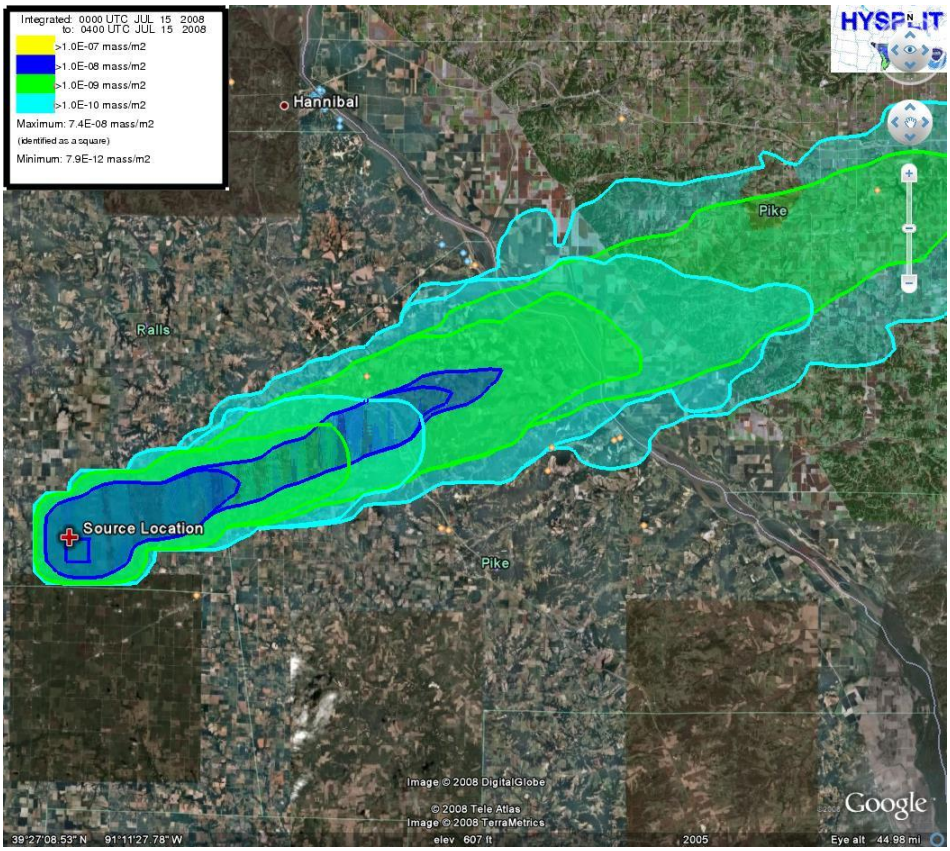
9. When the file has finished processing, choose the option to open Google Earth File (kmz).

10. As Google Earth opens, you will be brought right to that site. The concentration (dispersion) model will display. There is a set of controls in the upper right hand side of the Google main screen to control your animation. You can play this animation.

11. Notice the Places box on the left hand side of the Google Earth page. All of the "Concentration" boxes have been selected. You may unselect them and choose the individual deposition boxes to make note of the areas of deposition.



Ralls County Concentration Display from Google Earth



Ralls County Dispersion Map from Google Earth

Extend

Teacher notes: For this activity students will be creating their own emergency response program. The students need to take on the roles listed below and be active engaged learners in this situation. This is their plan, and they need to figure it out. The scenario should be set to focus on a real life situation the students could encounter. The scenario can be altered by changing the wind speed, location, holding tank size, etc. Each group can have a different scenario and the differences in their results can be discussed. A sample scenario is included below. The groups need to identify the roles they will be taking on and the idea that they are presenting to the community needs to be stressed. The presentation can be in any format, but each group needs to have a plan that they can submit to the company. Copies of the plan should be made ahead of time so they can be distributed. I have included a sample of how the plan can be constructed. The cartographers should work together to create their maps. They need to follow the instructions with the CAMEO software provided by the STORMS project. Chemists should use the following website, http://cameochemicals.noaa.gov/ to help find their information. Each group needs to turn in an emergency response plan and present it to the class.

The Scenario noted below is simply a situation you may choose to use. You can also create a situation closer to home for your school and community. You might want to consider multiple scenarios so each group would have a unique presentation.

Emergency Management of a Chemical Leak

Directions: Read the following scenario

The Scenario

The Amana refrigeration plant is located in Middle Amana (latitude 41° 47.5' N, longitude, 91° 54.9' W) Iowa, approximately 0.25 miles away from the school. The elevation in Middle Amana is 741 feet above sea level. Middle Amana is located in Iowa County. The Amana plant, in an effort to help the environment, has decided to collect old refrigerators. All refrigerators contain Freon – a chemical that circulates through the walls of the refrigerator and is changed from a liquid to a gas. This change allows it to cool the contents of the refrigerator. Refrigerators constructed before 1992 used Freon that contained dichlorodifluoromethane, a type of chlorofluorocarbon (CFC) that is very harmful to the ozone layer. Scientists began to notice the harmful effects those CFC's in the late 70's. By 1992, most CFC's were banned around the world.

To help rid the world of dichlorofluorocarbons, the Amana refrigeration plant decided to collect old refrigerators and remove their Freon and recycle it. People were allowed to bring their old refrigerators to the plant and drop them off, for a small fee. All of the dichlorofluorocarbons were removed and placed in a holding tank, approximately 10 feet in diameter and 15 feet in length. The tank was horizontal and filled with the dichlorodifluoromethane liquid chemical 80.4% of the way up.

On a beautiful partly cloudy day, with a temperature of 71°F, medium humidity and a NW wind at 15 mph (no inversion), a worker at the Amana plant noticed a hole in the tank, 95% of the way up the tank and 4 inches wide. "Oh no," she though, "what would the people of Middle Amana do"? "Especially with a school so near"? "What would happen"? "Would anyone die"?

YOUR JOB:

Your group's job is to create an emergency management plan to deal with this situation. Your plan will be presented to a member of the Amana plant administration, our principal, and a representative of the Amana Society. They will judge your plans based on the criteria listed in the rubric below. The winning plan will be enacted when we have a mock disaster here at the school. You will need to create an engaging presentation and turned in your emergency response plan when you present.

Within each group you will need to assign each other the following roles:
Cartographer – this person is responsible for the mapping of the affected area. They will use the CAMEO operation and the ALOHA operation in order to create a map of the affected area. They will present their findings to the group and will help determine the location of disaster clean up.
Chemist – your job is to research the hazardous properties of dichlorodifluoromethane. You need to find out everything you can about

the chemical in order to help the group decide how to clean up the chemical. Use this website http://cameochemicals.noaa.gov/ for help!

Environmentalist – your job is to find out how this chemical will affect the land and the air. You will need to work closely with the cartographer and the chemist to determine where the chemical is going and what damage it can cause. Use this website for help! http://earth1.epa.gov/chemfact/

First Responder – your job is to find out how this chemical will affect humans and animals. You need to determine what can be done to help those in direct contact with the chemical. Are there any long term affects of the chemical?
http://www.epa.gov/chemfact/f_freon.txt

Everyone's Job – to work together to create an emergency response plan. You must follow the rubric below!

What your paper should look like!

Title: Be creative!

Overview: A brief description of what you plan to do!

Materials: What materials will you need to complete your plan?

Procedure: How will your plan be put into place? What happens? How will you clean this up? Who do you need to help? Will people die? Will their babies have three legs?

Chemical analysis: What does the chemical do? Why is it so bad?

Maps: CAMEO and ALOHA maps that demonstrate the movement of the cloud and the areas affected.

Environmental impact: How is the environment affected? Now? In the future?

Human / Animal Impact: How are humans and animals affected? Now? In the future?

Conclusion: The highlights of your plan – why is your plan the best there is?

Sources: List all sources that you used in your paper.

Your Emergency Response Plan Check List!
Did you ……
_____ Create a unique plan to help save people's lives?
_____ Include all materials that you will need?
_____ Determine if human and animal life will be affected?
_____ Finish your maps?
_____ Collaborate with each other to make a real life plan?

_____ Research the chemical and its affects?
_____ Type your paper?
_____ Dress up?
_____ Rehearse?
_____ Work well with each other?

Background

Your task is to design a plan of action for our area in the case of an accidental release of a particular chemical. You will determine the specifics of the accident such as the chemical type, weather conditions, location of release, amount of the chemical, etc. You will run a simulation of the accident using a computer model to evaluate how the chemical will disperse in your area. An emergency plan of action for your community will be generated based on your results.

Students will need to do the following:

1. Describe the situation or scenario – be sure to include weather, type of chemical, location, amount, etc. Try to be as specific as possible when explaining the situation.
2. Generate a dispersion model using CAMEO software.
3. Build an emergency management plan. (Now that you have the dispersion model/map, what would you do???) You should be able to explain your reasoning on WHY you choose your plan of action.
4. Present your situation and plan to the class.

CAMEO: Computer-Aided Management of Emergency Operations

1. Launch the CAMEO application from the Start menu by looking in All Programs or choose the icon from your desktop.

2. To get familiar with the program, we will first explore ALOHA from the Navigator options. >Click on ALOHA

3. A text box will open and provides some of the limitations of the program. Be familiar with these limitations. >Click OK

4. We will practice with the following scenario:

   On the Michigan Avenue Bridge in Chicago, IL, an tanker truck carrying liquid chlorine has been involved in an accident. The tanker, now lying on its side on the southern side of the bridge, is leaking chlorine gas. The elevation is 578 feet and the location is 41º 53' 18.72" N; 87º 37' 27.77 W. The tanker is a horizontal cylinder that is 20 feet in length and 10 feet in diameter and the material is stored at ambient temperature. The tank is 70% full (by volume) and the leak developed from a circular hole that is two inches in diameter and located 90% of the way to the top of the tank.

   Weather conditions at the time of the leak are cloudy (no inversion) and wet with a temperature of 51º F and an anemometer level (10 m) wind from WNW at 10 knots.

5. Use the information above the complete the SiteData input. >Click on SiteData then >Click Add

6. Type in Location is "Michigan Avenue Bridge, Chicago, IL." Type in Elevation is "578 feet." Use 41º 53.3' N and 87º 37.5' W for your coordinates and then Select this location from the Location Information menu.

7. To complete the SetUp menu, >Click SetUp then >Chemical. Scroll down the chlorine and Select this.

8. Next, you will add the atmospheric conditions. >Click Setup then >Atmospheric then >User Input. Enter a Windspeed of 10 knots, Wind WNW, Measure Height (Click second radio button) or enter 10 m, Ground Roughness is Urban, Cloud cover is complete, then >Click OK

9. In this next box, you will enter an Air temperature of 51º F, Stability Class is the default (though there is a choice to override this), Inversion height will be the default of no inversion, and Humidity is wet, then >Click OK

10. Next, you will input the Source information. >Click SetUp, >Source, >Tank. Input a horizontal tank with a diameter of 10 feet, length 20 feet, and volume will autocalculate, then >Click OK

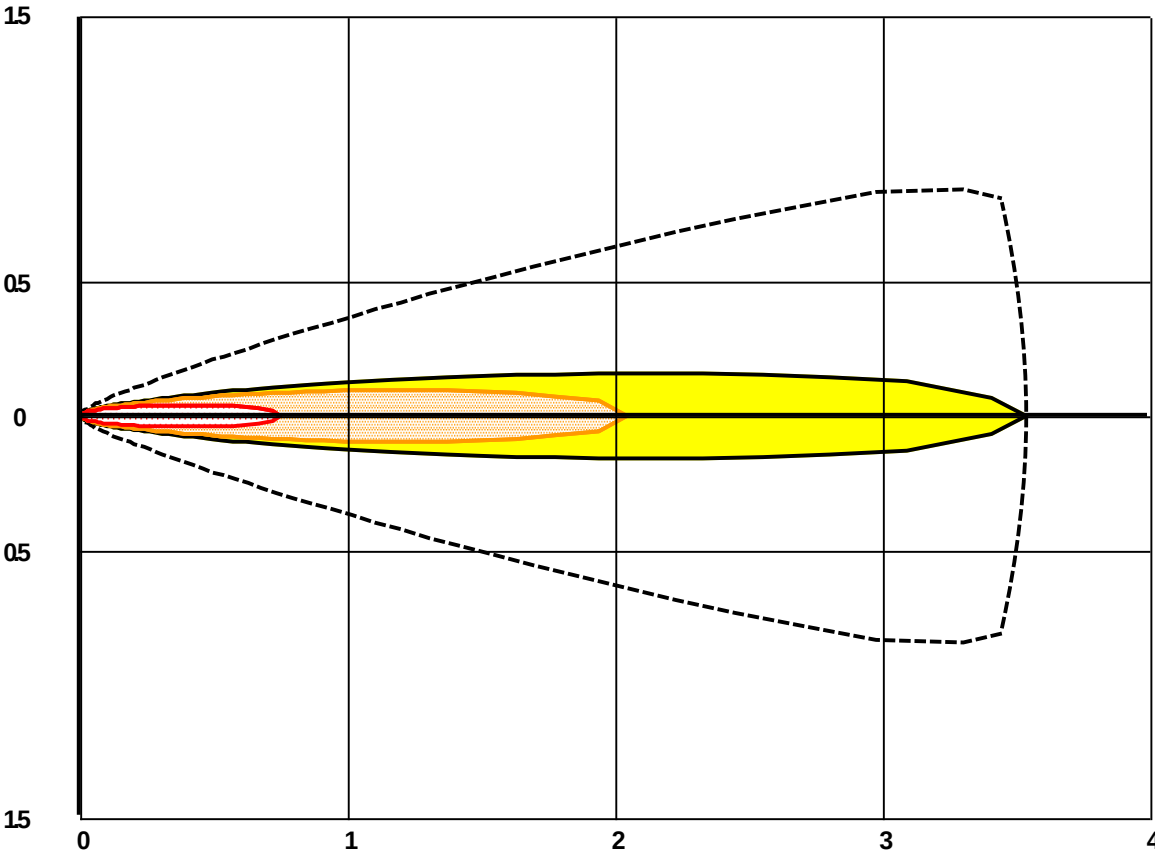
11. Continue in the next box by inputting that the tank contains liquid and the temperature is ambient, then >Click OK

12. In the next box, input that the tank is 70% full by volume, then >Click OK

13. In this box, identify the 2” opening through a hole, then >Click OK

14. In this last box, include the opening is 90% of the way to the top of the tank, then >Click OK

15. >Click Display, then >Threat Zone. Use ERPG 3, 2 and 1 for the red, orange, and yellow threat zones respectively. You may show confidence lines only for the longest threat zone.



Your ALOHA plot should look similar to this

16. To get the map background on which to plot the footprint of the plume:

    a. Go to the MARPLOT Maps link to find all United States maps http://web-services.gov/mmaps/index.htm

    b. Select Illinois, then select Cook, then select the Open option.

    c. Click once on the file (it will be 17031 for Cook County) to highlight it, then click on “Extract all files”, then click Next, then click Browse, then click on the Weather folder you created on your desktop, then click OK, then Next. Uncheck the box next to “Show extracted files”, and then click Finish.

    d. Go back to your CAMEOfm session on your task bar.

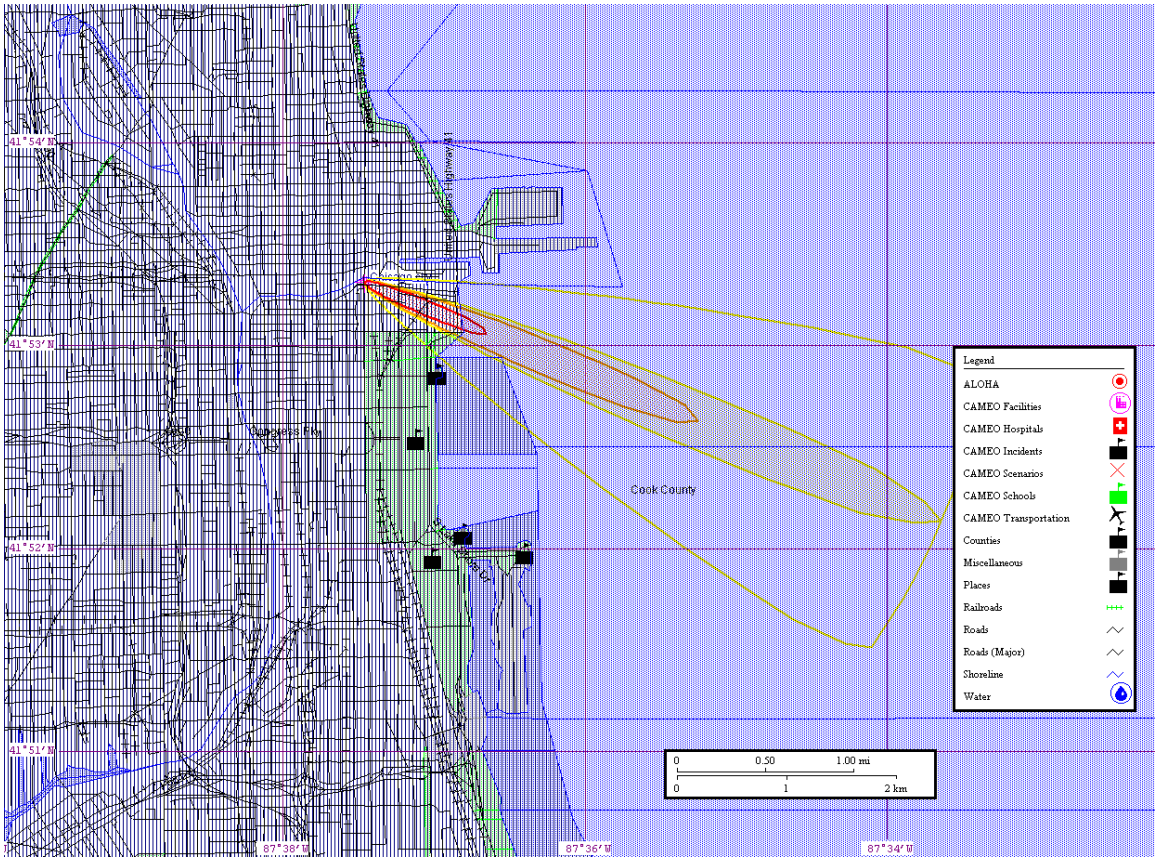
17. The next step is to plot the plume’s footprint onto the map. Launch MARPLOT from the CAMEO Navigator display. From the View menu, select GoToView, then Map

List, then Find New Map. In the “Look in:” dialog box, select the Weather folder. Then click on the “17031” folder, then Open, then click on NAME.MAP, then Open, then Go to Map.

18. Now we will mark the point of origin for the plume. Just below the menu bar, select the little down arrow to the left of the term “Focus Pt.” Then select “Go to Lat/Long” and enter 41º 53’ 18.72” N; 87º 37’ 27.77 W.

19. Finally, let’s plot the plume on the map. From the Sharing menu, select ALOHA and then Set Source Pt.

20. You can zoom by selecting the + magnifying glass at the left side of the display.



MARPLOT Map with plume overlay.