

## **A Storm is Coming!** **Lessons in Hurricane Preparedness**

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### **INTRODUCTION**

The busy 2004 hurricane season, with fifteen Atlantic storms certainly served to remind us that we should learn the essentials of hurricane preparedness. I find that a study of hurricanes and their effect on our state's coastal areas provides an exciting and interesting start to the school year in my seventh grade Texas History classes. We study the causes and effects of the storms and how to prepare for emergency situations. While this unit will focus only on hurricane preparedness, in the classroom we will first study the formation and structure of hurricanes and round out our studies by investigating the *Great Galveston Storm of 1900*. I would suggest that those teachers living in coastal areas choose a storm from their own locale. When there was the possibility that our area might be struck by an approaching storm, as was the case with *Ivan* in September 2004, the energy level in my classroom was electrifying. Students eagerly watched the news and weather and were going to the school computer lab to check out weather web sites.

On May 24, 2005, the American Red Cross reported that they had found many Americans in coastal regions who were not prepared for the coming hurricane season that lasts from June 1 to November 30:

Waiting until the last minute to prepare for a hurricane, or assuming that a major storm will not hit your community is a mistake, said Joe Becker, Senior Vice President, Preparedness and Response for the American Red Cross. We saw that last year when four major hurricanes in just six weeks devastated communities all across Florida and the Southeastern United States, with many people caught off-guard. Last year's...hurricanes--*Jeanne*, *Frances*, *Ivan* and *Charley*--led to the largest natural domestic disaster relief operation in the history of the American Red Cross. In the months after the first hurricane hit Florida in mid-August 2004, the Red Cross opened more than 1,800 shelters and evacuation centers, provided shelter to more than 425,000 evacuees, served more than 11 million meals and snacks to victims and emergency responders, and started casework with more than 59,000 families affected by the hurricanes. (Simmons)

There is a lesson to be learned from last year's hurricane season. Clearly the public needs an increased awareness of disaster preparation. It is my hope that this unit will help my students learn a logical approach for dealing with not just hurricanes, but disasters of all types.

### **HURRICANE BASICS**

Hurricanes that strike the Atlantic and Gulf coasts of the United States have their origins in the Atlantic Ocean off of the western coast of equatorial Africa, the Caribbean Sea, and the Gulf of Mexico. As the ocean waters heat up in summer, evaporation creates an upward movement of air and heat (Lawrence). Under the right conditions these winds become an actively moving area of disturbed conditions called a tropical depression. If the winds begin rotating with sustained speeds of 35 to 73 miles per hour, the disturbance is elevated to tropical storm status (Nye). At this point it is important to clarify what sustained means. Just because it is raining and the wind

is blowing does not mean it is a tropical storm or hurricane. Sustained winds means they are constantly blowing at a given speed for at least 24 hours with no let up.

Tropical storms are given names and if the storm advances to hurricane status it keeps the same name. Once a name is used, it is retired. Names were first assigned to storms in 1950 using the International Phonetic Alphabet: Able, Baker, Charlie, etc (“Ask a Hurricane Hunter”). In 1953 the Atlantic storms were given female names (“Historical Hurricane Tracks”). A name tends to give a storm character and makes it easier to remember in future discussions. It is also easier to track more than one storm at a time when a name is assigned (“Ask”). Each year an alphabetical list is prepared by the Tropical Prediction Center (formerly the National Hurricane Center) (“Tropical Prediction Center”). One can determine the final number of Atlantic tropical storms and hurricanes for each year by seeing how much of the alphabet was used for that year’s storms. By 1979 it was decided to add males to the list, (a reflection of the women’s movement no doubt). Today’s Atlantic lists include names from English, French and Spanish: e.g. Fran, Harvey, Ophelia, Chantal, and Jose (“Ask”).

When winds reach a sustained speed of 74 mph a tropical storm becomes a hurricane. Hurricanes are divided into five categories of intensity on the Saffir – Simpson scale:

74 to 95 mph winds	Category I	Damage - Minimal
96 to 110 mph winds	Category II	Damage - Moderate
111 to 130 mph winds	Category III	Damage - Extensive
131 to 155 mph winds	Category IV	Damage - Extreme
156 mph and up winds	Category V	Damage - Catastrophic

*Hurricane Tracking*

Students should be reminded that they might hear reference to three speeds when watching storm coverage on the news. My students find this confusing if it is not explained to them. The sustained speeds of the winds, as discussed above, range from 74+ mph and travel in a counterclockwise direction. There is usually mention of gusting winds as well. These may be significantly higher than the sustained winds. The weather person will also discuss the forward motion of the storm: the speed at which the whole storm travels forward. This is usually quite slow, 10 to 14 mph on average, and is used by weather forecasters to determine when landfall will occur (“Ask”).

The stronger the winds, the greater the wave energy and higher the waves formed by those winds. These high, onshore-moving waves cause water to pile up along the coastline. In addition, the lower the air pressure in the hurricane, the higher the water level will rise as well. These two factors combine to cause a major rise in sea level to occur, called the storm surge. Most of the damage and loss of life in hurricanes are the result of the flooding caused by the storm surge. Waves along Galveston’s beaches are typically very small, usually less than 2 feet high (Dupré, personal communication). However, during the *Great Galveston Storm of 1900*, the waves may have been as high as 20 feet or more, and were superimposed on a storm surge of 15 feet, causing the massive destruction and loss of life (“Hurricane Preparedness”).

The counter-clockwise motion of the winds causes the area to the right side of the hurricane (as facing the coastline) to have the highest storm surge and greatest winds and rain. Thus the worst flooding, wave erosion, and wind damage occur on the right (or “dirty”) side as the storm makes landfall. Landfall refers to the time (and place) when the eye of the hurricane crosses onto the land (Lawrence). In contrast, on the left side of landfall, the storm surge is lower, and the winds are less strong and are predominantly oriented offshore. For this reason flooding, erosion, and wind damage is less severe at the left quadrant of the storm. If landfall occurs at high tide, the storm surge will be worse, and the erosive effects of the high waves will be felt even farther

inland. This is the reason the times of high and low tide are of great interest to meteorologists as they monitor the approaching hurricane.

Hurricane-force winds may be sustained over hundreds of miles of open, malleable water. When the storm comes on shore, however, friction begins to slow the winds down. Therefore, the longer and farther the storm travels over the land, the slower the wind speeds become. When the winds drop to below 74 mph the storm returns to tropical storm status, yet continue to move inland. The winds will eventually diminish, but the rain will continue to fall, often resulting in flooding hundreds of miles from the coast. *Hurricane Ivan* (2004) entered Alabama from the Gulf of Mexico, crossed over the southeastern United States, reentered the Atlantic Ocean, crossed over Florida to reenter the Gulf and come on shore in Louisiana, leaving massive flooding in its wake (“Historical”).

Several conditions will exist within the hurricane as the huge storm moves forward. Winds will continually blow and gust at 74+ mph in a counterclockwise direction, yet at the center of the storm, which is called the eye, there is an eerie calm, with no wind or rain. The eye can be from 10 to 40 miles wide (“Ask”). Clear and cloudless skies will be seen overhead. It is extremely important to monitor the storm. One needs to know if the storm has passed over or if the eye is passing by. The forward motion of the storm and the width of the eye determine how long it will take the eye to pass over an area (“Ask”). This is not the time to go outside, as the storm will return in full force as the edge of the eye (the eye wall) approaches. The circulating winds are strongest at the eye wall.

Conditions for tornadoes are optimum inside the hurricane. Due to the noise level of the winds, it may not be possible to hear an approaching tornado. This is one of the reasons people who live away the coast, with no fear of tidal flooding and stronger winds, should nonetheless still seek dependable shelter. Because of massive amounts of rain, inland flooding is also a very real danger both during and after the storm.

How long will it take a hurricane to pass over an area? That is determined by the overall size of the storm and the speed of its forward motion. One’s location in relationship to the eye is also important. If on the outer edges, the storm will pass by relatively quickly. If located near the center of the storm’s path, then the full brunt of the storm will be felt and it will take longer to pass over. It should also be noted that the only difference between a tropical storm and a hurricane is wind speed. A tropical storm can, in fact, produce more flooding than a hurricane if its forward motion is slow. *Tropical Storm Allison* visited the Houston area in June of 2001, causing massive flooding (*Tropical Storm Allison Recovery Project*). During this phase of the unit I like to show actual news footage of past storms. Several examples are listed in the bibliography, including *Winds of Danger* and *Raging Planet – Hurricanes*. Please note that the emphasis of this unit is on preparedness. There are several excellent web sites listed in the bibliography for those desiring a detailed study of the formation and structure of hurricanes.

## **HURRICANE PREPAREDNESS**

### **Heed the Warnings**

Hurricane season lasts from June 1 to November 30. If there is the possibility of a storm approaching your area, heed the weather announcements. They are an indication of how vulnerable your area is and how much preparation time you will have. A tropical depression is an organized system of clouds and thunderstorms with defined circulation and maximum sustained winds of 38 mph or less. Tropical storms are organized systems of strong thunderstorms with defined circulation and maximum sustained winds of 39 mph to 73 mph. A hurricane is an intense tropical weather system with defined circulation and maximum sustained winds of 74 mph or higher (*Hurricane Tracking Map*). As shown earlier in the Saffir-Simpson Scale, the

higher the wind speeds of a hurricane, the more severe the damage to be expected. A hurricane watch is issued for coastal areas when there is a threat of hurricane conditions within 24 – 36 hours. The storm could change course, but this is the time to make preparations. A hurricane warning is issued when hurricane conditions are expected in a designated coastal area in 24 hours or less (*Hurricane Tracking Map*). This means it is headed your way. An alert means it is happening now and it is too late to prepare.

### **Preparing the Home**

Each year homeowner's insurance policies should be assessed for sufficient coverage. These policies do not cover flooding. A separate policy is required from the National Flood Insurance Agency Program (FEMA). Many Houston families were shocked to find that they were responsible for the damages that occurred after the flooding from *Tropical Storm Allison* in 2001. Don't wait until hurricane season to purchase this insurance. The policy must be in effect for thirty days prior to a claim.

If you are building a new house, ask the contractor to install roofing clamps that attach to the rafters and are relatively inexpensive. They can make the difference in whether or not a roof flies off (*Winds of Danger*). These can also be added to existing homes. Most of the Miami homes destroyed by *Hurricane Andrew* in 1992 did not have these clamps (*Winds of Danger*). As the storm approaches, check for loose or damaged roofing shingles and flashing that could be ripped away and cause more damage. Clean out gutters and downspouts to facilitate removal of water from roof. Loose handrails and fence slats will loosen and become projectiles during the storm. Anything that is loose in the yard, on your porch, or on a balcony should be taken inside ("Homeowner Tips" 8). This includes what might be thought of as large, heavy objects: picnic tables, lounge chairs, bicycles, hanging potted plants and trashcans. Move valuables away from windows that could break during the storm. Put shades down and close curtains. This action will not stop the window from breaking, but it could prevent shattered glass from flying into the room. Keep tools handy for making repairs during the storm ("Hurricane Preparedness"). If you plan on evacuating, move valuable items upstairs or on top of tables in case of flooding. Turn off gas pilot lights. In the event of flooding the flame could go out, allowing gas vapors to escape, creating the possibility of an explosion.

Place cars inside the garage but don't forget that electric garage door openers may not work if electricity is out ("Homeowner Tips" 8). If a garage is not available for your car, then pull into the driveway as close to the house as possible. This will provide a bit more protection from wind damage. Automobiles left in the streets, which are usually at a lower level than buildings, are more prone to flooding. Gas tanks should be filled before the storm arrives. If electricity is off after the storm, then the electrical pumps at gas stations will not be operating. Stations in your neighborhood may be damaged by the storm. You could have an emergency situation or need to go to work the next day. Waiting until the last minute can be a mistake. It is not unusual for stations to run out of gas as large numbers of people try to fill up. Due to hurricane damage, supplies may not be replenished for several days after the storm.

All appliances that are not absolutely necessary should be unplugged. *But, do not do this once the storm commences.* Power surges (due to lightning strikes) can damage and destroy your appliances (and your life!) if you are touching the plug during the surge. For this reason it is unwise to speak on the phone or to touch metal plumbing fixtures. They too can carry electrical power surges. This is good advice to follow during any type of thunderstorm. We usually have lots of arguments about which appliances are necessary during the storm. The students tend to feel they cannot live without TVs, DVDs, and CD players. Mentioning the replacement costs for these items usually changes some minds. I prefer to unplug everything: lamps, computers, TVs, kitchen appliances, washers and dryers, fans, nightlights, microwave and electronic toothbrush.

Don't forget to unplug telephone, cable TV, and Internet connections. Power surges can also affect these lines. If it appears that water will enter the home, the electricity should be turned off at the main breaker (*Hurricane Tracking Map*).

Refrigerators and freezers can be expensive appliances to replace. Yet, people are usually reluctant to unplug them as they may contain several hundred dollars worth of food. Even if there are no power surges, the electricity may go off. Plan ahead of time as to how you will handle this situation. Food in a freezer will probably stay frozen for many hours, if the freezer is not opened. Continuously opening the door to check on things will release all of the cold air. My students like acting out this scene. Of course, at some point, one of the adults will have to check inside to see if items are still hard. The same goes for the refrigerator. During *Hurricane Alicia* in 1983 the electricity at my house only went off for a few hours. By not opening the door, the cold was kept inside and the food was fine. After several hours it would be advisable to check items for coolness. Some things may have to be thrown out. An alternative would be to have ice and ice chests on hand to transfer the more perishable food items such as milk, mayonnaise, and luncheon meats. Everyone should be reminded that the more often the ice chest is opened, the faster the ice will melt. I have heard it suggested that refrigerators and freezers would stay insulated longer if covered with a blanket. An adult should only do this *after the appliance has been unplugged*. If the electricity was to come back on and the blanket not removed, a fire could start. If the electricity stays off long enough some foods may have to be thrown out. It is better to lose the cost of the food than end up in the hospital with food poisoning. The day after *Hurricane Alicia* I attended a great outdoor cookout. A couple in my neighborhood sold wholesale frozen lobster tails, stored in freezers in their garage, to local restaurants. When they started to thaw, they got out the charcoal and everyone feasted outside on barbecued lobster. A neighborhood party after the storm passes may be the answer to thawing food. Just remember to put the leftovers on ice.

### **Preparing the Family**

The family should have a plan of action as part of their hurricane (and emergency) preparedness. Prepare the children ahead of time as to what to expect during the storm. What should you do if you hear a tornado coming during the storm? Go to an interior room or closet. If there is time, get into the bathtub and pull a mattress over you. Bathtubs and toilets are often the only things left in place after a tornado due to the fact that they are anchored to the pipes under the ground. Leaving windows open can alleviate the pressure differences that cause houses to implode during tornadoes. Of course, this is not a great idea during a hurricane and tornadoes rarely give enough warning for a person to run around opening windows.

What if the roof flies off or the house starts to flood during the storm? What will you do? Where could you go? If a fire breaks out during the storm, does everyone know how to put out a fire? Do you have a fire extinguisher? Children should know how to dial 911, the name of the medical insurer, doctor, and preferred hospital in case parents are injured ("Hurricane Preparedness"). Perhaps going to a more sturdy shelter should be considered before the storm arrives. People living in trailers should definitely evacuate. Plan to leave early. You don't want to be caught on roads when the storm hits. If for some reason you are out during the storm, do not drive through high water. There will be massive traffic tie-ups in large population areas as people attempt to evacuate (Stinebaker 1). Prepare an emergency medical kit and be sure the children know how to use it. Has everyone taken a CPR class?

No one should be outside during the storm, including pets. For pets that do not normally come inside the home, some type of accommodation should be a part of advanced planning. Children need to be reminded that a lovable pet probably can hear things which the people in the house cannot hear. Even if the pet is friendly and playful, it should be left alone. A normally

friendly cat or dog will be frightened and may react differently during the storm to a person who approaches it.

Before the storm arrives, everyone should bathe, wash hair, brush teeth and wash all clothing and dishes. Water could become contaminated or the service disrupted both during and after the storm. Fill large water coolers or purchase bottled water. Clean the bathtub and fill it with water for towel bathing, emergency boiling, and flushing the toilet. Quickly pouring a bucket of water into the toilet bowl will allow it to flush even if the water is cut off. An emergency bucket with a lid (for toilet use) may be necessary if the toilet backs up during the storm. It is best not to drink water from the faucet until the authorities have declared it safe after the storm.

Cell phones should be fully charged. It is tempting to call friends during the storm to see how everyone is doing. Just remember you may need the phone for an emergency later. If the electricity is off after the storm, cell phones can be recharged in an automobile with the proper equipment. It is a good idea to warn family in other areas not to worry if they cannot reach you by cell. Even if your phone is charged, the atmospheric conditions of the storm and the heavy consumer usage may jam the airwaves.

### **Going to a Shelter**

Prepare an emergency shelter kit in case you decide to go to a shelter before or after the storm. Remember, if you need to leave quickly, no one is going to wait for you to pack your kit. Plan to take a change of clothing, glasses and/or contact lenses, personal hygiene items such as soap, toothpaste and toothbrush, toilet paper, blankets and pillows. A favorite book, stuffed animal, or toy is a good idea for young children. Books can keep adults occupied too. Some shelters may appreciate food contributions. Pets are usually not accepted at shelters. If pets are allowed at the shelter or you plan to use a designated pet shelter or friend's house, remember to take proof of vaccinations, collar, leash with I. D., carrier, water, food, bowls and medications. Having a photo of your pet will help if it becomes lost ("Hurricane Preparedness"). NOAA recommends that the time to drop your pet elsewhere should be scheduled into your evacuation planning.

Be sure to find out where the designated shelters are in your area before the storm arrives. Important papers that might be needed after the storm should be placed in a waterproof container ("Hurricane Preparedness"). If you go to a shelter, take them with you. These may include insurance papers, birth certificates, wills, addresses of closest relatives, phone numbers of insurance agents, photos of your home's contents and computer contents copied onto a disk. It is a good idea to have copies of these items on file with someone you trust who does not live in your immediate area. Don't forget to take money. Banks may not reopen right away and ATMs cannot operate without electricity. NOAA also recommends keeping your house and car keys with you at all times. This would also apply to your safety deposit box and mail box keys.

### **Emergency Supply List**

Don't wait until the last minute to get supplies. Store shelves will be empty. Each family should develop a list of emergency supplies and discuss why they are necessary. By including the entire family in this discussion, children will learn how to deal with a larger range of emergency situations in a calm and thoughtful manner. Don't forget food and water for pets. Do you have enough cat-box litter? The number of people in the family determines the amount of food and water needed by that family. Remember you are not just buying for the duration of the storm. You could be without power, gas, and water for up to two weeks. Grocery stores may be low on inventory after the storm or not open at all. Plan for the worst-case scenario. Everyone has different needs. Running out of prescription medicines could be life threatening for some people. If there is a baby in the family, plan for enough diapers and formula.

Because the electricity may go off, batteries should be at the top of your supply list: lots of new batteries. Assume that you will not have utilities for two weeks after the storm. Batteries will be very hard to find during that time period. There should be enough flashlights for each member of the family. Each family will need a battery operated radio or TV. Weather radios will broadcast continual information during the storm (“Hurricane Preparation”). During the storm you will want to know if the eye is going to pass over your area. After the storm it is important to listen for flood warnings and lists of which shelters and hospitals are operational. If you are using rechargeable batteries, recharge them before the storm. The batteries will only last so long. Remind children that while it might help to pass the time to listen to the radio, watch the TV, or play the *Game Boy*, the batteries may be needed later.

Several of the hurricane preparedness charts we have used from local stores list candles and lighter fluid for camping lanterns as good items to purchase. My students have decided they are not good at all. During the storm, wind from a broken window or a frightened pet or child could knock one of these items over. The chances of the fire department responding to a fire are pretty slim during a hurricane. And, after the storm they are still a bad idea. Consider the number of homes and apartments that burn when someone leaves a candle burning. As we discuss these ramifications, my students enjoy realizing that they are using more common sense than the adults who make up these lists. Some families may have electrical generators for use after the storm. It should be remembered that the generators must not be operated inside the house. There are new products that could be very useful. Flashlights are on the market which work when shaken and do not require batteries. There are also rechargeable power strips that do not have to be plugged in to use. They can recharge cell phones, digital cameras, and jump car batteries.

An understanding of the words *perishable* and *non-perishable* is important when discussing foods to stock. Perishable foods have a limited lifetime and may need refrigeration and/or cooking; not a good idea if utilities go out. Non-perishable foods have a long shelf life and do not require refrigeration. An important consideration is whether the foods you stock pile will require cooking. You may be without utilities after the storm. Those who own barbeque pits or camping stoves will want to purchase plenty of charcoal, lighter fluid, and/or fuel, and matches. As silly as it sounds, everyone should be reminded that BBQs and camp stoves cannot be used inside the house. Students should be reminded that as a storm approaches, these items will disappear from store shelves and may not be available after the storm. Emergency situations can be created by any number of natural and man-made disasters. Creating an emergency supply and keeping it replenished at all times is a good idea.

My students enjoy discussing which foods should be included in their lists of non-perishable foods. We have found that not all of the items suggested on the hurricane tracking charts provided by local TV stations and grocery stores are appropriate. For example, noodles require water and must be cooked. Canned goods top the list of non-perishable items. But it is important to clarify that the canned goods are non-perishable as long as they are in the unopened cans. It is not necessary to cook canned food. If one is hungry, cold canned beans are just fine. Not everyone likes that idea. We often have to remind some members of the class that they may have to make sacrifices to comfort. It is important to stress that leftovers from canned goods will have to be refrigerated once they are opened. For this reason, ice and ice chests should be on the list of items to obtain before the storm arrives. The U.S. Department of Homeland Security recommends the following foods which require no refrigeration, preparation, cooking and little or no water: peanut butter, protein and fruit bars, dried fruits, nuts, crackers, and vitamins (“Ready America”).

My classes usually argue for plenty of candy, cookies and chips. We have to discuss the importance of proper nutrition, especially when one might be in a stressful situation. Cookies and chips may become soft and stale in the humid climate after the storm if not properly sealed.

Bread is fine only if it will be used right away. The increased humidity will cause it to mold very quickly. Fresh fruits and vegetables will also rot faster. Families should plan to eat any perishable foods first. In 2001, *Tropical Storm Allison* took Houston by surprise. When it appeared that the storm might revisit the city with more rain and flooding, the populace finally realized they were experiencing an emergency situation. The grocery stores were mobbed. I, too, went to my neighborhood store to stock up. People were cleaning off the shelves and had overflowing baskets. But what was in the baskets was shocking. Families were loading up on fresh meats and dairy products. This experience strengthened my resolve to educate my students as to the proper preparations for emergency situations.

Bottled water should also be at the top of the supply list. Here again, if you wait until the last minute, it will be very hard to find. FEMA (Federal Emergency Management Agency) delivered 40 million liters of water and 163 million pounds of ice to affected areas during the four storms that hit the U.S. in 2004 (FEMA). The reason for purchasing/obtaining water will be discussed later. Powdered milk and dehydrated soups appear on many lists of supplies. An important question to ask is whether you want to use your water supplies for such items. Remember it will be hot after the storm and you may not be able to drink the water from the tap. Plan on at least three gallons of water per person per day (FEMA and American Red Cross). Replacing the water with beer and soda always enters the discussion at this point. I remind the students that the body needs water. They may be able to survive without food for a few days, not water. Sodas contain high amounts of sugar and sodium, meant to make a person thirstier; so they will buy more of the product. Beer is not water! Do you want someone making important decisions while drunk?

As we discuss the supplies needed to weather the storm, and its aftermath, I find that my students begin to develop a sense of responsibility and show improvement in their ability to think logically. What are the consequences of owning an electric can opener? You could be without food if the electricity goes out and there is no manual opener to use on all those cans. This always leads to a discussion of other ways to open the cans. They usually involve knives and sure-fire ways to do bodily harm to one's self. If the water is off or contaminated, how will you wash your dishes and yourself? Paper plates, bowls, plastic utensils, cups and handwipes should be added to the list. Do you want bugs in your house? Be sure to get plenty of garbage bags for all of those dirty paper plates. Trash pick up could be delayed if the city is busy removing storm debris. The bugs that weathered the storm will probably be looking for a dry place to hang out. Maybe some bug spray for the house should be considered. And speaking of bugs, the mosquitoes after a storm and all of that standing water will be awful. Better add insect repellent to the list. I do like to caution my students as to how dangerous it is to use too much repellent. Several years ago I watched a news program which warned of people going into convulsions after dousing themselves in bug repellent all day. Whenever possible try to spray it on clothing, not skin.

Many people like to board up their windows before the storm. Lumberyards tend to run out of plywood and nails very quickly when a storm is forecast for an area. Others prefer to tape their windows by placing a big X of tape across the glass. The tape will not prevent breakage. It may keep broken glass from flying into the room. What if your roof starts to leak during the storm? Rolls of plastic to cover furniture and large containers to capture leaking water will be necessary. Consider cleaning your trashcans and bring them into the house or garage before the storm. The large plastic trashcans our city issues to everyone would be capable of holding a large amount of water. What will you do if the toilets overflow? Better have some cleaning supplies and disinfectant on hand for sewage overflows. If the toilet continues to overflow, then you will need an emergency container and lid for rest room usage. Do you have enough toilet paper to last the family for two weeks? Wet wipes were a great suggestion made by my students. They were not a part of the hurricane tracking chart lists that we used. They allow clean up without using



precious water. A camera and film, or a charged digital camera, will be necessary to record any damage for insurance purposes after the storm. It is better to plan in advance. Planning ahead of time helps to keep people calm if they feel they know what to do and they have a purpose of action. This can also help in assessing if the family truly is prepared for an upcoming disaster and allow time to ready the home and/or evacuate.

## **EXPERIENCING THE STORM**

If one lives along the coast, with its danger of storm surge, or in an area prone to flooding, then evacuation is advisable. In some coastal areas, local authorities will impose mandatory (required) evacuation. When deciding whether or not to evacuate several factors come into play. Personal safety is obvious. There are always some people who choose to stay feeling they can better protect their property. But serious questions should be asked. Can a person really protect his or her property from the ravages of a storm? Just what would that person be able to do during the storm that would make a difference? If that person is injured or incapable of escaping, how many other people will have to put themselves in danger to rescue that person? These are excellent questions for the students to ponder, allowing them to place things in a proper perspective and consider how their actions may affect other people's lives. Before the storm arrives, local authorities will issue lists of available shelters. Schools are often used, as they are generally sturdy buildings with ample facilities: bathrooms, showers in gymnasiums, cafeterias, and large open spaces for bed cots. But, do not assume that the local school will be used as a shelter. It may exist in an area prone to flooding. Even if you plan on staying in your home, you should know where the closest shelter is in case your home is unlivable after the storm.

Obviously, no one should go outside. Objects of considerable weight will be flying through the air: garbage cans, branches, roofing shingles, and lawn chairs. In the high speeds of hurricane winds these objects can become deadly missiles. During *Hurricane Alicia*, in 1983, shards of glass became deadly missiles in downtown Houston. "Hundreds of window panes were broken out of skyscrapers by gravel thrown from nearby rooftops. The windows were designed to withstand hurricane winds but not impact from [flying] gravel" (*Hurricane Alicia*). News reporters are always shown standing outside in the storm. The networks want to increase ratings and the reporters want to keep their jobs. Do not follow their examples. Going outside is stupid and dangerous.

The temptation to stand at a window and observe the storm should be discouraged. Heavy objects blown toward the windows would not even be seen at the high wind speeds of the storm. The damage inflicted by a flying object or broken glass could require medical treatment that would not be available during the storm. Photos circulate after every hurricane showing bizarre phenomena such as a board shot through a telephone pole or a piece of furniture stuck up in a tree. Beware the eye of the storm. Because the storm will return quickly you should avoid the temptation to run outside to fix something or check on your home. This is why the portable radio or TV is so important. Without access to the news how will you know if the calm you are experiencing is the eye or the end of the hurricane?

Be aware that flushing the toilet during the storm may be a bad idea. Once sewers are full of water the sewage lines from buildings will back up. If the streets are under water, then you should assume that the lines are full. Anything flushed will be sent right back into your house, or your neighbor's apartment. If the flooding is bad enough, the toilet may back up as well!

## **AFTER THE STORM**

### **Safety first**

Don't drink tap water until authorities give the ok. Trees can be knocked over due to high winds or the saturation of the ground. Their roots are often wrapped around water lines and

when the tree falls the water line breaks. This will either disrupt the water service entirely or allow contaminated floodwater and dirt to run through the line. It is for this reason that having a substantial supply of water is so important.

Flooding and flash flooding is always a serious threat both during and after tropical storms and hurricanes. “The storm surge [pushing inland] would block the natural drainage of flooded inland bayous and streams for a day or more” (Berger 1). As the storm moves inland, flooding will occur upstream and all of that water will eventually flow towards the coast inundating the area previously hit by the storm. It is advised not to stand near riverbanks. The ground will be saturated and slippery, making it easy to fall into the fast moving waters. Neighborhoods can become flooded if sewer drains become blocked with debris. According to my sister who lives in Florida, the city of Tampa asks that people not wash clothes, use dishwashers, or use any water unnecessarily after the storm passes. That extra water usage may be the final amount that could cause the city’s sewers to back up and flood.

There is always the temptation to go outside after the storm to assess damage and satisfy curiosity. But everyone, including adults, should be warned of possible dangers. Even a city has its population of wild animals. Raccoons, possums, rats and stray domestic animals will have weathered the storm and been pushed out of their natural habitats. They will not be in a good mood. In southern states, alligators may seek higher, dry land in someone’s back yard or driveway. Snakes will also be looking for dryer environs. This is especially important to remember when clearing debris.

Electrical wires may be down, yet still active. One would not have to touch the wire to be electrocuted if the wire is crossing a puddle a person decides to walk through. The news media often show pictures of children gleefully riding their bikes through low lying floodwaters or splashing their friends as they play. It should be remembered that the flooding means the sewers are full and the sewage water has come above ground. This is not a good place for children to play. There are other dangers in the water to consider. Sewer manholes can be popped up by rising water. These open holes may not be visible and could easily be stepped into, sweeping a person away through the sewer tunnels. Debris from the storm could be under the water such as broken glass, sharp wooden and metallic edges, and rusty nails. Colonies of ants will ride leaves and other debris in floodwaters. Anyone bumping into his or her “life raft” would represent higher and dryer ground. Especially for small children, massive ant bites could be quite serious. Avoid the temptation to drive around and sightsee. Debris in the road could damage your car and you will just get in the way of emergency personnel. If you must go outside, check your home for damages and contact your insurance company right away. Finally, do have a plan to check on elderly, disabled, or single neighbors.

## CONCLUSION

Because of our proximity to Galveston, we always finish our hurricane studies with an investigation of the *Great Galveston Storm of 1900*. This year, as we saw the pictures of the devastation wrought by the *Indonesian Tsunami of 2004*, it became easier for my students to relate to the tidal surge that washed across Galveston Island in 1900 and caused most of the island’s destruction. This recent event allowed my students to better understand that nature is a strong force with which humans cannot always contend. Hence, we need knowledge about natural disasters that can befall a region, and the preparations necessary to deal with such disasters when they occur.

As the population of the United States increasingly moves into the coastal zone, it becomes even more important that families know how to prepare themselves for approaching storms. My students appreciated the fact that the lessons learned through this unit would enable them to safely prepare their families for a future emergency situation. The lessons in this unit emphasize

using logic and planning, which hopefully will result in their ability to prioritize in an emergency situation. They were proud to know that with their newfound knowledge they might be better equipped to prepare their families for a disaster than their parents. As a result of studying this unit, several of my students have shown an interest in attending Madison High School in Houston, which offers a meteorology magnet program for those interested in weather-related careers.

## **LESSON PLANS**

### **Lesson Plan I: Where in the World?**

The students will create a map of the world with a key showing:

1. Where hurricanes occur.
2. The names used to describe these large storms in various parts of the world (hurricane, cyclone, and typhoon).
3. The times of year the storms occur in different regions.
4. The average intensity of storms in different regions of the world.

The web site for the Department of Atmospheric Sciences at the University of Illinois at Urbana-Champaign has a map showing the regions of the world affected by hurricanes:

<http://www.severewx.atmos.uiuc.edu/index.html>.

### **Lesson Plan II: Track That Storm**

Obtain a hurricane-tracking chart for this lesson. Area businesses give these out for free in areas affected by hurricanes. Several of the web sites listed in the Bibliography also offer tracking charts that can be downloaded.

After a review of latitude and longitude have the students track several hurricanes on a tracking chart. This exercise will help the class understand the weather reports on television and the use of coordinates to relay the position of a storm. This exercise becomes especially exciting if an actual storm is approaching. During hurricane season a nightly homework assignment is to watch the weather and write down the coordinates of any existing storms. In the event there are no storms, I make up coordinates for storms named after my students' teachers. They always seem to enjoy this comment on their teachers' personalities.

The following site provides blank tracking charts for all regions of the world affected by hurricanes: <http://www.nhc.noaa.gov/>.

### **Lesson Plan III: Emergency Planning**

Break the class into small groups of four or five. Give each group one or two natural disasters from the following list: hurricane, fire, earthquake, flood, tornado, lightning strike, and volcanic eruption.

Each group will prepare a presentation on the immediate actions to take during an emergency situation caused by a natural disaster. Informational handouts must be presented to the rest of the class to supplement their presentations. The groups should roll play their reactions to each disaster. The following questions are to be addressed:

1. What should you do immediately after the disaster occurs? Consider such options as evacuation and shelter in place.
2. What phone numbers should you have on hand for such an emergency? The group should obtain those numbers and explain why they would be useful.
3. What supplies should you have on hand for such an emergency? Make a list.

4. What type of medical implications could result from this emergency? Make a list and then describe the proper emergency medical procedures to follow. Give a demonstration to the class.
5. What are your options if you are forced to leave your home?

This lesson could also be used for man-made disasters such as chemical plant explosions and automobile accidents. The main objective here is to instill the habit of planning in advance as to how one would handle an emergency situation. This type of planning involves logic and organization and can provide a calming affect in the event of an actual disaster.

#### **Lesson Plan IV: Prepare Household Inventory and Emergency Preparedness Booklet**

The objective of this lesson is to prepare every member of the family for an emergency. The final result will be a booklet customized by the students with emergency information specific to each family.

1. The first step will be to make a household inventory which would be useful if an insurance claim must be made. Should families save receipts or photograph belongings for the list? And, where will they keep this list? These questions can be answered in a family conference. Someone trustworthy should have a copy in case the original is destroyed. For security reasons, request that parents sign off on this portion of the project which will not be brought to school. Emphasize that this should be a family project. Even if the parents have already created such a list, ask that they allow their children to make another. This will help prepare the students for such responsibilities as adults. The students will be making a booklet aimed at preparing and educating the family for a possible emergency situation.

Because the inventory should not come to school, have the students leave several blank pages in the booklet. The inventory can be added after the classroom project is completed.

2. Prepare a list of items to be kept in an emergency preparedness kit.
3. Prepare a list of procedures to follow in the event of a disaster. In the case of this lesson, the students would be making booklets covering emergency procedures for hurricanes. But the lesson could be expanded to cover other types of disasters either in the same booklet or one for each type of event. Drawings and pictures should be used to enhance the information.
4. Draw a diagram of the home and show escape routes or structurally safe areas in case of flooding, high winds, or tornadoes. Decide where the family will meet if a quick escape is necessary.
5. Create a dated check-off sheet for practicing emergency drills.
6. Create a dated check-off sheet for maintaining the emergency supply list. Remember that the supply list will vary for each family according to special needs and family size as described in the unit.
7. Create a dated check-off sheet showing that the family has studied the following web sites in preparing this assignment. The sites may have to be studied by the students at school if there is no computer at home.

<http://www.ready.gov>

<http://www.fema.gov>

<http://www.redcross.org>

<http://www.noaa.gov>

8. When the booklets have been completed take the students to the *FEMA Kids* website where they can apply for a *Disaster Action Kids* certificate: <http://www.fema.gov/kids/dizkid1.htm>

### **Lesson Plan V: Evacuation and the Choices One Must Make**

As with the above lesson, this is specific to hurricanes. It too could be adapted to any number of emergency situations. Divide the class into family groups. Tell them they have thirty minutes to evacuate and can take one car full of belongings.

Before breaking into groups the teacher will lead a class discussion about sentimental value and what types of items are replaceable and irreplaceable. Each family will discuss the following issues and write a group report:

1. What would you need to take to the shelter, friend's house, or motel? In the written report, each family must justify the need for each item.
2. What belongings would you want to take to your place of shelter? Are you taking them because you simply want to have them with you, because you are trying to save them, because they are valuable or because they are sentimental or irreplaceable?

Caution the students to make up the items to be discussed. Parents may not wish for their family valuables to be discussed at school.

3. Each family should also record a list of their decisions on a large piece of paper. After the discussions end, display all of the papers at the front of the room. A representative from each group will describe the family's decisions. Finally, the teacher will circle common answers.
4. As a homework assignment have each student discuss these questions with their families and make a list of what they would take in the case of an evacuation. This should not be done at the time of disaster when people are rushed, nervous and/or panicking. This list is for the families to use; a parent sign off sheet can be used for fulfillment of the homework assignment.

### **Lesson Plan VI: Emergency Assistance**

In this lesson, a hurricane has damaged the family home. To whom does one turn for help? Not everything is covered by insurance. Groups of students will research sources of aid and create charts showing how to access that aid and what help is available from the following agencies:

1. FEMA  
Access FEMA at <http://www.fema.gov> for information on the steps to follow when applying for assistance.
2. American Red Cross  
Access the Red Cross at <http://www.redcross.org> for immediate aid with shelter, food and clothing.
3. Federal, state, and local agencies.
4. These questions should be answered by the students. Who should you call first? Who provides immediate assistance and who helps with long-term aid? Which aid is free and which involves low cost or interest free loans to cover damage not covered by insurance? Which organization will be looking for volunteer aid?

### **Lesson Plan VII: Insurance**

The objective of this lesson is to provide real world experience in understanding and purchasing insurance and in dealing with the financial aftermath of damage caused by a hurricane.

Have the students examine homeowner's insurance policies. Get old ones from teachers or insurance agents. If possible have an agent come and speak to the class. As the result of too much flooding and too many hurricanes and tropical storms in the last several years, homeowners

along the Gulf Coast have seen their insurance premiums jump and their coverages drop. In Texas, several insurance companies left the state rather than continue to write homeowners policies.

As future consumers and homeowners, these are issues our students need to understand. Insurance can be expensive and coverages vary from one company to another. This is an interdisciplinary lesson to be taught with the math department in middle school and could also include the economics, history, and government departments in high school.

### ***Part I***

The following topics would be covered simultaneously in the history and math (or government and economics) classes by the teachers. The students would take notes and develop an insurance vocabulary list. The history assessment would be through fill in the blank testing. In math class, the students would work on problems involving deductibles and determination of fair market value, probability charts, and the cost of rebuilding a home. Topics to be covered in class:

1. Compare insurance pricing from various companies on comparable houses.
2. Compare coverages. Some of the newest policies no longer cover mold or broken pipes under houses.
3. What is a deductible? What are advantages of a higher deductible in the long run?
4. What is renters insurance?
5. What causes insurance rates to go up? What is credit scoring? How do other disasters in your state affect your rates, even though you did not have a claim?

How does making a claim affect your rates?

6. Define insurance terms – deductible, coverage, exclusion, appraiser, adjuster, fair market value (look at policy for more terms).
7. Put strong emphasis on need for flood insurance. After *Tropical Storm Allison* hit Houston in 2001 thousands of homes were flooded. Many homeowners discovered that their neighborhoods that “never” flooded, did just that. In spite of having paid insurance premiums for years, they found that they were liable for flood damage and were forced to take out loans to repair their homes.
8. What is liability? Who pays if your tree damages the neighbor’s house?

### ***Part II***

This portion of the assignment will be handled through the math or economics class.

Divide the class into family groups. Give each group an insurance policy and disaster scenario: house with fair market value replacement, another with value limits, houses with and without flood insurance. Each family will have to decide who to call and how to go about repairing or rebuilding their homes. They will have to provide their math teacher with a spreadsheet of expenses and insurance funds spent. For high school students an additional assignment would involve getting at least three quotes for each job to be done.

### ***Part III***

When studying the *Constitution*, students learn about the role played by lobbyists in local and national governments. As an interdisciplinary unit with the government classes, high school students could study the influence of insurance industry lobbyists on insurance legislation. Advanced classes could present case studies of how rates and coverages have been affected in various states by such lobbying.

### **Lesson Plan IX: Scams**

The purpose of this lesson is to teach students how to avoid being taken advantage of by scam artists. Unfortunately, people affected by natural disasters such as hurricanes become easy prey for such opportunists. After a hurricane or tropical storm there are usually not enough people to take care of all the repairs and necessary cleanup in a timely manner. This creates an open market for the scam artists.

What is a scam? Have the students look up the definition and bring it to class. They should be able to give examples of scams.

When getting repairs from a disaster one can obtain references from the BBB (Better Business Bureau): <http://www.bbb.org>.

Have the students produce a poster with the tips from the BBB as to how one can decide who is safe to hire. The students could also roll play interviewing and hiring different contractors.

Questions to be answered:

1. Should you pay someone for work up front?
2. Are they bonded? What does that mean?
3. Can the workers provide local references?
4. Is the work guaranteed?
5. Will the work be done in a timely manner?
6. Will the work be up to city codes? What are city codes?

### **Lesson Plan X: Write It Down**

In the event that a hurricane strikes your area, ask the students to keep a journal of their observations. In addition to keeping them occupied during the storm it will give them an opportunity to record their experiences in relationship to what they studied in this unit.

### **Lesson Plan XI: Case Studies**

In the seminar “*Living with Geologic Hazards*,” University of Houston Professor William R. Dupre encouraged us to study past geologic events to understand why they happened and if the lessons learned were applied to the future. Give each group of students an historical storm and ask them to decide if the residents of an area learned lessons from their experiences. They should be able to demonstrate how those lessons were applied. In the case of Indianola, Texas, the population went through several storms in the late 1800s. The lesson learned was that they had chosen an unfortunate site for a town and they abandoned it (*Winds of Danger*). After the *Great Galveston Storm of 1900*, the residents finally decided to build a seawall and raise the grade of the island to protect themselves from future tidal surges. These were positive attempts made after learning the lessons from nature’s fury. Unfortunately, today we see continued development in areas prone to hurricanes. The lessons have not been learned. After presenting their cases the students might hold a debate on the pros and cons of coastline development.

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