

Chemistry and Environmental Sciences

There's a Whole Lotta Spillin' Goin' On!

Subjects: Hazardous chemicals, pollution, environmental science, accidental release

Unit Learning Objectives: The learner should be able to:

1. Compare and contrast hazardous chemical spills
2. Comprehend how hazardous chemicals affect the environment.
3. Explain the difficulty involved in cleaning up a hazardous spill.
4. Explain how the chemical travels once it is released.
5. Assess how hazardous chemicals affect the human body and animal life.
6. Analyze a chemical spill and its affects on its surroundings.
7. Create an emergency management system based on a real life situation

Evidence of Understanding: By the end of this unit, students should be able to demonstrate a clear understanding of hazardous chemicals and how they affect the environment and animal life. This will be modeled in an emergency management plan for the clean up of a hazardous chemical. Students will be focused on the impact of chemicals on the environment and human life.

Technology: Students will need access to a computer with internet access and special programs, such as imovie, iphoto, power point, etc. They will also need access to a camcorder and a VCR to show they products.

National Science Education Standards:

Content Standards

- Standard A – abilities necessary to do scientific inquiry
- Standard C – populations and ecosystems
- Standard E – abilities of technological design.
- Standard F – populations, resources and environments, natural hazards, risks and benefits.
- Standard G – nature of science

Materials: Perfume, cleaning products, computer access, camcorders, VCR, internet

Teacher Notes: Time is based on a 45 minute class period. Students should have background information on smoke plumes, weather and some marginal information on chemicals. This unit can be integrated into a life science classroom during discussions on about pollutants and how they affect the human body. It can also be done in a biology classroom, environmental science class, chemistry class, or earth science class!

Time Line

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|--------------|---|
| Day 1: | Oh it Smells So Good |
| Day 2: | Where my spills at? Speaker |
| Days 3- 5: | Research and PSA |
| Day 6: | Present projects |
| Day 7: | Finish presentations and have classroom discussions |
| Days 8 – 11: | There's a whole lotta spillin' goin' on. |
| Day 12: | Share plans |
| Day 13: | Mock disaster simulation |

Engage (25 min)

Activity: Oh It Smells So Good

1. Students should work in groups of 3-4. Distribute to each group a film container filled with a unique smelling liquid (Axe body spray, perfume, vanilla, etc.)
2. Instruct each group that inside their container is a special chemical. They need to pour the 'chemical' on their lab station, in one pool, and then figure out how to clean it up.
3. Provide to each group paper towels and a variety of cleaning supplies, anything they will need to clean up their spill. The spill needs to be cleaned up and the smell needs to be erased.
4. After the activity, question the students on how this relates to air pollution and accidental spills by companies and trucks. What effort must be put in to cleaning up those spills? How did they clean up their spill? Etc. This can be done in a large group setting, or with lab questions.
5. Extension. Have students place the same 'chemicals' in a different environment, and practice cleaning it up. Example environments include spraying it into the air, water, rocky terrain, etc.
6. Discuss the different strategies used to clean up the chemicals on a flat dry surface, compared to their new environments. What did they do differently, the same? Why? Which one was harder to clean?

Explore (2-4 days)

Activity: Where my spills at?

Teacher Notes: Contact your local emergency management coordinator early enough so they can participate. Be sure to reserve media center equipment, such as camcorders and other recording devices for the public service announcements.

- Part 1:
1. Using your local resources, contact your local emergency management coordinator, found at the following website:
http://www.iowahomelandsecurity.org/asp/resource_room/Maps/CountyCoordinators.pdf
 2. Have someone related with your counties emergency management system or hazmat team come in and discuss how chemical spills in Iowa would be cleaned up.
 3. Allow students to ask questions to help them in upcoming activities

- Part 2:
4. After the speaker, have students research a state's emergency response plan. This information can be found at www.fema.gov.
 5. Students should work in groups of 3-4, and each group should research a different state.

6. They need to present their findings in a public service announcement (PSA) that can be broadcast in each state to help prepare residents in the event of a chemical spill.
7. The PSA should include at least the following information
 - a. What does the plan include?
 - b. Who is responsible for each part of the plan?
 - c. What should you do if there is a chemical emergency?
 - d. How long will the clean up process take?
 - e. What supplies should people have in case of an emergency?
 - f. How will the environment be cleaned up?
 - g. How will humans and animals be treated?
 - h. Any other information you feel is necessary?

Explain (1 – 2 days)

Activity: Where my spills at? continued.

1. Have students groups share their PSA's with the class.
2. As a class discuss the environmental impact of hazardous chemical spills. Question students on how the spills were cleaned up and what can be done to ensure that all chemicals are cleaned up out of the environment. Discuss long lasting effects the spills can have on the environment and on the population. Continue to question the students on the differences between the plans, and why those differences are necessary. Determine the distance that the chemicals were able to travel and what affected that distance. Use the CAMEO and ALOHA software to aide in this discussion.

Extend (3-5 days)

Activity: There's a whole lotta spillin' goin' on.

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 on the CLEER impact website at <http://cleerimpact.keigansystems.com/>. 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.

There's a whole lotta spillin' goin' on

Name: _____

The Scenario

A tanker truck carrying anhydrous ammonia was traveling through your home town when it encountered a slick spot in the road. It overturned and in the process broke the valve on its tank. Liquid ammonia immediately begins to spill out and turn into its gaseous form. The mayor learned of the accident and is immediately very concerned. "Oh no," she thought, "what would the people of the area do"? "Especially with a school so near"? "What would happen"? "Would anyone die"? She quickly called together the town's emergency management team to resolve this serious crisis.

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 CLEER Impact 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 dichlorofluoromethane. 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: CLEER impact 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?

Evaluate (1 – 2 Days)

Activity: There's a whole lotta spillin' goin' on Continued!

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.

There's a whole lotta spillin' goin' on Grading 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				

