CAMEO Refresher Exercise Set: June, 2010
CAMEO and Google Earth

CAMEO Chemicals

Exercise 1:

1. Find the following information from the CAMEO Chemicals software:

Chemical Name: _____ CAS # : 7664-41-7

UN/NA #: _____ DOT Label: _____

NFPA Values
- Flammability _____
- Health _____
- Reactivity _____
- Special _____

Regulatory Information
- CAA Threshold Quantity _____
- CERCLA RQ _____
- ERCLA TPQ _____
- RCRA Chemical Code _____

ERG Initial Isolation Zone: _____

ERG Downwind Protection Distance: _____

General Description _____

_____

Reactivity _____

_____

First Aid _____

_____

Reactive Hazards _____

_____

Health Hazards _____

_____

Fire Hazards & Firefighting _____

_____

Chemical Properties:
- AutoIgnition _____
- Flash Point _____
- Specific Gravity _____
- Molecular Weight _____
- Water Soluability _____
- Vapor Pressure _____
- Vapor Density _____

Action Levels:
- LEL - UEL _____
- IDLH _____
- TLV _____
- TEEL-1 , 2, 3 _____
- ERPG-1, 2, 3 _____
- AEGL-1, 2, 3 _____

Exercise 2:

1. Find the following information from the CAMEO Chemicals software:

Chemical Name: _____ CAS # : 7664-41-7

UN/NA #: _____ DOT Label: _____

NFPA Values
- Flammability _____
- Health _____
- Reactivity _____
- Special _____

Regulatory Information
- CAA Threshold Quantity _____
- CERCLA RQ _____
- ERCLA TPQ _____
- RCRA Chemical Code _____

ERG Initial Isolation Zone: _____

ERG Downwind Protection Distance: _____

General Description _____

_____

Reactivity _____

_____

First Aid _____

_____

Reactive Hazards _____

_____

Health Hazards _____

_____

Fire Hazards & Firefighting _____

_____

Chemical Properties:
- AutoIgnition _____
- Flash Point _____
- Specific Gravity _____
- Molecular Weight _____
- Water Soluability _____
- Vapor Pressure _____
- Vapor Density _____

Action Levels:
- LEL - UEL _____
- IDLH _____
- TLV _____
- TEEL-1 , 2, 3 _____
- ERPG-1, 2, 3 _____
- AEGL-1, 2, 3 _____

CAMEOfm EXERCISE:

Displaying CAMEOfm Facilities on Google Earth.

It is possible to display CAMEOfm Facility records on Google Earth. The process is as follows:

1. *Open CAMEOfm; open the Facilities module*
2. *Select a single facility record, or a group of facility records*
3. *Select the "File / Make KML file" menu*
4. *Choose "Current Record, Found Set, or All Records" from the Make KML File dialog box*
5. *Select the "Open in Google Earth" box*
6. *Select "Make KML File"*

Your computer should launch Google Earth and zoom-in to the selected Facilities.

1. Open CAMEOfm; open the Facilities module

2. Conduct a CAMEOfm Search to select a group of facility records

3. If your Facility records are linked to MARPLOT, select the Sharing / MARPLOT / Show All on Map menu

4. Return to the CAMEOfm Facilities module; the found set of records should still be active

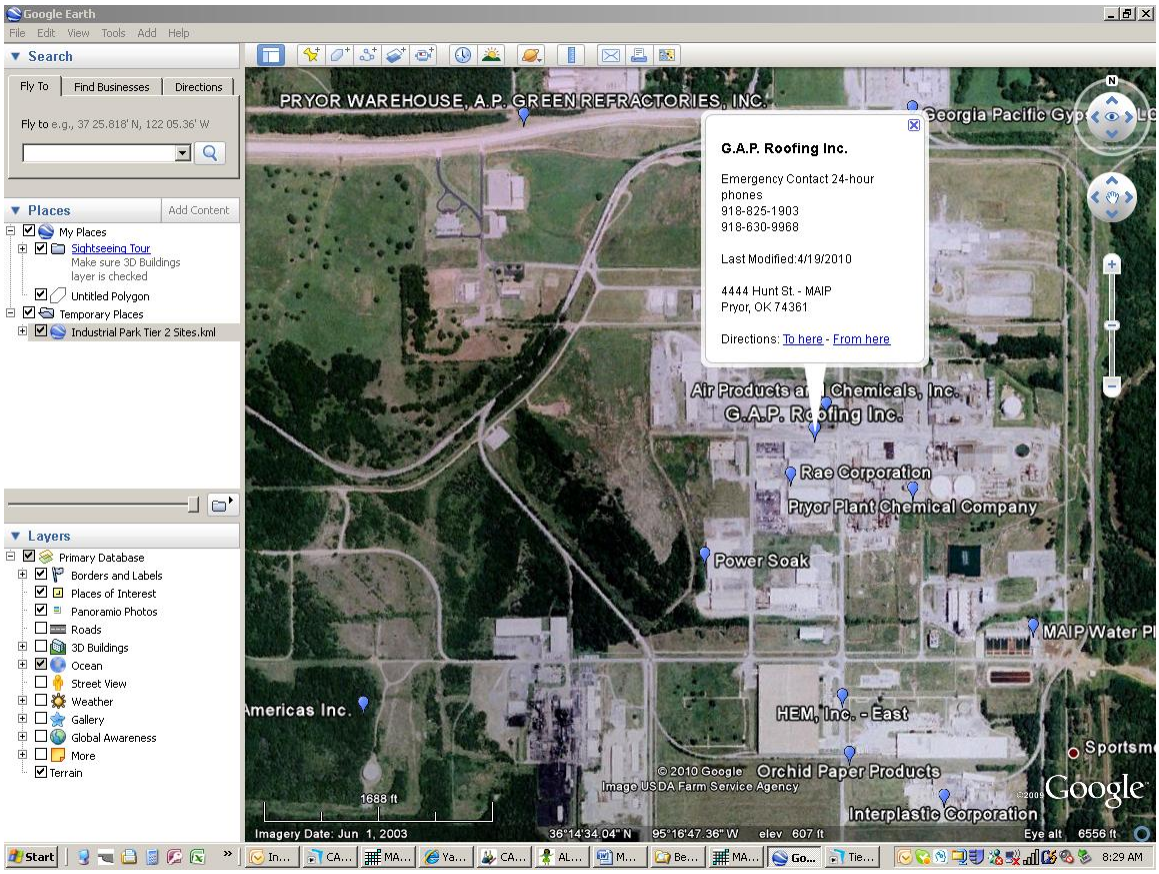
5. Select the "File / Make KML file" menu

6. Choose "Current Record, Found Set, or All Records" from the Make KML File dialog box; Select the "Open in Google Earth" box

7. Select "Make KML File"; name and save the file

Your computer should launch Google Earth and display the selected facility sites.

Notice that by “clicking” on the map symbols, the computer will display the Facility Name, Contacts, Phone Numbers, and Lat Long. This information is taken from the CAMEOfm Facility record.



ALOHA EXERCISE:

Plotting ALOHA Threat Zone on Google Earth.

It is possible to display ALOHA Threat Zones on digital photos. The process is as follows:

1. *Create an ALOHA Threat Zone*
2. *Display the Threat Zone on MARPLOT using the Sharing menu*
3. *In MARPLOT, select the "ALOHA" button and select"Export ALOHA objects to KML"; save the .kml to your computer*
4. *Launch Google Earth; use the File / Open menu to select the .kml file*

Step 1: *Create an ALOHA Threat Zone*

Chemical:	Anhydrous Ammonia (chemical from above Exercise 1)	
Atmospheric:	Wind Speed	16 mph
	Wind Direction	ESE
	Ground Roughness	Open County
	Cloud Cover	5
	Temperature	85
	Inversion	none
	Humidity	18%
Source:	Tank Type	Horizontal
	Diameter	5 feet
	Length	12 feet
	Volume	1763 gallons
	State of Chemical	Liquid
	Temperature	Ambient
	Volume in Tank	1,000 gallons
	Leaking Tank	Leaking Tank, chemical is not burning as it escapes into the atmosphere
	Area and Type of Leak	Circular 2" Short Pipe
	Location of leak	0% of way to top of tank

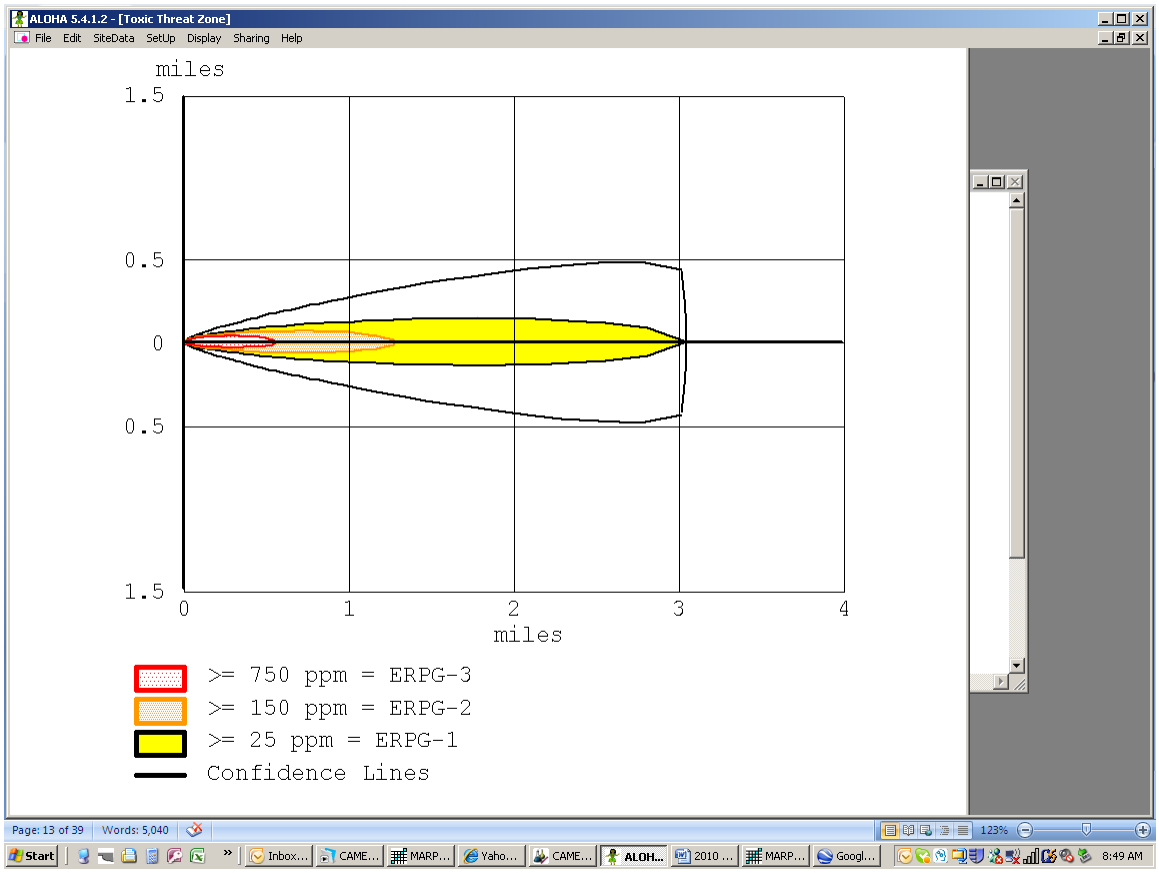
Display:	Threat Zone:	Toxic area of Vapor Cloud
	Toxic Level of Concern	ERPG-1, -2, -3

THREAT ZONE:

Model Run: Gaussian

Red : 135 yards --- (500 ppm = ERPG-3)

Orange: 512 yards --- (50 ppm = ERPG-2)



SITE DATA:
Location: OKLAHOMA CITY, OKLAHOMA
Building Air Exchanges Per Hour: 1.52 (unsheltered single storied)
Time: May 28, 2010 0846 hours CDT (using computer's clock)

CHEMICAL DATA:
Chemical Name: AMMONIA Molecular Weight: 17.03 g/mol
AEGL-1(60 min): 30 ppm AEGL-2(60 min): 160 ppm AEGL-3(60 min): 1100 ppm
IDLH: 300 ppm LEL: 160000 ppm UEL: 250000 ppm
Ambient Boiling Point: -29.7° F
Vapor Pressure at Ambient Temperature: greater than 1 atm
Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
Wind: 16 miles/hour from ese at 3 meters
Ground Roughness: open country Cloud Cover: 5 tenths
Air Temperature: 85° F Stability Class: D
No Inversion Height Relative Humidity: 18%

SOURCE STRENGTH:
Leak from short pipe or valve in horizontal cylindrical tank
Flammable chemical escaping from tank (not burning)
Tank Diameter: 5 feet Tank Length: 12 feet
Tank Volume: 1,763 gallons
Tank contains liquid Internal Temperature: 85° F
Chemical Mass in Tank: 2.51 tons Tank is 57% full
Circular Opening Diameter: 2 inches
Opening is 0 feet from tank bottom
Release Duration: 3 minutes
Max Average Sustained Release Rate: 2,020 pounds/min
(averaged over a minute or more)
Total Amount Released: 5,020 pounds
Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
Model Run: Heavy Gas
Red : 975 yards --- (750 ppm = ERPG-3)
Orange: 1.3 miles --- (150 ppm = ERPG-2)
Yellow: 3.0 miles --- (25 ppm = ERPG-1)

Note: your threat zone distances will differ from the above based on your selections for location and time of day.

MARPLOT EXERCISE:

Display an ALOHA Threat Zone on both MARPLOT and Google Earth.

Displaying Threat Zone on MARPLOT.

1. Activate MARPLOT
2. Navigate to your desired "release point"; *a location in Mayes County, Oklahoma is used for the example*
3. Select the Pointer Tool
4. Left-click on the map at your chosen "release point"
5. Select the ALOHA button; select "Set Source Point at Click Point"

Producing a Population Estimate for the ALOHA Threat Zone

1. In MARPLOT, right-click on one of the Threat Zone lines
2. From the right-click menu, select "Get Population within Selected Overlay Object(s)

Plotting the ERG Initial Isolation Zone on MARPLOT

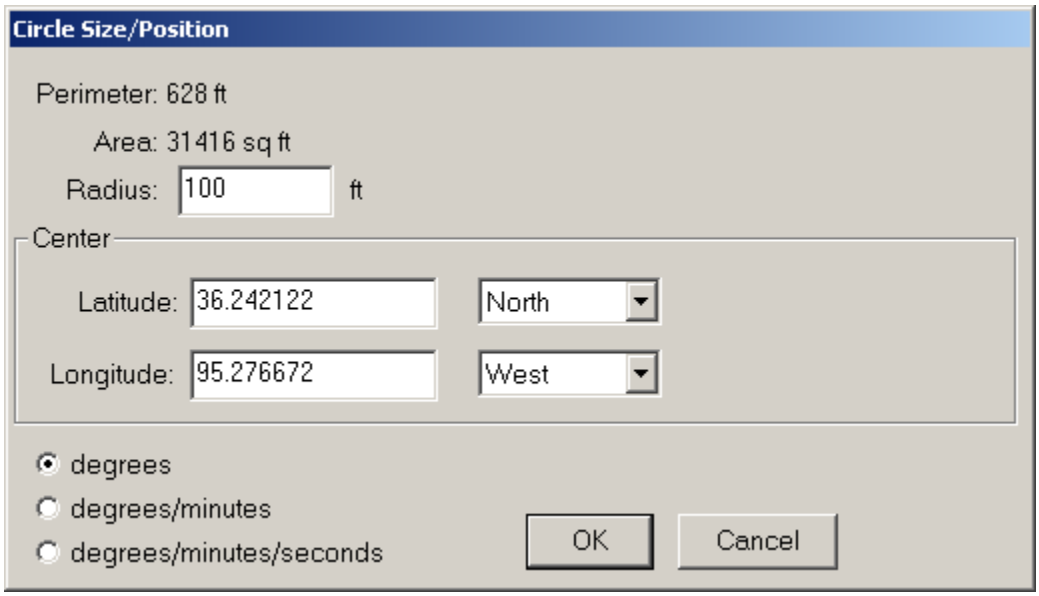
1. Determine the Initial Isolation Zone distance for Ammonia (see Exercise 1 for CAMEO Chemicals) Answer for Large Spill – Daytime = 100 feet
2. Since the distance will be relatively short (100 feet), you should zoom-in close to the release point
3. In MARPLOT, select the Circle drawing tool from the left-side

4. Select the “Window Width” drop down menu and choose “feet”

5. Left-click on the release point and drag to create a circle object

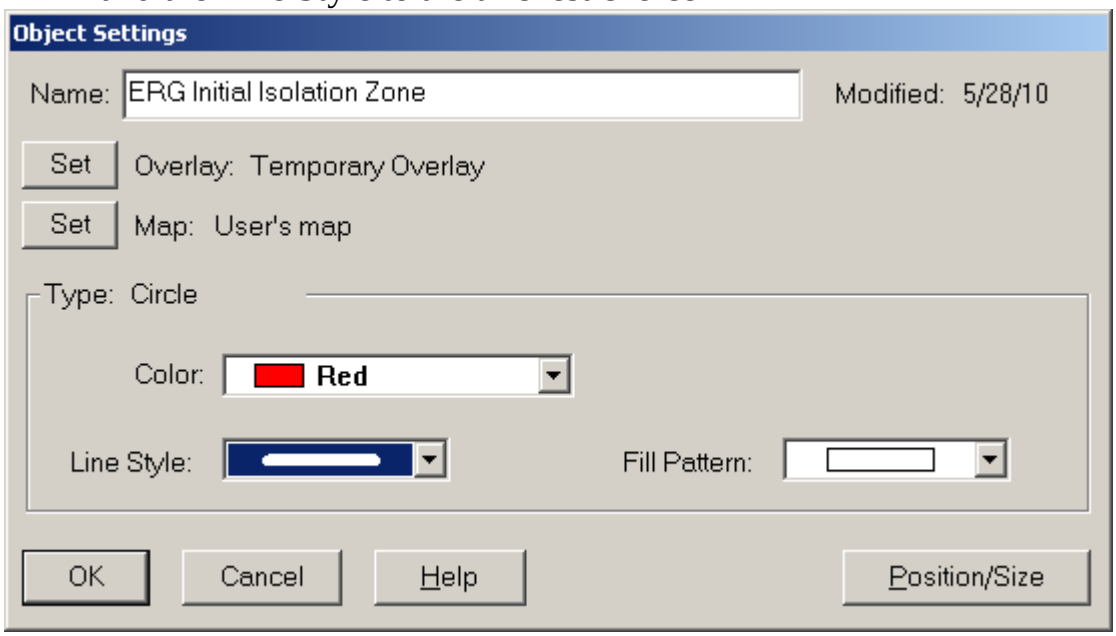
6. Select the “Position/Size” button from the Objects Settings dialog box

7. Set the Radius to “100” ft

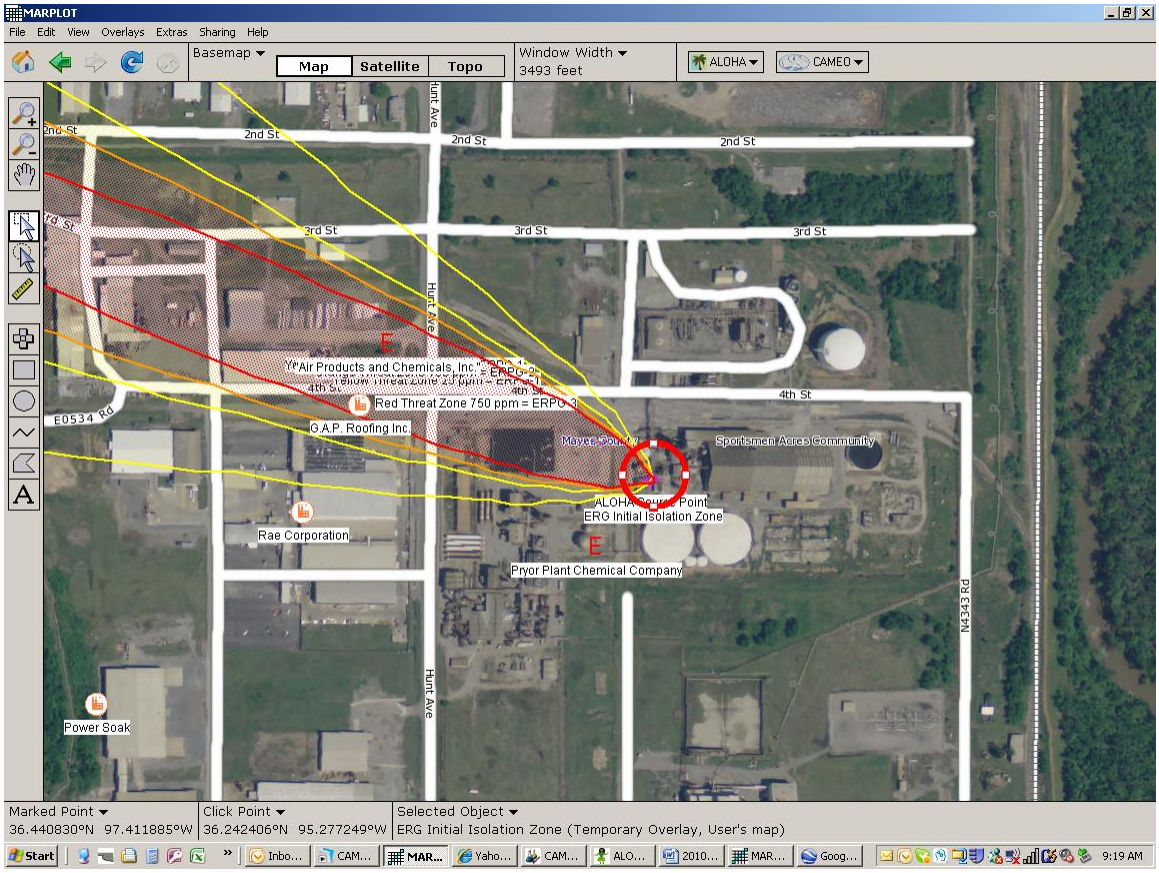


8. Select the “OK” button

9. Name the object “ERG Initial Isolation Zone”; set the color to “Red” and the Line Style to the thickest choice



10. Select the “OK” button



Displaying Threat Zone on Google Earth.

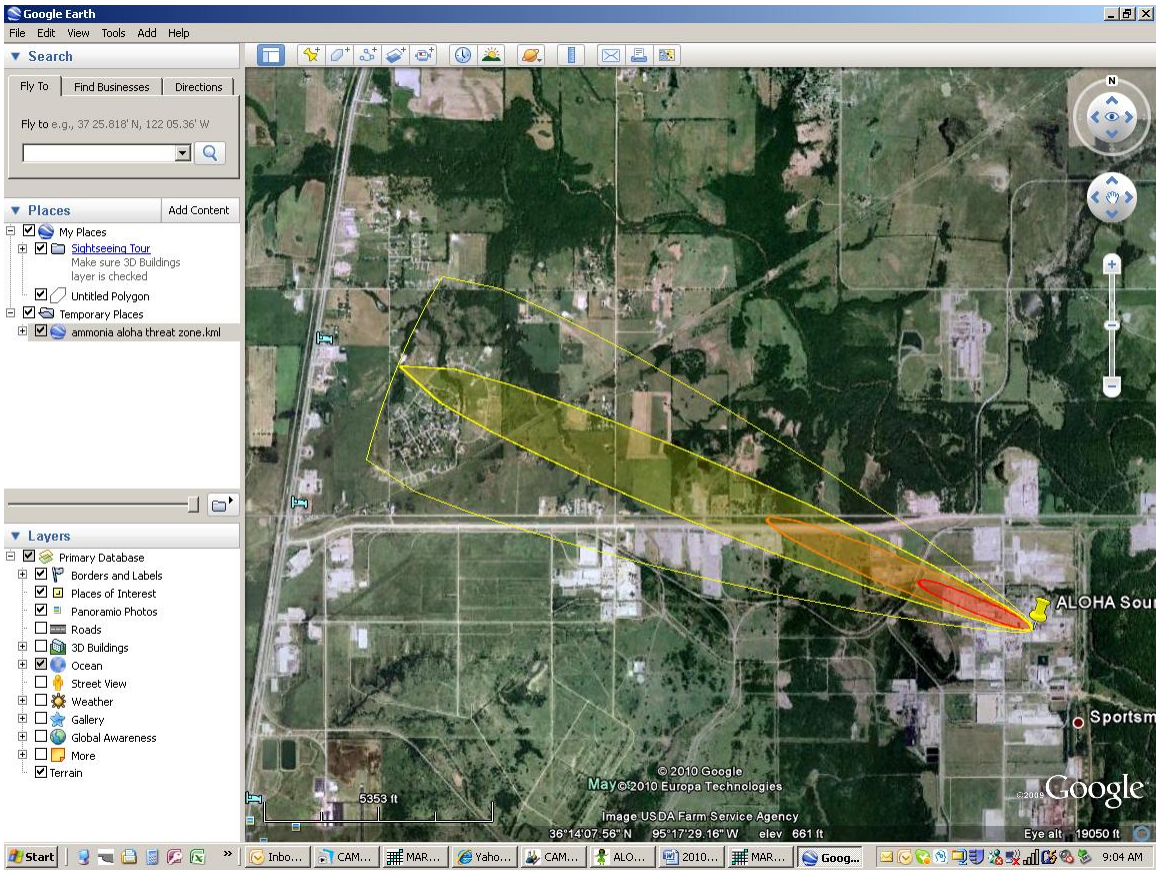
1. In MARPLOT, Select the ALOHA button; select “Export ALOHA Objects to KML”

2. Name and save the .kml file

3. Launch Google Earth

4. Select the “File / Open” menu

5. Select the ALOHA kml file you just saved



ANSWERS

Exercise 1:

1. Find the following information from the CAMEO Chemicals software:

Chemical Name: AMMONIA CAS # : 7664-41-7

UN/NA #: 1005_____ DOT Label: NON-FLAMMABLE GAS

NFPA Values

Flammability	1
Health	3
Reactivity	0
Special	0

Regulatory Information

CAA RMP: Regulated chemical with a Threshold Quantity of 10000 pounds.
CERCLA: Regulated chemical with a Reportable Quantity of 100 pounds.
EHS (EPCRA 302): Regulated chemical with a Reportable Quantity of 100 pounds and a Threshold Planning Quantity of 500 pounds.
TRI (EPCRA 313): Regulated chemical.
RCRA Chemical Code: none

ERG Initial Isolation Zone: _____

ERG Downwind Protection Distance: _____

Initial Isolation and Protective Action Distances

	Small Spills (From a small package or small leak)			**Large Spills** (From a large package or many small packages)		
	First **Isolate** in all Directions (Feet)	Then **Protect** persons Downwind during-		First **Isolate** in all Directions (Feet)	Then **Protect** persons Downwind during-	
Name of Material		**Day** (Miles)	**Night** (Miles)		**Day** (Miles)	**Night** (Miles)
Ammonia, anhydrous	100	0.1	0.1	500	0.5	1.4
Anhydrous ammonia	100	0.1	0.1	500	0.5	1.4

General Description _____

General Description
A clear colorless gas with a strong odor. Shipped as a liquid under its own vapor pressure. Density (liquid) 6 lb / gal. Contact with the unconfined liquid can cause frostbite. Gas generally regarded as nonflammable but does burn within certain vapor concentration limits and with strong ignition. Fire hazard increases in the presence of oil or other combustible materials. Although gas is lighter than air, vapors from a leak initially hug the ground. Prolonged exposure of containers to fire or heat may cause violent rupturing and rocketing. Long-term inhalation of low concentrations of the vapors or short-term inhalation of high concentrations has adverse health effects. Used as a fertilizer, as a refrigerant, and in the manufacture of other chemicals.

Rate of onset: Immediate

Persistence: Minutes

Odor threshold: 17 ppm

Source/use/other hazard: Explosives manufacture; pesticides; detergents industry.

Reactivity

Reactivity Alerts

Water-Reactive

Air & Water Reactions
Soluble in water with evolution of heat. The amount of heat generated may be large.

Bases

Response

First Aid

First Aid
Warning: Ammonia is extremely corrosive to the skin, eyes, and mucous membranes. Contact with the liquified gas may cause frostbite. Caution is advised.

Signs and Symptoms of Acute Ammonia Exposure: Inhalation of ammonia may cause irritation and burns of the respiratory tract, laryngitis, dyspnea (shortness of breath), stridor (high-pitched respirations), and chest pain. Pulmonary edema and pneumonia may also result from inhalation. A pink frothy sputum, convulsions, and coma are often seen following exposure to high concentrations. When ammonia is ingested, nausea and vomiting may result; oral, esophageal, and stomach burns are common. If ammonia has contacted the eyes, irritation, pain, conjunctivitis (red, inflamed eyes), lacrimation (tearing), and corneal erosion may occur. Loss of vision is possible. Dermal exposure may result in severe burns and pain.

Emergency Life-Support Procedures: Acute exposure to ammonia may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary.

Inhalation Exposure:
1. Move victims to fresh air. Emergency personnel should avoid self-exposure to ammonia.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. Transport to a health care facility.

Dermal/Eye Exposure:
1. Remove victims from exposure. Emergency personnel should avoid self- exposure to ammonia.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.Warning: Do not attempt to neutralize with an acid wash; excessive liberation of heat may result.
3. If eye exposure has occurred, eyes must IMMEDIATELY be flushed with lukewarm water for at least 15 minutes.
4. Remove contaminated clothing as soon as possible.
5. Wash exposed skin areas THOROUGHLY with soap and water.
6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
7. Transport to a health care facility.

Ingestion Exposure:
1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
2. DO NOT induce vomiting or attempt to neutralize!
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. Activated charcoal does not strongly bind ammonia, and therefore is of little or no value.
5. Give the victims water or milk: children up to 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old, 200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). Water or milk should be given only if victims are

conscious and alert.
6. Transport to a health care facility. (EPA, 1998)

Reactive Hazards

Reactivity Profile
AMMONIA is a base. Reacts exothermically with all acids. Violent reactions are possible. Readily combines with silver oxide or mercury to form compounds that explode on contact with halogens. When in contact with chlorates it forms explosive ammonium chlorate [Kirk-Othmer, 3rd ed., Vol. 2, 1978, p. 470]. Reacts violently or produces explosive products with fluorine, chlorine, bromine and iodine and some of the interhalogen compounds (bromine pentafluoride, chlorine trifluoride). Mixing of bleaching powder (hypochlorite solution) with ammonia solutions produces toxic/explosive ammonia trichloride vapors. Undergoes potentially violent or explosive reactions on contact with 1,2-dichloroethane (with liquid ammonia), boron halides, ethylene oxide (polymerization), perchlorates or strong oxidants (chromyl chloride, chromium trioxide, chromic acid, nitric acid, hydrogen peroxide, chlorates, fluorine, nitrogen oxide, liquid oxygen). Reacts with silver chloride, silver oxide, silver nitrate or silver azide to form the explosive silver nitride. May react with some heavy metal compounds (mercury, gold(III) chloride) to produce materials that may explode when dry. [Bretherick, 5th ed., 1995, p. 1553].
Belongs to the Following Reactive Group(s)

Health Hazards

Health Hazard
Vapors cause irritation of eyes and respiratory tract. Liquid will burn skin and eyes. Poisonous; may be fatal if inhaled. Contact may cause burns to skin and eyes. Contact with liquid may cause frostbite. (EPA, 1998)

Fire Hazards & Firefighting

Fire Hazard
Mixing of ammonia with several chemicals can cause severe fire hazards and/or explosions. Ammonia in container may explode in heat of fire. Incompatible with many materials including silver and gold salts, halogens, alkali metals, nitrogen trichloride, potassium chlorate, chromyl chloride, oxygen halides, acid vapors, azides, ethylene oxide, picric acid and many other chemicals. Mixing with other chemicals and water. Hazardous polymerization may not occur. (EPA, 1998)
Firefighting
Wear positive pressure breathing apparatus and full protective clothing.

Small fires: dry chemical or carbon dioxide. Large fires: water spray, fog or foam. Apply water gently to the surface. Do not get water inside container. Move container from fire area if you can do it without risk. Stay away from ends of tanks. Cool containers that are exposed to flames with water from the side until well after fire is out. Isolate area until gas has dispersed. (EPA, 1998)

Molecular Formula:
3N

Flash Point: data unavailable
Lower Explosive Limit: 16.0 % (EPA, 1998)
Upper Explosive Limit: 25.0 % (EPA, 1998)
Autoignition Temperature: 1204.0 ° F (USCG, 1999)
Melting Point: -107.9 ° F (EPA, 1998)
Vapor Pressure: 400.0 mm Hg at -49.72 ° F (EPA, 1998)
Vapor Density: 0.6 (EPA, 1998)
Specific Gravity: 0.6818 at -28.03 ° F (EPA, 1998)
Boiling Point: -28.03 ° F at 760 mm Hg (EPA, 1998)
Molecular Weight: 17.03 (EPA, 1998)
Water Solubility: data unavailable

AEGL-1	AEGL-2	AEGL-3
30.0 ppm for 10 minutes	220.0 ppm for 10 minutes	2700.0 ppm for 10 minutes
30.0 ppm for 30 minutes	220.0 ppm for 30 minutes	1600.0 ppm for 30 minutes
30.0 ppm for 60 minutes	160.0 ppm for 60 minutes	1100.0 ppm for 60 minutes
30.0 ppm for 4 hours	110.0 ppm for 4 hours	550.0 ppm for 4 hours
30.0 ppm for 8 hours	110.0 ppm for 8 hours	390.0 ppm for 8 hours

(AEGL, 2003)

ERPG-1	ERPG-2	ERPG-3
25.0 ppm	150.0 ppm	750.0 ppm

(AIHA, 2008)
TEEL: data unavailable
IDLH: 300.0 ppm (NIOSH, 2003)

Exercise 2:

1. Find the following information from the CAMEO Chemicals software:

Chemical Name: Acrylonitrile, stabilized CAS # : 107-13-1

UN/NA #: 1093 DOT Label: FLAMMABLE LIQUID POISON

NFPA Values

Flammability	3
Health	4
Reactivity	2
Special	

Regulatory Information

CAA RMP: Regulated chemical with a Threshold Quantity of 20000 pounds.
CERCLA: Regulated chemical with a Reportable Quantity of 100 pounds.
EHS (EPCRA 302): Regulated chemical with a Reportable Quantity of 100 pounds and a Threshold Planning Quantity of 10000 pounds.
TRI (EPCRA 313): Regulated chemical.
RCRA Chemical Code: U009

ERG Initial Isolation Zone: • As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.

ERG Downwind Protection Distance:

S p i l l
• See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under “PUBLIC SAFETY”.
Fire
• If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

General Description _____

General Description
A clear colorless liquid with a strong pungent odor. Flash point 32°F. Prolonged exposure to the vapors or skin contact harmful. Density 6.7 lb / gal. Vapors heavier than air. Combustion produces toxic oxides of nitrogen. Requires storage and handling in closed systems. Used in insecticides and to make plastics, fibers and other chemicals.

Rate of onset: Immediate

Persistence: Minutes to hours

Odor threshold: 17 ppm

Source/use/other hazard: Plastics, coatings, adhesives industries; dyes; pharmaceuticals; flam gas.

Reactivity _____

Reactivity Alerts

Highly Flammable
Polymerizable

First Aid _____

Fire Hazard
Materials are too dangerous to health to expose fire fighters. A few whiffs of vapor could cause death or vapor or liquid could be fatal on penetrating the fire fighter's normal full protective clothing. The normal full protective

clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials. Explosion hazard is moderate. It is flammable and explosive at normal room temperatures. Can react violently with strong acids, amines, strong alkalis. Vapors may travel considerable distance to source of ignition and flash back. Dilute solutions are also hazardous (flash point of a solution of 2 percent in water is 70F). When heated or burned, toxic hydrogen cyanide gas and oxides of nitrogen are formed. Avoid strong acids, amines, alkalis. Incompatible with strong oxidizers (especially bromine) copper and copper alloys. Unstable, moderate hazard is possible when it is exposed to flames, strong acids, amines and alkalis. May polymerize spontaneously in the container, particularly in absence of oxygen or on exposure to visible light. If polymerization occurs in containers, there is a possibility of violent rupture. (EPA, 1998)

Reactive Hazards

Reactivity Profile
ACRYLONITRILE produces poisonous hydrogen cyanide gas on contact with strong acids or when heated to decomposition. Reacts violently with strong oxidizing agents (dibenzoyl peroxide, di-tert-butylperoxide, bromine) [Sax, 9th ed., p. 61]. Rapidly ignites in air and forms explosive mixtures with air. Polymerizes violently in the presence of strong bases or acids. Underwent a runaway reaction culminating in an explosion on contact with a small amount of bromine or solid silver nitrate [Bretherick, 5th ed., 1995, p. 404].
Belongs to the Following Reactive Group(s)

Nitriles
Hydrocarbons, Aliphatic Unsaturated

Response Recommendations

Health Hazards

Health Hazard
It is classified as very toxic. Probable oral lethal dose for human is 50-500 mg/kg (between 1 teaspoon and 1 oz.) for a 70 kg (150 lb.) person. Irritant skin dose -- 500 mg. Toxic concentrations have been reported at 16 ppm/20 min. Acute toxicity is similar to that due to cyanide poisoning, and the level of cyanide ion in blood is related to the level of poisoning. Inhalation or ingestion results in collapse and death due to tissue anoxia (lack of oxygen) and cardiac arrest (heart failure). (EPA, 1998)

Fire Hazards & Firefighting

Firefighting
In advanced or massive fires, fire fighting should be done from a safe distance or a protected location. Isolate for 1/2 mile in all directions if tank car or truck is involved in fire.

Small fires: dry chemical, carbon dioxide, water spray or foam. Large fires: water spray, fog or foam. Stay away from ends of tanks. Do not get water inside container. Cool containers that are exposed to flames with water from the side until well after fire is out. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. (EPA, 1998)
Fire Hazard
Materials are too dangerous to health to expose fire fighters. A few whiffs of vapor could cause death or vapor or liquid could be fatal on penetrating the fire fighter's normal full protective clothing. The normal full protective clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials. Explosion hazard is moderate. It is flammable and explosive at normal room temperatures. Can react violently with strong acids, amines, strong alkalis. Vapors may travel considerable distance to source of ignition and flash back. Dilute solutions are also hazardous (flash point of a solution of 2 percent in water is 70F). When heated or burned, toxic hydrogen cyanide gas and oxides of nitrogen are formed. Avoid strong acids, amines, alkalis. Incompatible with strong oxidizers (especially bromine) copper and copper alloys. Unstable, moderate hazard is possible when it is exposed to flames, strong acids, amines and alkalis. May polymerize spontaneously in the container, particularly in absence of oxygen or on exposure to visible light. If polymerization occurs in containers, there is a possibility of violent rupture. (EPA, 1998)

Chemical Properties:

Molecular Formula: H_2C $CHCN$

Flash Point: 32.0 ° F (EPA, 1998)
Lower Explosive Limit: 3.0 % (EPA, 1998)
Upper Explosive Limit: 17.0 % (EPA, 1998)
Autoignition Temperature: 898.0 ° F (USCG, 1999)

Melting Point: -116.0 ° F (EPA, 1998)
Vapor Pressure: 100.0 mm Hg at 73.4 ° F (EPA, 1998)
Vapor Density: 1.9 (EPA, 1998)
Specific Gravity: 0.8004 at 77.0 ° F (EPA, 1998)
Boiling Point: 171.0 ° F at 760 mm Hg (EPA, 1998)
Molecular Weight: 53.6 (EPA, 1998)
Water Solubility: 10-50 mg/mL at 70.9° F (NTP, 1992)
AEGL: data unavailable

ERPG-1	**ERPG-2**	**ERPG-3**
10.0 ppm (AIHA, 2008)	35.0 ppm	75.0 ppm

TEEL: data unavailable
IDLH: 85.0 ppm ; A potential human carcinogen. (NIOSH, 2003)