



disaster preparedness report

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National Weather Service

September 1986

WHAT'S HAPPENING IN DISASTER PREPAREDNESS

o Tornado Death Toll The tornado death toll is currently the lowest it has been since record keeping began in 1916. As of September 9, 1986, there have been 11 fatalities from a preliminary count of 842 unconfirmed tornadoes. This is the fewest number of deaths on record. One year ago this month, there were 956 tornadoes (preliminary) with 91 deaths. Since 1959, the average number of twisters has been 705 a year. One reason for the lower figures is the small number of violent tornadoes.

The death toll from tornadoes has decreased steadily despite population growth in tornado-prone areas. From 1916 to 1925, tornadoes have killed about 300 people each year. Since 1950, deaths have averaged 105. The record low death toll was set in 1981, when 24 people died in the United States from the twisters. Fred Ostby from the National Severe Storms Forecast Center pointed out that the main reasons for the declining death toll are better warnings and better education.

o WSO Paducah Does Outstanding Job on Southeast Missouri Tornado Outbreak On Thursday night, May 15, 1986, southeast Missouri was raked by one of the most concentrated outbreaks of tornadoes in the Central Region in recent years. It is estimated around 14 separate tornadoes occurred in three counties between 5 p.m. and 9 p.m. WSO Paducah issued 11 tornado warnings, most within a 3-hour period. Considering the widespread destruction, it is a credit to the joint National Weather Service/civil defense/media warning, preparedness and awareness system that loss of life was limited to one and injuries were few.

The area has had an aggressive preparedness and awareness campaign that was initiated some years ago by WSFO St. Louis and is now supported by WSO Paducah. The area has a well-organized and trained spotter's network and internal radio communications system that keeps everyone well informed. Warnings preceded damage in the populated areas by as much as 35 minutes. A Cape Girardeau television news crew was in Sikeston and carried a tornado live as it approached and moved through the city. The local Holiday Inn Motel implemented a tornado shelter plan that moved guests to safe areas.

o San Antonio Severe Weather Event Sam Sitterle, President General Manager, SIT Broadcasting Corporation (owner of two San Antonio Radio Stations) wrote a letter to Bill Crouch, MIC, WSFO San Antonio, to congratulate him and his staff on a most commendable job during a severe weather event on Wednesday, June 4, 1986. He wrote "Our listening audience never once had to wonder as to what might be coming next nor did they lack for information concerning roadways, creeks, and streams in the Bexar County area. The general public always turns to the media in an emergency, but few realize that we are only as good as the National Weather Service. We were excellent on Wednesday, thanks to you! With continued communication such as this past week, I'm certain San Antonio can keep loss of life and property to a bare minimum should such an unfortunate event occur in the future. Again, our deepest and sincerest thanks for a job well done."

o Lightning Only four states in the United States exceed Tennessee in the number of lightning deaths since 1959. Intent on doing something about that, WSFO Memphis WPM, Jim Poirier, assembled a packet of information about lightning which was mailed to all Tennessee broadcasters and newspaper editors. By attracting attention to this underrated killer, Jim hopes to increase the lightning awareness of Tennesseans and reduce the toll of dead and injured (see attachment).

o Volunteer Fire Department Selling NWR Receivers In a study of the May 1985 tornado outbreak in western Pennsylvania, the Center for Disease Control in Atlanta found that 52 percent of those injured or killed had less than a minute's warning and 65 percent had less than 5 minutes notice. Partly as a result of this finding, the Volunteer Fire Departments of western Pennsylvania are trying to improve warning dissemination by selling tone alert NWR's at discount prices to the residents of several counties in western Pennsylvania.

o Ham Radio Operators at WSFO Pittsburgh A Great Help On May 17, 1986, WSFO Pittsburgh activated their ham network. The WSFO reported: "It was simply unbelievable how many ham weather reports we received in southern Butler County. Just to name a few...we got two half-inch hail reports and a report of a roof being blown off a house under construction in Jackson Township. We all stayed right on top of this storm as it approached Armstrong County. Before crossing over into Armstrong County, the storm decreased in intensity. This was determined from ham ground truth reports, Doppler, and our radar."

This case, once again, shows that hams are a very valuable resource we need to cultivate if we are to optimize our service to the public.

o HAMFAIR WSFO Seattle participated in the Tacoma HAMFAIR, August 16 and 17. Thirty new severe weather spotters signed up for the Spotter Program. Additionally, Dick Hutcheon and Chuck Ruscha of the forecast office conducted a 1-hour training class for spotters. Over 2,000 ham operators attended the fair, which is the largest in the Pacific Northwest.

- o Spotter Recruiting Chet Henricksen, MIC, WSFO Philadelphia, has informed us they are recruiting spotters from the following:

"Shadow Traffic" -- For those who are not aware of this group, it is a commercial group that reports traffic information to the media.

2,500 spotter guides have been distributed to the New Jersey State Police Officers through their training academy. Every patrol person in the state will have a copy in his/her car.

Department of Transportation -- Approximately 1,000 available spotters in New Jersey road maintenance workers.

- o First Awareness Week for Wyoming Wyoming held their first Severe Thunderstorm Awareness Week, May 11 through 16. The Cheyenne office is to be congratulated in gaining the Governor's support. Bill Parker did not let the example presented by the Cheyenne flood pass by and pushed his advantage at the right time. Nice going!

- o Hurricane Awareness WSO Mobile MIC, Mike Pass, was approached in early June by an advertising firm working for Delchamps Food Stores for assistance in producing a hurricane tracking chart. Mike suggested they use material contained in NOAA/PA 78019 and 77020 and furnished them with copies of the brochures. The result of this work will be the distribution of 100,000 copies of their "Hurricane Tracking Chart and Action Checklist" in their stores along the Gulf Coast from Lake Charles, Louisiana, to Panama City, Florida. Congratulations, Mike!

Also, Mike Pass met with Scott Paper Company safety officials to discuss their hurricane preparedness plan. Scott Paper Company is the largest employer in Mobile with 3,200 employees, and their plant ranks among the largest in the world. Besides the review of their hurricane plan, Mike also provided a review on the usage and understanding of hurricane probabilities.

- o Hurricane Preparedness in Houston/Galveston WSO Houston was quite active in hurricane preparedness in advance of the 1986 season. Inbetween Magazine, a Galveston publication, and the Houston Chronicle both ran special sections on hurricanes and their dangers. An innovation of Houston WPM, Ron Stagno, was the use of a fictitious but possible short story recounting the experiences of an individual who went through a category five hurricane striking the Houston area.

In addition to the newspaper features, the Houston office assisted KRIV-TV in producing a 30-minute hurricane preparedness documentary focusing on the difference between the Alicia experience and the effects of a truly devastating hurricane. A "hurricane newsletter" has been used and distributed by a number of industries, businesses, and community emergency management offices. Houston MIC, Steve Harned, and WPM, Ron Stagno, combined have given over 35 hurricane preparedness talks since April.

Using the artistic talents of WSS, Bobby Fields, the office has begun preparing a series of cartoon illustrations depicting hurricane safety rules. The plan is to distribute these as public service announcements.

o Hurricane Preparedness in Louisiana WSFO New Orleans MIC, Glenn Trapp, is not letting any moss grow under his feet. In the middle of May, Glenn met with New Orleans city and parish officials to discuss hurricane preparedness efforts. The meeting was followed by a hurricane evacuation decision exercise for the city of New Orleans.

In the latter part of May, Glenn participated with Rod Perkins in a Hurricane Workshop for Southwest Louisiana Parish Directors. The Workshop was held in Cameron and conducted by the State of Louisiana Emergency Services Office. The end of May also saw Glenn's assistance in the NOAA Public Affairs Hurricane Workshop for the Media.

New Orleans WPM, Mike Koziara, spoke to the American Public Works Association meeting covering an overview of meteorological hazards in southeast Louisiana.

o Preparedness In Puerto Rico Dr. Jose Colon, WSFO San Juan Area Manager, reported recently that the office has kept active with disaster preparedness activities throughout Puerto Rico. In mid-May, Dr. Colon made a disaster preparedness presentation to about 300 professional pharmacists at the University of Puerto Rico. Flooding and tropical storms were the main emphasis of his talk.

In the latter part of May, Dr. Colon spoke to more than 60 Civil Defense coordinators from across the island. In early June, Dr. Neil Frank from the National Hurricane Center was the special guest at a hurricane symposium organized by the Department of Natural Resources with cooperation from the NWS, Corps of Engineers, and the Puerto Rican Civil Defense. The start of the hurricane season, as well as Dr. Frank's participation in the symposium generated a great deal of media attention and publicity for hurricane awareness. During the luncheon at the Symposium, the Department of Natural Resources presented Robert Calvesbert, San Juan Hydrologist, with a plaque for his work over the last several years in flood mitigation.

o Hurricane Preparedness Meeting Brownsville MIC, Richard Hagan, addressed 110 people at the Annual Valley Hurricane Preparedness Meeting held in Weslaco, Texas. Richard assembled an interesting program with WSFO San Antonio MIC, Bill Crouch, speaking on the historical perspective of hurricanes along the Texas coast; Dr. Carlton Ruch, from Texas A&M, discussing hurricane relocation planning; Lt. David McEathron, from the Texas Department of Public Safety, speaking on hurricane event responsibilities; Mr. R. G. Decanniere describing details of amateur radio operations during hurricanes; and Mr. Tim Smith, Weathercaster for Channel 5, speaking on the role of the media before and during a hurricane event.

- o Hurricane Awareness Activities in Georgia WSO Savannah MIC, Gary Butler, and WSFO Atlanta WPM, Max Blood, participated in the Governor's Hurricane Conference held in Savannah during the middle of May. The Conference was a 2-day affair with Governor Joe Frank Harris and Dr. Neil Frank serving as the main speakers. The Conference was preceded by a direct mailing of hurricane safety information to over 80 media outlets along the Georgia coastline.
- o Hurricanes in the Maryland-Delaware Area The WSFO Washington Management Area has released an excellent compilation of hurricanes and tropical storms affecting the Maryland-Delaware areas this past century. While a number of storms have adversely impacted on the area (e.g., Agnes in 1972, Eloise in 1975, David in 1979, and Gloria in 1985) no hurricane has made initial landfall in either state in the past century according to the study.
- o Delaware Hurricane Awareness Week The Hurricane Awareness Week in Delaware (August 18-23) started off with a bang -- Hurricane Charley was near the coast on Monday, August 18. Through the week, MIC Marian Peleski gave a presentation to a capacity crowd (80 persons) at the Seaside Nature Center in Cape Henlopen State Park. She taped or did live interviews with three of the four radio stations in Sussex County, Delaware. The message of hurricane safety was well-distributed in the county most vulnerable to hurricanes.
- o South Carolina Activities On June 3, 1986, Richard Shenot and Bernard Palmer participated in a Hurricane Workshop and SLOSH Training Session at Charleston. Attendees included all coastal county preparedness directors, state EPD officials, the Red Cross, military representatives, Corps of Engineers, the South Carolina Coastal Council, and several other interested agencies. Recent changes in the SLOSH storm surge model for South Carolina were covered. SLOSH results are now available which provide greater detail of the important Hilton Head Island resort area.

They are both preparing audio tapes to be used by WYAB Radio, Myrtle Beach, in a hurricane preparedness program. The broadcast will feature a simulated scenario describing how a storm similar to Hurricane Hazel would affect the radio station's listening area if landfall occurred at Myrtle Beach with a subsequent track over northeast South Carolina.

On June 13, 1986, in Charleston, the National Weather Service and South Carolina Sea Grant held a workshop for the media on accurate hurricane reporting to see how the media can be an effective educator in hurricane preparedness and response.

South Carolina Governor Riley signed a proclamation designating the week of July 20 through July 26, 1986, as Hurricane Safety Week. Among the numerous events the WSFO Columbia participated in were daily Public Information Statements (PNS) highlighting important hurricane definitions and safety tips.

o Kudos for Beverly Poole The Adjutant General, Mr. Bill Wellman, and the Executive Director, Mr. Wilbur R. Buntin, Jr., of the Kentucky Disaster and Emergency Services, presented Beverly Poole, Forecaster and Warning Preparedness Meteorologist, WSFO Louisville, with an honor and appreciation for her efforts on behalf of the Emergency Management Program for the state of Kentucky.

Beverly represented the National Weather Service by training Skywarn spotters, conducting several weather safety seminars throughout the state of Kentucky, and presenting a Lightning Safety Campaign to many elementary schools and daycares.

She also was responsible for securing a proclamation from the Governor of Kentucky, Martha Layne Collins, in conjunction with the 1986 Kentucky's Severe Storms Awareness Week.

o Community Preparedness Trip to Southeast Alaska At the invitation of the Alaska Division of Emergency Services and at their expense, George Carte was invited to Petersburg June 23-25 to give community preparedness presentations to local officials and the general public. The officials were especially interested in the earthquakes and their tsunami hazard following the large events near Adak. In addition to presentations, a training exercise and disaster plan review was also conducted. Jack Sharp of the ADES Office in Juneau visited Petersburg with Carte and participated in the training.

A detailed briefing was given to local officials from ALASCOM, electric utility, fire department, public works, airport, and radio stations. Two lengthy interviews were given to local radio stations who service many small communities. A session with the new Civil Defense Coordinator in Petersburg was also held.

o Interagency Tsunami Warning System (TWS) Coordination Meetings During the period June 16-18, TWS Coordination meetings were held in Seattle. One meeting, held on June 16 and 17, included only NWS people. The second meeting, which was on June 18, included representatives of other agencies as described below. In general, these meetings are conducted about every 2 years for coordinating agency operations with a view towards cooperation, efficiency, effectiveness and advancements, and to resolve problem areas. The impetus for this year's meetings was resolution of problems related to tsunami warnings that were issued for the Adak/Atka area during the May 7 and 17, 1986, events.

o WSO Dayton Support During Chemical Fire A chemical fire erupted following a train derailment in Miamisburg, Ohio, during the evening hours of July 8, 1986. The tanker that erupted was carrying phosphorus which is very volatile when exposed to air. The smoke from the fire was considered toxic, and an evacuation process began almost immediately. At one time, there were approximately 30,000 people in emergency shelters. That was the largest number of evacuees due to a train derailment in U.S. history.

National Weather Service support began at the onset of the derailment. Surface winds and short term wind and weather forecasts were provided on an almost continuous basis over a 5-day period. As the information became available, upper air data to 5,000 feet from the twice-a-day soundings were relayed to local, state, and Federal officials.

Stan Wasserman, Eastern Region Headquarters, congratulated WSO Dayton for their support during this event and for their timely response and comprehensive manner in which requests for weather information was handled.

o Boating Safety Brochure Produced by WSO Jacksonville MIC, Jack Schnabel, WSO Jacksonville, recently completed a marine boating safety brochure that was printed and distributed by the Jacksonville, Florida, Marine Association. The marine boating brochure titled "Hurricane Coming, Now What!" encourages boat owners to develop individual hurricane development plans before hurricane season, as the storm approaches, and after the storm. The brochure also gives local tide information and boat mooring instructions. Originally, the brochure was to have been a joint effort, but its content and editing fell on Jack's shoulders. Over 6,000 brochures have been printed and will be distributed to boat owners and as handouts at boat stores, marinas, etc.

o Current Publications As you know in the June issue of the Disaster Preparedness Report, a list was provided showing the publications that we are no longer printing. Attached is a current list of publications that are still available from NLSC, and when they start to run low, we will restock these items.

ATTACHMENT

70027 Survival in a Hurricane (wallet card)
74025 Tornado Safety Rules in Schools
76015 NOAA Weather Radio
76016 Skywarn Tips for Tornado Safety (wallet card)
76018 Lightning Safety (wallet card)
77014 Flash Flood (wallet card)
77015 Flash Flood (wallet card) (Inundaciones Repentinias)
Spanish Version of 77014
77020 Hurricane Tracking Chart (Atlantic)
77021 Hurricane Tracking Chart (Eastern and
Central Pacific)
78019 Storm Surge and Hurricane Safety with North
Atlantic Tracking Chart
79013 Public's Guide to General Weather Information
79017 The Naming of Hurricanes
79018 Winter Storms
80003 Riding Out Winter Storms (wallet card)
81010 Floods, Flash Floods and Warnings
81011 Spotter's Guide for Identifying and Reporting
Severe Local Storms
82001 Tornado Safety
82002 Dust Storm Driving Safety (wallet card)
82003 Catalog of Weather and Flood Hazard Awareness
Material
82004 Watch Out Storms Ahead
83001 Thunderstorms and Lightning
84001 Skywarn Spotter (ID card)
85001 Heat Wave
85002 Hawaiian Hurricane Safety Measures with
Central Pacific Tracking Chart
85005 Tornado Safety Tips (Como Protegerse En Caso De Tornado)
Spanish version of 76016
85006 Survival in a Hurricane (Como Sobrevivir En Un Huracan)
Spanish version of 70027
85010 Owlle Skywarn on Flash Flood (Inundaciones Replampago)
Spanish version of 77016
86001 Natural Hazard Watch and Warning

ACTION CHECKLIST

Here is a list of the many things to consider before, during and after a hurricane. Some of the safety rules will make things easier for you during a hurricane. All are important and could help save your life and the lives of others.

Stay or Leave?

When a hurricane threatens your area, you will have to make the decision whether you should evacuate or whether you can ride out the storm in safety at home.

If local authorities recommend evacuation, you should leave! Their advice is based on knowledge of the strength of the storm and its potential for death and destruction.

In general:

- If you live on the coastline or offshore islands, plan to leave.
 - If you live in a mobile home, plan to leave.
 - If you live near a river or in a flood plain, plan to leave.
 - If you live on high ground, away from coastal beaches, consider staying.
- In any case, the ultimate decision to stay or leave will be yours. Study the following list and carefully consider the factors involved—especially the items pertaining to storm surge.

At Beginning of Hurricane Season (June)

Make Plans for Action

- Learn the storm surge history and elevation of your area
- Learn safe routes inland
- Learn location of official shelters
- Determine where to move your boat in an emergency
- Trim back dead wood from trees
- Check for loose rain gutters and down spouts
- If shutters do not protect windows stock boards to cover glass.

When a Hurricane Watch is Issued for Your Area

- Check often for official bulletins on radio, TV, or NOAA Weather Radio
- Fuel car
- Check mobile home tie-downs
- Moor small craft or move to safe shelter
- Stock up on canned provisions
- Check supplies of special medicines and drugs
- Check batteries for radio and flashlights
- Secure lawn furniture and other loose material outdoors
- Tape, board, or shutter windows to prevent shattering

- Wedge sliding glass doors to prevent their lifting from their tracks

When a Hurricane Warning is Issued for Your Area

- Stay tuned to radio, TV, or NOAA Weather Radio for official bulletins
- Stay home if sturdy and on high ground
- Board up garage and porch doors
- Move valuables to upper floors
- Bring in pets
- Fill containers (bathtub) with several days supply of drinking water
- Turn up refrigerator to maximum cold and don't open unless necessary
- Use phone only for emergencies
- Stay indoors on the downwind side of house away from windows
- Beware of the eye of the hurricane
- Leave mobile homes
- Leave areas which might be affected by storm tide or stream flooding
- Leave early—in daylight if possible
- Shut off water and electricity at main stations
- Take small valuables and papers but travel light
- Leave food and water for pets (shelters will not take them)
- Lock up house
- Drive carefully to nearest designated shelter using recommended evacuation routes.

After the All-Clear is Given

- Drive carefully; watch for dangling electrical wires, undermined roads, flooded low spots
- Don't sight-see
- Report broken or damaged water, sewer, and electrical lines
- Use caution re-entering home
- Check for gas leaks
- Check food and water for spoilage



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric
Administration
National Weather Service
NOAA/PA 78019

HURRICANE TRACKING CHART AND ACTION CHECKLIST.

BE PREPARED.

STOCK UP NOW ON HURRICANE SUPPLIES AT DELCHAMPS BEFORE THE STORM.



Delchamps Super Stores
OPEN 24 HOURS. EVERY DAY.

TERMS TO KNOW:

Tropical disturbance: A moving area of thunderstorms in the Tropics that maintains its identity for 24 hours or more. A common phenomenon in the tropics.

Tropical depression: Rotary circulation at surface, highest constant wind speed 38 miles per hour (33 knots).

Tropical storm: Distinct rotary circulation, constant wind speed ranges 39-73 miles per hour (34-63 knots).

Hurricane: Pronounced rotary circulation, constant wind speed of 74 miles per hour (64 knots) or more.

Small craft cautionary statements. When a tropical cyclone threatens a coastal area, small craft operators are advised to remain in port or not to venture into the open sea.

Gale Warnings may be issued when winds of 39-54 miles an hour (34-47 knots) are expected.

Storm Warnings may be issued when winds of 55-73 miles an hour (48-63 knots) are expected. If a hurricane is expected to strike a coastal area, gale or storm warnings will not usually precede hurricane warnings.

A **Hurricane Watch** is issued for a coastal area when there is a threat of hurricane conditions within 24-36 hours.

A **Hurricane Warning** is issued when hurricane conditions are expected in a specified coastal area in 24 hours or less. Hurricane conditions include winds of 74 miles an hour (64 knots) and/or dangerously high tides and waves.

Actions for protection of life and property should begin immediately when the warning is issued.

Flash Flood Watch: means a flash flood is possible in the area; stay alert.

Flash Flood Warning means a flash flood is imminent; take immediate action.

Tornadoes spawned by hurricanes sometimes produce severe damage and casualties. If a tornado is reported in your area, a warning will be issued.

HURRICANE TRACKING CHART

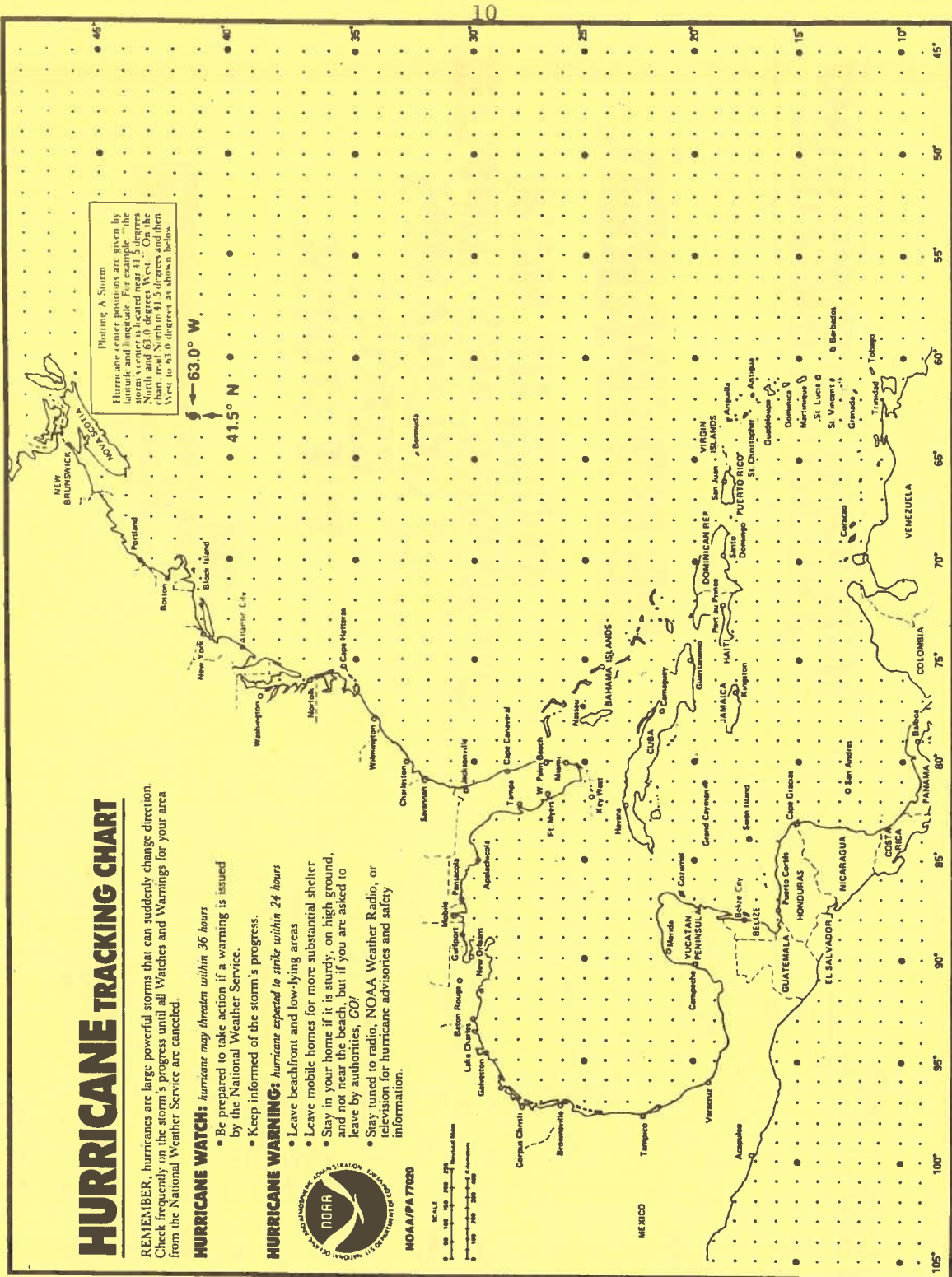
REMEMBER, hurricanes are large powerful storms that can suddenly change direction. Check frequently on the storm's progress until all Watches and Warnings for your area from the National Weather Service are canceled.

- HURRICANE WATCH:** *hurricane may threaten within 36 hours*
- Be prepared to take action if a warning is issued by the National Weather Service.
 - Keep informed of the storm's progress.

- HURRICANE WARNING:** *hurricane expected to strike within 24 hours*
- Leave mobile homes for more substantial shelter and not near the beach, but if you are asked to leave by authorities, GO!
 - Stay tuned to radio, NOAA Weather Radio, or television for hurricane advisories and safety information.



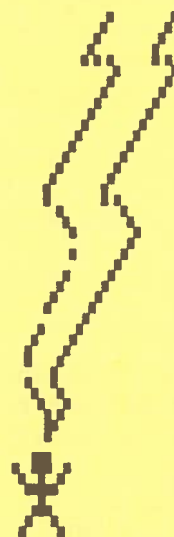
NOAA/PA 77020



THE NEW Delchamps Super Stores
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TENNESSEE LIGHTNING AWARENESS

JUNE 1986





U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
 NATIONAL WEATHER SERVICE FORECAST OFFICE
 7777 Walnut Grove Rd. - OM 1
 Memphis, TN. 38119-2198

June 1, 1986

TO: Tennessee Broadcasters, Editors, Law Enforcement and Emergency Management
 Directors, Educators, and All Interested Parties:

Every year in Tennessee, people are struck by lightning. Some are painfully injured, and others are killed. Because lightning strikes one or two people at a time, it doesn't receive as much attention as more spectacular storms, such as tornadoes and hurricanes, attract. So, lightning tends to be underrated when compared to more violent and attention-grabbing tornadoes.

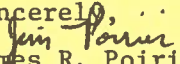
The summer months of June through September are the deadliest ones as far as lightning is concerned in Tennessee. That's why the National Weather Service takes this opportunity to call attention to the dangers posed by a thunderstorm's lightning strokes.

The following information about lightning activity will inform you as to the nature of the problem; that is, what is lightning and how does it affect Tennesseans? Safety rules that will help people survive thunder-and-lightning storms are also included so they can survive and enjoy nature's fireworks.

Knowledge by itself doesn't prevent a death or injury; but preparedness combined with positive action will reduce the annual toll of death and injuries associated with lightning. The goal of the National Weather Service is to reduce the loss of life and injuries due to severe weather. The education of the public to the hazards, and the mitigation of those hazards, is of prime importance in this effort. The National Weather Service relies on the involvement of various groups and many people to raise the weather awareness level of the public. If you have any questions or comments, please contact me, Jim Poirier, Warnings and Preparedness Meteorologist for Tennessee at the National Weather Service Forecast Office in Memphis, at (901) 757-6441. Or, contact the Meteorologist- or Official-in-Charge of your local National Weather Service Office:

Tri-Cities Area	Ed Vogt (Acting)	(615) 323-6200
Knoxville	Robert Menken	(615) 970-2784
Chattanooga	Bill Pollock	(615) 892-3747
Nashville	Derrel Martin	(615) 361-4887
Memphis	Richard I. Coleman	(901) 757-6400
	(Area Manager for Tennessee)	

A decrease in the number of tornado fatalities has been seen since the 1950's, primarily because people are more familiar with safety rules. Let's try for the same results with lightning deaths. Thanks for your participation and support!

Sincerely,

 James R. Poirier
 Warnings & Preparedness Meteorologist
 Enclosure



LIGHTNING FACTS AND FIGURES FOR TENNESSEE

Lightning is an effect of electrification in a thunderstorm. As air rises during the formative stages of a thunderstorm, interactions of the electrically charged particles in the building cloud (cumulonimbus) produce an intense electrical field. A large positive charge is concentrated in the upper part of the storm, and a large negative charge is formed in the lower regions. The earth is normally negatively charged with respect to the atmosphere, but as the storm passes over the ground, the negative charge in the base of the cloud induces a positive charge on the ground below and for several miles around the storm. The ground charge follows the storm like an electrical shadow, growing stronger as the negative cloud charge increases. The attraction between positive and negative charges causes the positive ground current to flow up buildings, trees, and other elevated objects in an effort to establish a flow of current. But air, being a poor conductor of electricity, prevents that flow of current until huge electrical charges have built up. Lightning occurs when the difference between the positive and negative charges - the electrical potential - becomes great enough to overcome the resistance of the insulating air and to force a conductive path for current to flow between the charges. Electrical potential can be as high as 100 million volts,

Thus, this "separation of charge" into positive and negative areas within the thunderstorm cloud is the important factor in the occurrence of lightning. So, current can flow between the cloud and the ground, from cloud to cloud, from one part of a single cloud to another part, or even from cloud to air. Pilots near hurricanes have reported seeing vertical lightning erupt from the tops of thunderclouds and disappear into the stratosphere.

It's estimated that at any given moment, nearly 2,000 thunderstorms are in progress over the earth's surface, and lightning strikes the earth 100 times each second. There are about 45,000 thunderstorms daily and 16 million annually around the world. There are at least 100,000 thunderstorms annually across the United States. Referring to Table 1, statistics from 1959-1984 for the U.S. show that 2,574 people have lost their lives, and 6,472 have been injured by lightning, an average of over 100 people killed and about 250 injured each year. Property loss is estimated in the hundreds of millions of dollars annually. Table 1 also shows that, in Tennessee, 101 people were killed by lightning in that 26 year period, ranking Tennessee 5th highest in the nation for lightning fatalities. In an average year in Tennessee, 4 people are killed by lightning, and 10 people are hurt.

Further research on Tennessee lightning statistics, for the period 1970-1985, shows that more lightning fatalities occur in the eastern half of Tennessee than in the western half of the state. Of the 59 deaths that occurred in that 16 year span, fully 63% (almost two-thirds) of the deaths occurred in the eastern half of the state, and 37% of the lightning fatalities were recorded in the western half. One explanation for this east-half bias is that there are somewhat more thunderstorms over the higher terrain of the east; thus, with more lightning activity, more lightning deaths and injuries would be expected in the east. One lightning researcher, quoted by the National Safety Council, determined that in the April to October lightning season, the average person in the U.S. can expect 40 to 80 lightning strikes within one-half mile. In Tennessee, and especially eastern Tennessee, the number might be closer to 80 than to 40. Incidentally, in that 1970-1985 span, 148 Tennesseans were injured by lightning.

Referring to the county-by-county breakdown of lightning deaths in Tennessee for the period 1970-1985, one would expect to find more deaths in high population density areas, such as Davidson County (Nashville) or Shelby County (Memphis), and the statistics bear this out. Franklin County, with 5 lightning fatalities, was the county leader in the state for the 16 year period. While Franklin County is not a major population center, Tims Ford Lake provides outdoor recreational opportunities. Thus, with a recreational draw, lightning strikes to people could be higher. Macon County, in northcentral Tennessee, had 4 fatalities, which is comparatively quite a few for a county with a small population.

A small number of years in the data sample (16), and an unfortunate lightning strike (or four!) can make some counties stand out.

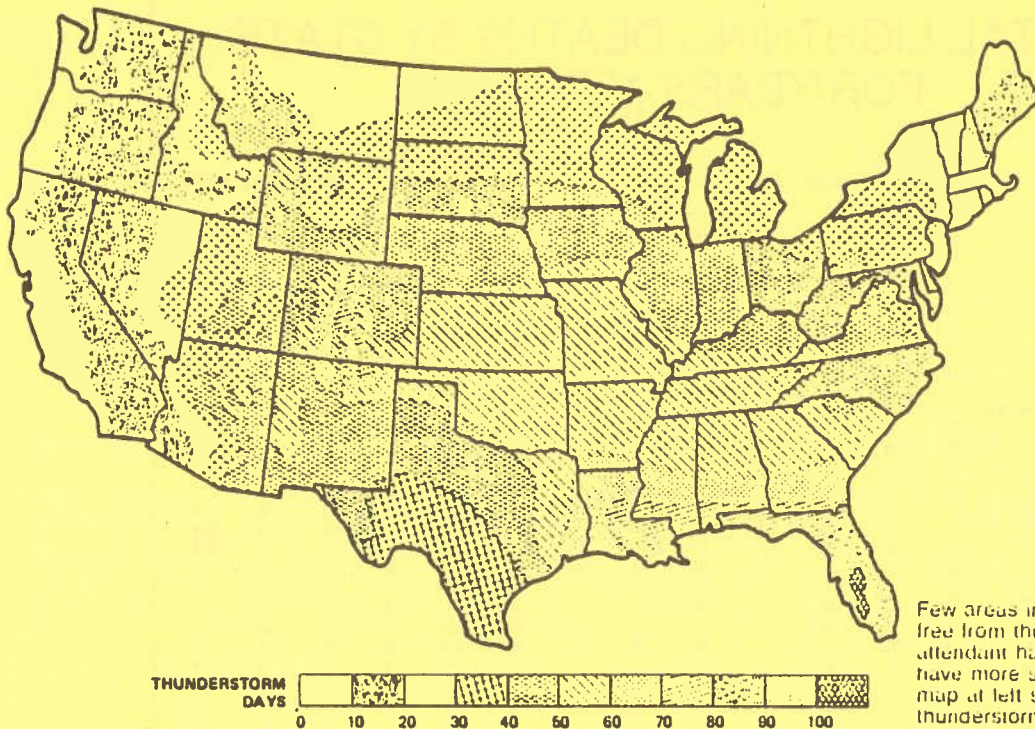
Lightning can occur in any month of the year in Tennessee, but judging by the statistics, the danger to humans increases dramatically from April through September, and particularly the June-July-August period. Of the 59 deaths in Tennessee from 1970 to 1985, 33 -or 56%- occurred in the summer months of June through August. Also, thunderstorms can occur at any time of day. But more occur with the high heat of the afternoon and early evening; unfortunately, this is when more people are out-of-doors and vulnerable. Consequently, the majority of fatalities and injuries occur between the hours of 1 pm and 9 pm.

Of the 59 deaths from 1970 to 1985, the sex of the victim was reported in 48 cases. 36 males died, and 12 females were killed by lightning. While lightning can't discriminate between male and female, this male-weighted bias may occur because more men work and play outdoors. Outdoor jobs, such as construction, and outdoor pastimes, such as fishing and hunting, are male dominated activities.

The way to reduce the loss of life and injury associated with lightning (and other aspects of severe weather) is to know and actively use the safety rules. This is especially true for people who routinely work or play outdoors. But even for those stay-at-homes, did you know that 2 people in Tennessee were struck by lightning inside their dwellings when lightning followed the wires outside into their homes?

Here are some safety rules...

- MOVE INSIDE** to a house, a large building, or an all-metal vehicle. Avoid using the telephone (except in emergencies) or using or standing near electrical appliances, because lightning can follow the wires inside. If you need to gab, use a cordless phone.
- GET OFF THE WATER** and into a substantial building, or at least into an enclosed and all-metal vehicle with the windows closed. If in an open boat, lie down in the boat with cushions between you and the metal sides and bottom.
- IF OUTSIDE, GET DOWN** to avoid being the highest point for a lightning discharge. If you're caught in a flat, open field, and especially if you feel your hair standing on end, drop to your knees. That way, only your feet and knees would be touching the ground.
- MOVE AWAY FROM** motorcycles, scooters, golf carts, bicycles, tractors, and other metal farm equipment, wire fences, clotheslines, metal pipes, drains, railroad tracks, and any other metallic paths.
- SHUN LONE TREES** and the tallest trees. If caught in the woods, pick a small tree as your rain shelter and stand at least 5 feet from the trunk to avoid flying bark if the tree is struck.
- AVOID STANDING** in a small isolated shed or other small structure in open areas, especially an ungrounded type of structure. You would be confined very close to the path of any lightning stroke.
- IF IN A GROUP** spread out before you kneel down.



Few areas in the United States are free from thunderstorms and their attendant hazards, but some areas have more storms than others. The map at left shows the incidence of thunderstorm days—days on which thunderstorms are observed—for the United States.

Lightning Safety Rules

If you plan to be outdoors, check the latest weather forecast and keep a weather eye on the sky. At signs of an impending storm—towering thunderheads, darkening skies, lightning, increasing wind—tune in your NOAA Weather Radio, AM-FM radio, or television for the latest weather information.

When a thunderstorm threatens, get inside a home, a large building, or an all-metal (not convertible) automobile. Do not use the telephone except for emergencies.

If you are caught outside, do not stand underneath a tall isolated tree or a telephone pole. Avoid projecting above the surrounding landscape. For example, don't stand on a hilltop. In a forest, seek shelter in a low area under a thick growth of small trees. In open areas, go to a low place, such as a ravine or valley.

Get off or away from open water, tractors, and other metal farm equip-

ment or small metal vehicles, such as motorcycles, bicycles, golf carts, etc. Put down golf clubs and take off golf shoes. Stay away from wire fences, clotheslines, metal pipes, and rails. If you are in a group in the open, spread out, keeping people several yards apart.

Remember—lightning may strike some miles from the parent cloud. Precautions should be taken even though the thunderstorm is not directly overhead. If you are caught in a level field or prairie far from shelter and if you feel your hair stand on end, lightning may be about to strike you. Drop to your knees and bend forward, putting your hands on your knees. Do not lie flat on the ground.

FIRST AID

Persons struck by lightning receive a severe electrical shock and may be burned, but they carry no electrical charge and can be handled safely. Someone who appears to have been killed by lightning often can be revived by prompt action. When a group has

been struck, the apparently "dead" should be treated first.

The American Red Cross says that if a victim is not breathing, you should immediately begin mouth-to-mouth resuscitation, once every 5 seconds to adults and once every 3 seconds to infants and small children, until medical help arrives.

If both pulse and breathing are absent, cardiopulmonary resuscitation—a combination of mouth-to-mouth resuscitation and external cardiac compression—is necessary. This procedure should be administered only by persons with proper training.

Victims who appear only stunned or otherwise unhurt may also need attention. Check for burns, especially at fingers and toes and next to buckles and jewelry. Give first aid for shock. Do not let the victim walk around. Send someone for help. Stay with the victim until help arrives. Be prepared.

A Red Cross first aid course provides excellent instruction on how to render aid to a person who has been struck by lightning.

SEVERE THUNDERSTORM: Winds more than 57 mph or hail 3/4 inch or more in diameter.

SEVERE THUNDERSTORM WATCH: Severe thunderstorms are possible.

SEVERE THUNDERSTORM WARNING: Severe thunderstorms have been sighted or indicated by radar.



NOAA/PA 83001
(Rev. June 1985)

TOTAL LIGHTNING DEATHS BY STATE FOR YEARS 1959-1984

STATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Alabama	0	0	2	2	4	16	24	14	1	1	0	0	64
Alaska	0	0	0	0	0	0	0	0	0	0	0	0	0
Arizona	0	0	0	0	2	1	16	13	9	0	0	0	41
Arkansas	0	0	8	0	11	28	27	19	3	0	0	0	96
California	0	0	0	0	0	2	3	5	3	0	0	0	13
Colorado	0	0	0	1	9	14	29	15	0	1	0	0	69
Connecticut	0	0	0	0	0	3	5	3	1	0	0	0	12
Delaware	0	0	0	0	2	2	3	3	0	0	0	0	10
District of Columbia	0	0	0	0	0	1	1	1	0	0	0	0	3
Florida	0	0	4	3	20	62	68	62	32	2	1	1	255
Georgia	0	0	2	3	4	15	25	10	2	1	0	0	62
Hawaii	0	0	0	0	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	1	1	6	5	5	1	0	0	0	19
Illinois	0	0	0	4	7	21	12	11	7	2	0	0	64
Indiana	0	0	1	2	6	21	15	12	5	2	0	0	64
Iowa	0	0	1	3	9	14	6	13	4	4	0	0	54
Kansas	0	0	0	3	8	5	13	7	4	1	2	0	43
Kentucky	1	0	0	2	7	16	15	9	10	0	0	0	60
Louisiana	0	0	1	5	8	19	37	13	11	0	2	1	97
Maine	0	0	0	0	0	3	5	6	0	3	0	0	17
Maryland	0	0	0	0	2	5	6	6	1	0	0	81*	101
Massachusetts	0	0	0	1	3	3	5	7	1	0	0	0	20
Michigan	0	0	0	1	6	19	20	21	5	0	0	0	72
Minnesota	0	0	0	2	2	8	6	12	8	1	0	0	39
Mississippi	1	0	4	2	11	9	23	17	5	0	0	0	72
Missouri	0	0	5	4	19	18	10	8	3	1	0	0	68
Montana	0	0	0	0	2	8	6	2	0	0	0	0	18
Nebraska	0	0	0	1	3	13	8	6	4	0	0	0	35
Nevada	0	0	0	0	0	1	0	2	0	0	0	0	3
New Hampshire	0	0	0	0	0	3	2	0	0	0	0	0	5
New Jersey	0	0	0	1	2	7	17	14	5	0	0	0	46
New Mexico	0	0	0	1	3	8	21	26	4	0	0	0	63
New York	0	0	0	0	5	18	51	25	4	2	0	0	105
North Carolina	0	1	4	2	20	29	45	32	4	0	0	0	137
North Dakota	0	0	0	0	0	4	3	3	0	0	0	0	10
Ohio	0	0	0	3	7	21	38	14	8	2	2	0	95
Oklahoma	1	1	1	9	12	11	7	15	11	3	1	0	72
Oregon	0	0	0	0	1	0	0	1	2	1	0	0	5
Pennsylvania	0	1	0	0	7	24	26	25	8	1	0	0	92
Puerto Rico	0	0	0	0	0	3	5	8	5	3	0	0	24
Rhode Island	0	0	0	0	0	0	1	0	2	0	0	0	3
South Carolina	0	0	1	0	5	9	29	11	6	0	0	0	61
South Dakota	0	0	0	0	4	1	4	1	3	3	0	0	16
Tennessee	0	1	1	6	12	30	16	17	13	2	3	0	101
Texas	0	0	0	13	24	14	36	21	14	7	1	0	130
Utah	0	0	0	0	1	5	3	6	2	0	0	0	17
Vermont	0	0	0	0	0	4	5	4	0	0	0	0	13
Virginia	0	0	0	0	9	6	8	8	2	0	0	0	33
Washington	0	0	0	0	0	1	0	0	0	0	0	0	1
West Virginia	0	0	0	0	4	2	8	2	1	0	0	0	17
Wisconsin	0	0	0	1	0	8	12	10	2	1	1	1	36
Wyoming	0	0	0	0	2	4	7	6	2	0	0	0	21
TOTAL	3	4	35	76	264	545	737	551	218	44	13	84	2574

* Deaths resulting from a lightning-related commercial aircraft crash, Elkton, Md., December 8, 1963.

TABLE 1

NWS HEADQUARTERS STAFF

CENTRAL REGION

FTS

James L. Campbell, W/OML1 Acting Chief, Warning & Forecast Branch
 Linda S. Krenkau, W/OML1 Program Assistant
 Lorraine V. Brown, W/OML1 Clerk, Disaster Preparedness

Regional (WPM) 758-3239
 Regional Hydrologist 758-3229
 Chicago (Focal) 353-4680
 Ann Arbor (Focal) 378-2220
 Des Moines (Focal) 862-4496
 Indianapolis (Focal) 331-4035
 Louisville (Focal) 352-5210
 St. Louis (Focal) 279-7018
 Sioux Falls (Focal) 782-4244
 Topeka (Focal) 752-2630
 Denver (Focal) 327-3611
 Cheyenne (Focal) 328-2376
 Minneapolis (Focal) 725-3400
 Milwaukee (Focal) 362-3243
 Bismarck (Focal) 783-4224
 Omaha (Focal) 864-4207

EASTERN REGION

Eugene Kilgore
 Albert Kachic
 John Kwiatkowski
 Mary Jo Parker
 Martin Ross
 Dick Calcapterra
 Dennis Decker
 Rich Schwerdt
 Ralph Izzo
 Tim Scrom
 Dave Dilley
 Tom Dunham
 Bill Drzal
 Dave Sisk
 Fred Ronco/John Rimkunas

FTS

Regional (WPM) 649-5455
 Reg. Hydrologist 649-5464
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 Columbia, SC (WPM) 677-5501
 Philadelphia (WPM) 597-3696
 Parkersburg, WV (WPM) 923-1344
 Raleigh (WPM) 672-4436
 Washington (WPM) 763-8275
 New York (Focal) 662-5340
 Albany (Focal) 562-6586
 Boston (Focal) 223-1354
 Buffalo (Focal) 437-4800
 Pittsburgh (Focal) 722-2882
 Pittsburgh (Focal) 722-2882
 Portland (Focal) 833-3552

SOUTHERN REGION

Brian Peters
 Max Blood
 Jay Shelley
 Buddy McIntyre
 Ron Stagno
 David Imy
 Nelson DeVilliers
 Bill Alexander
 Jim Poirier
 Don DeVore
 Bill Hare
 Francisco Torres-Cordero
 Dick Wood
 Mike Koziara
 Larry Lahiff

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 Atlanta (WPM) 246-7586
 Birmingham (WPM) 229-0837
 Fort Worth (WPM) 334-8505
 Houston (WPM) 526-5834
 Jackson (WPM) 490-4639
 Little Rock (WPM) 740-5331
 Lubbock (WPM) 738-7362
 Memphis (WPM) 222-6441
 Oklahoma City (WPM) 749-4155
 San Antonio (WPM) 730-5025
 San Juan (WPM) 8-809-753-4893
 Albuquerque (Focal) 474-2170
 New Orleans (Focal) 682-6891
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 Glenn Trapp
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 Charles Ruscha
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 Dep. Reg. Hydrologist 588-5137
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 Los Angeles (Focal) 793-7215
 Phoenix (Focal) 261-3500
 Portland (Focal) 423-4340
 Reno (Focal) 470-5719
 Salt Lake City (Focal) 588-5133
 San Francisco (Focal) 466-7767
 Seattle (Focal) 392-6087
 Great Falls (Focal) 585-1311

ALASKA REGION

A. Jay Hull

Regional (WPM) 8-907-271-5127

PACIFIC REGION

Vacant

Regional (WPM) 8-808-546-2853