SHAREHOLDERS REPORT 2019

NATIONAL WEATHER SERVICE

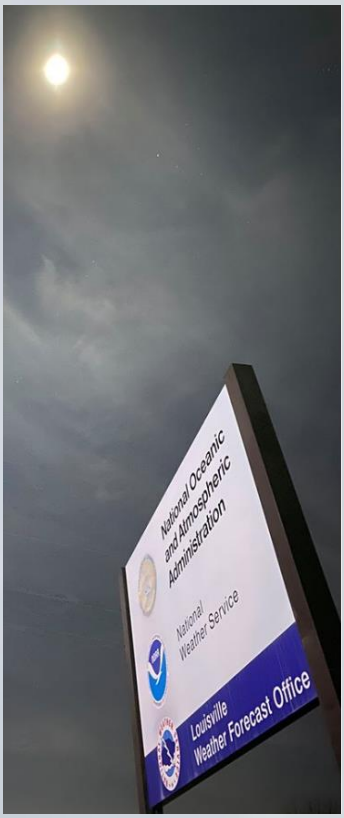
LOUISVILLE

It's hard to believe, but this is the 15th edition of National Weather Service (NWS) Louisville's Shareholders Report. I come to work every day for one overarching reason: to better serve you, our shareholders! This report details the activities of NWS Louisville across our 59 counties in southern Indiana and central Kentucky.

2019 will be remembered for a very wet first half of the year which transitioned quickly to drought in September and October (page 3).

Warning Coordination Meteorologist Joe Sullivan led the KenTenn Weather Workshop in Bowling Green (page 5), we unveiled the Adopt-a-County program (page 4), and hosted two summer students via the Ernest F. Hollings Undergraduate Scholarship program (page 7).

Meteorologist Andrea Schoettmer was promoted to Service Hydrologist. This is a critical position and Andrea hit the ground running (page 5). Our partners at the Ohio River Forecast Center, United States Geological Survey, and NWS Central Region Headquarters assisted with this critical selection. We also hired a new meteorologist, Brian Neudorff, who is a former Chief Meteorologist from a television station in Twin Falls, Idaho. Brian will be developing our YouTube page.



Goals for 2020

Improving all facets of Tornado Warnings

Meteorologists will personally visit officials in all 59 of our counties

Add a new river forecast flood point on the Cumberland River in Burkesville, Kentucky

Complete flood damage surveys and invite structural engineers to provide guidance on storm damage surveys

Create 10 YouTube weather videos

I hope you find that our activities demonstrate the sort of stewardship you expect from your public servants. The NWS was appropriated $1.2 billion for Fiscal Year 2018-19, which was an investment of only $3.53 per American. I am grateful to Lead Forecaster and Shareholders Report Editor Tom Reaugh for assembling another excellent report.

I welcome your suggestions as to how the NWS can be an even better investment for you.

Cheers,

John Gordon, Meteorologist-in-Charge (MIC)

Cover photo: Heather Scott, Campbellsville, Kentucky

2019: From Flood to Drought

Tom Reaugh, Lead Forecaster

From January 2018 through June 2019, over 100 inches of rain doused the middle Ohio Valley. 2018 was the wettest calendar year ever recorded in Louisville, Lexington, and Frankfort, and the first half of 2019 (January through June) ranked in the top 20. The Ohio River left its banks in February of both 2018 and 2019.

In July 2019 the pattern changed as a large upper ridge built over the southeast United States. Rains became much less frequent. July and August ended up being drier than normal in Louisville and Lexington, and by September 10 moderate drought had developed.

September is normally a relatively dry month, but September 2019 was extreme. It became the **first calendar month in recorded history during which no measurable rain fell at Lexington**. It was also the driest month on record at Louisville, 2nd driest at Frankfort, and10th driest at Bowling Green.

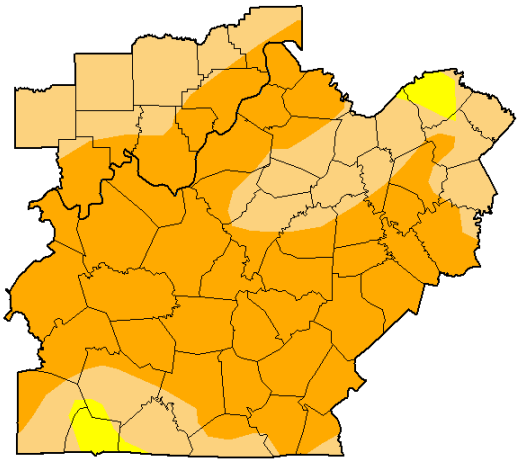
The intense dryness caused the drought to develop and spread so quickly that it was called a "flash drought." The dry spell peaked on October 1 as severe drought enveloped much of the region.

Local Drought Information
weather.gov/louisville/drought

Drought and heat tend to magnify each other. As heat increases drought tends to increase, and as drought increases heat tends to increase. The first three days of October were like none ever seen before in the month with afternoon temperatures in the middle and upper 90s. Louisville and Lexington set new all-time record highs for October with readings of 97 degrees, and Bowling Green set a monthly record at 98. A cold front passed through on the 6th and 7th and brought one to two inches of welcome rain, ending a record 39-day streak of no measurable rain at Lexington. Additional rains followed and the drought was erased by early November.

U.S. Drought Monitor

Louisville, KY Area



October 1, 2019

(Released Thursday, Oct. 3, 2019)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	97.47	65.07	0.00	0.00
Last Week 09-24-2019	2.53	97.47	68.91	9.58	0.00	0.00
3 Months Ago 07-02-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-01-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 10-01-2019	0.00	100.00	97.47	65.07	0.00	0.00
One Year Ago 10-02-2018	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:

None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

NWS Louisville participated in weekly discussions with U.S. Drought Monitor (USDM) authors to develop drought maps, such as the one pictured here. USDM maps are issued every Thursday morning for the entire United States and its territories.

Adopt-a-County

Brian Schoettmer, Forecaster

One of the roles of the Warning Coordination Meteorologist (WCM) in the NWS is to develop and cultivate relationships with our local county emergency managers (EM) and other officials. However, with 59 counties across central Kentucky and southern Indiana for which NWS Louisville is responsible, this can be quite a daunting task for one person to tackle. Compounding the challenge is the fact that our WCM, Joe Sullivan, will be retiring in 2020. Others in the office must step into the role of coordinating with county officials.

With these challenges in mind, NWS Louisville will be taking a new approach in 2020. Each staff member has adopted a set of counties for which they are a liaison. The goal is to gather and catalogue as much information about each county as possible while making sure EMs have the tools, resources, and contact information available to help them keep their communities Weather-Ready. With detailed information about county events, and in-depth knowledge of each county's particular needs, NWS Louisville can provide essential decision support services to EMs when weather threatens public safety. The NWS Louisville Adopt-A-County initiative is another way the NWS provides the best service possible to our stakeholders.

NWS Louisville Area of Responsibility

Snow Squall Warnings

Evan Webb, Forecaster

NWS Louisville now has the ability to issue Snow Squall Warnings (SQW). This is a new short-fused product similar to a Severe Thunderstorm Warning (SVR). Like an SVR, the SQW will be issued in a polygon format and usually will be in effect for 20-45 minutes.

A snow squall consists of a brief but intense burst of localized heavy snow with gusty winds and near zero visibility.

Snow squalls cause rapid changes in conditions that pose serious threats to personal safety. Multi-vehicle pile-ups can be deadly and costly disruptions to travel. Consider an alternate route or delaying travel when snow squalls are expected. Reduce speed and use low beam headlights in squalls.

KenTenn Weather Workshop

Jess Lee, Forecaster

On Saturday, November 16, 2019, the NWS offices in Louisville, Paducah, Nashville, Jackson (KY), and Morristown worked together to host the KenTenn Weather Workshop at Western Kentucky University. The goal was to provide the public and weather enthusiasts in Kentucky and Tennessee with the opportunity to interact with local meteorologists while learning the latest developments in the weather community.

John Gordon, MIC, with Owlie Skywarn at KenTenn.

The workshop included presentations from local NWS forecasters, TV meteorologists, professors, private weather forecasting companies, and emergency managers. A variety of topics were covered throughout the day, including presentations on everything from extreme weather prediction to satellite applications. During lunch, attendees participated in a weather trivia competition and won fun prizes like a NOAA Weather Radio and a rain gauge. In the afternoon a radar workshop was held with an introductory lesson on fundamental radar interpretation.

Owlie Skywarn attended the workshop and held a meet-and-greet with the 200 attendees. Owlie helped with the Children's Science Program in the afternoon, which included a weather safety presentation as well as fun science experiments led by Jason Lindsey, an area meteorologist well known for his "Hooked On Science" program.

Improving Flood Services at Burkesville, Kentucky

Andrea Schoettmer, Service Hydrologist

Heavy rains during the 2018-19 winter caused Lake Cumberland to swell to a record high level, leading to releases from Wolf Creek Dam of a magnitude never before seen. Historic flooding along the Cumberland River resulted. The worst was in Burkesville and communities downstream. The Burkesville river gage measured a record crest of 56.5 feet on March 1. Floodwaters inundated downtown Burkesville and other communities along the river. As a result, an inundation mapping project was started in summer 2019 by the U.S. Army Corps of Engineers (USACE) to show flood potential from Burkesville, KY to Celina, TN. The project is expected to be completed in 2020.

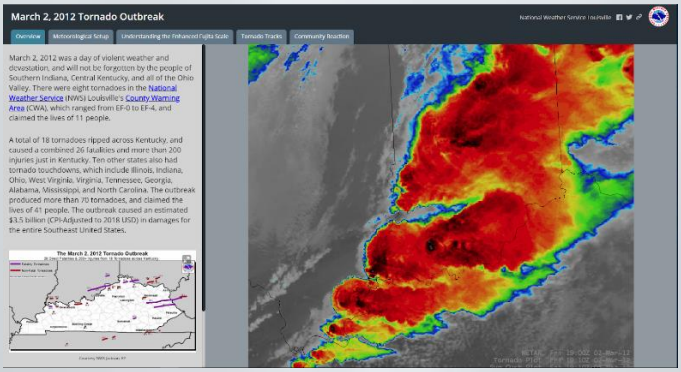
Burkesville flooding in 2019

NWS Louisville and the Ohio River Forecast Center are leading efforts to upgrade the Burkesville river data point to a forecast point. These combined efforts will provide better flood mitigation and planning tools to emergency managers and the citizens of south-central Kentucky.

Geographic Information System Projects

Evan Webb, Forecaster
C. J. Padgett, Student

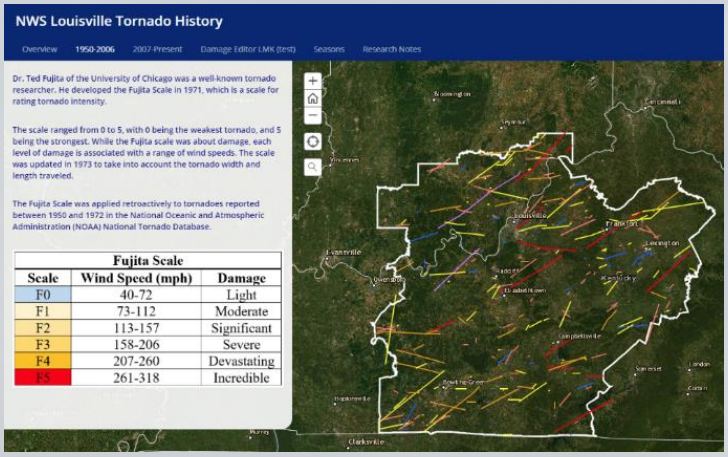
Students volunteering their time and ingenuity at NWS Louisville have created historical event story maps. A story map is a digital platform for presenting Geographic Information System (GIS) data. These story maps explore the meteorology and societal impact of past significant weather events in the Ohio Valley, such as the March 2, 2012 tornado outbreak. The immersive story maps are a great tool for keeping the past alive.



C.J. Padgett, a senior at Western Kentucky University (WKU), created the March 2, 2012 tornado outbreak story map. Bailey Stevens, a WKU graduate, created a story map for the catastrophic Louisville flash flood of August 4, 2009. Cody Moore, a University of Louisville graduate, created a story map on the 2009 ice storm, which will be published online in 2020.

After a tornado touches down in central Kentucky or southern Indiana, meteorologists from NWS Louisville conduct storm damage surveys to assess the damage and determine the rating and wind speed of the tornado. To record our data in the field, we have used the Damage Assessment Toolkit (DAT) operationally for the past several years. The DAT is a GIS interface used for collecting, storing, and analyzing damage survey data.

In 2019 NWS Louisville began testing the use of Survey123 for damage surveys. There are several advantages to using Survey123 as the new damage assessment tool. It is simple and intuitive, making field data easy to gather. Data captured are instantly available for analysis.



C.J. has been working on creating an all-new interactive GIS story map of tornadoes that have occurred in southern Indiana and central Kentucky. This engaging map will feature historic tornado events and will automatically update with new tornadoes that have been assessed using Survey123. The project will provide an interactive user interface for our tornado history webpage.

Student Involvement

Sam Carr, Forecaster

Student opportunities in the NWS are vital for those who wish to get hands-on experience in becoming a meteorologist. In an effort to provide students with necessary skill sets for the competitive job market, many NWS offices across the U.S. offer opportunities for students to become volunteers or paid scholars.

At NWS Louisville, volunteers are assigned one main project to complete over the course of a semester. Students are also given the opportunity to experience shift work, assist with damage surveys, network with professionals in the field, receive operational training, and learn about NWS forecast and warning services.

In 2019 NWS Louisville was fortunate to host three talented volunteers. Christine Aiena, an Ohio University alum, completed a social science assessment with members of the public to determine the effectiveness of our messaging on social media platforms. Olivia Cahill, a senior at WKU, developed sign language videos and pamphlets to be distributed to our deaf and hard of hearing communities. Evan Hatter, also a senior at WKU, created a variety of social media templates to be used for educational and historic weather-related purposes.

Undergraduates in their sophomore year are eligible to apply for the Ernest F. Hollings Scholarship. The scholarship includes tuition assistance for two years of full-time study and a 10-week, full-time paid internship at a NOAA facility during the summer between their junior and senior year. NWS Louisville hosted two Hollings scholars in 2019: Melissa Piper from Iowa State University and Kristine Chen from the University of Oklahoma. Melissa investigated new methods of predicting flash flooding and their effectiveness in central Kentucky and southern Indiana. Kristine analyzed urban heat island effects in an effort to develop specific criteria for Heat Advisories and Excessive Heat Warnings for the city of Louisville to use in its Heat Response Plan.

Another paid student opportunity is the NWS Pathways Internship Program, which ultimately allows students to work with professionals and receive formal training while pursuing their education. Students who complete the program may be eligible for conversion to a permanent civil service job. This past summer C.J. Padgett, a senior at WKU, was selected to be NWS Louisville's Pathways Intern. Having completed over 640 hours of service, he will be converted to a full-time employee at NWS Louisville in the summer of 2020.

NWS Louisville students, L to R: Christine Aiena, Melissa Piper, Olivia Cahill, Kristine Chen, C.J. Padgett, Evan Hatter. Also pictured: John Gordon.

Doppler Radar Service Life Extension Program

Steve Goodlett, Electronics Technician
Dan McKemy, Forecaster

The NWS Louisville Doppler weather radar is located at Fort Knox. The radar has been in operation for over two decades and has received many software updates. In 2019 several major hardware upgrades were made to NWS radars across the country thanks to a $150 million investment by the NWS, United States Air Force, and Federal Aviation Administration. Old breakers, cables, power filters, fuse holders, and blowers that were original to the radar were replaced with new, modern equipment. The original modulator was replaced with a solid state version which results in the removal of high failure transmitter modules. The radar at Fort Knox already has an excellent uptime record, and this new technology will ensure even better uptime rates for years to come.

Geothermal Heating and Cooling Saves on Energy Costs

Todd Adkins, Electronic Systems Analyst

In order to increase efficiency and improve occupant comfort levels, NWS Louisville's aging heating, ventilation, and air conditioning (HVAC) system was upgraded to a new geothermal system. The project took approximately five months, reaching completion in early October. The upgrade involved removing the office's original HVAC system and installing the new geothermal system while keeping the office fully operational 24/7. The new geothermal system includes a field of 10 wells that are each 350 feet deep, four geothermal heat pumps, a reheat unit, and associated pumping, controls, and duct work. Geothermal systems function by transferring heat to the ground in summer and from the ground in winter. The new system is expected to save 30% on energy costs along with substantial reductions in maintenance costs.

Giving Back

Brian Schoettmer, Forecaster

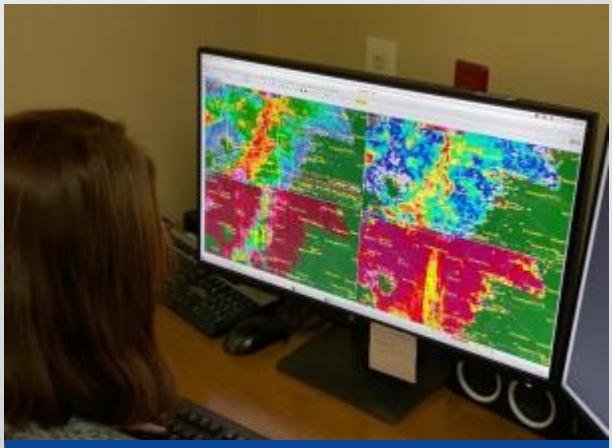
NWS Louisville took part in the 9th Annual NWS Week of Service with two activities. The first was taking up a collection of food items to donate to the Dare to Care Emergency Food Box program which serves 13 counties in the Kentuckiana region. Over the course of the week we collected a total of 222 items that weighed 291 pounds.

The second event was at Broad Run Park, part of the Parklands of Floyds Fork in Louisville. Several employees volunteered their time to plant ground cover to prevent erosion along the sides of a steep ravine. We were happy to help one of our Weather-Ready Nation Ambassadors!

Jess Lee, John Gordon, and others plant seedlings in Broad Run Park.

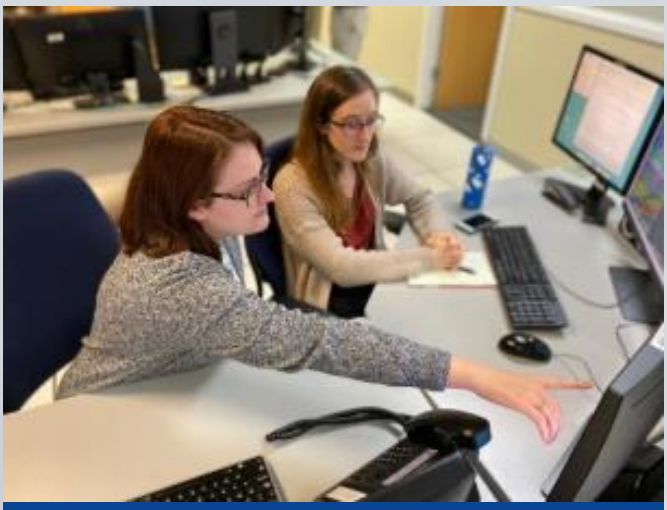
Preparing for Storms Using Real Data

Dan McKemy, Forecaster



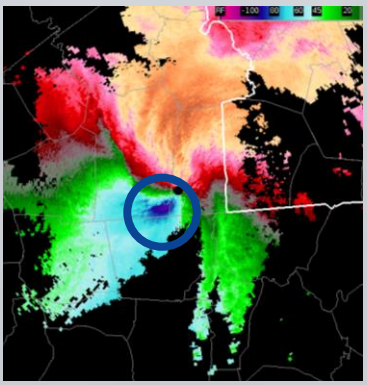
A meteorologist practices her skills using real data on a computer that is not connected to outside communications. She can issue practice warnings and other products as part of the simulation.

Southern Indiana and central Kentucky can be impacted by severe thunderstorms during any time of the year, though the spring and summer months are when we typically see the highest frequency of severe storms. NWS Louisville forecasters stay prepared for severe weather all year long by keeping up with the latest science and research that is published in the meteorological community, as well as practicing what they learn in various settings.

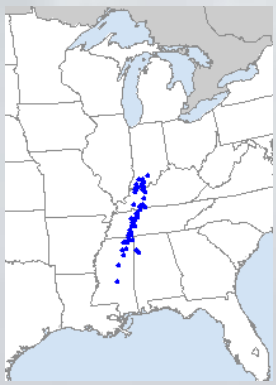


Meteorologists work side-by-side analyzing data and making decisions.

One way NWS Louisville forecasters practice their severe weather knowledge and skills is through the Weather Event Simulator (WES). The WES is a computer software program that plays back past events in real-time. Model data, radar data, and storm reports are available as the forecaster works through the event. They analyze storms and issue warnings in the simulator just as they would on an operational system. After the simulation ends the Science and Operations Officer (SOO) provides feedback on how the forecaster performed and what they can do to improve. Forecasters gain a better understanding of storms and the warning process, which in turn is beneficial for you, our customer, as more timely and accurate warnings are provided for future events.



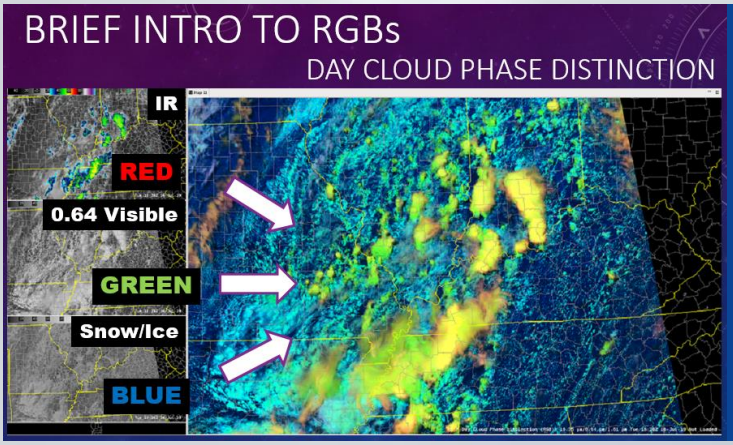
The deep blue colors (circled) in the image on the left indicate winds over 110 mph just 1,600 feet off the surface as the remnants of Tropical Storm Olga entered the Ohio Valley on October 26. Trees were blown down when winds at the surface gusted over 60 mph in a few spots. The blue dots on the map to the right show reports of wind damage as Olga moved north.



Presenting Research

Ryan Sharp, Lead Forecaster
Dan McKemy, Forecaster

In September, forecasters Ryan Sharp and Dan McKemy travelled to Huntsville, AL to attend the National Weather Association's (NWA) Annual Meeting. The main purpose of the trip was to learn from others in the operational weather community about the latest techniques in forecasting both from a meteorological perspective and social science perspective. A second goal for attending was to present research we completed at NWS Louisville. Ryan presented how we use composite satellite imagery to merge parts of the very large data set provided by the new GOES-16 satellite. These composite images (called RGBs, short for Red/Green/Blue) as well as the increase in resolution of the satellite have helped us to see many more interesting features than we had been able to with previous satellites (see below).



The Day Cloud Phase Distinction RGB combines the Infrared channel with the Visible and the Snow/Ice channels. The blue colors represent clouds made of liquid droplets, whereas those that are more green are beginning to have ice crystals mixed in. The yellow and pink colors are clouds tall enough for just ice crystals and have the potential to produce lightning.

Also at the NWA meeting, Dan McKemy presented a case study on two severe storms that formed during a shift he had worked. One storm was tornadic, whereas the other was not. He compared radar and environmental characteristics between the two storms that explained why one of them produced a tornado but the other did not. New training on severe storm conceptual models that we are learning are helping us to anticipate and observe features in radar data that could potentially help us to increase lead time and reduce our false alarm rate for Tornado Warnings.

Forecaster Dan McKemy (center in black shirt) presents his case study of tornadic and non-tornadic supercells to a crowd at the NWA meeting in Huntsville, AL.

Humana: Ambassador of Excellence

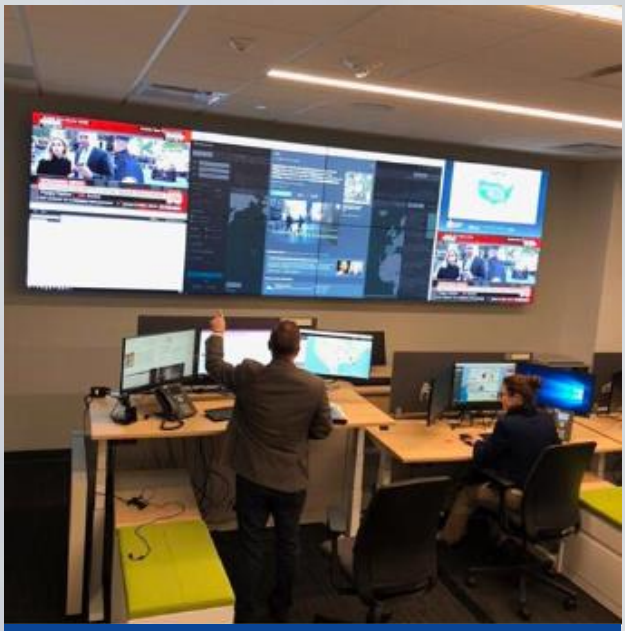
Brian Schoettmer, Forecaster

Ambassadors of Excellence have made significant contributions to building a Weather-Ready Nation. By serving as change agents and leaders in their communities, Ambassadors of Excellence have:

- Inspired others to take action and become ready, responsive, and resilient
- Created innovative ways to engage their community, workforce, and social network
- Formed unique collaborations with the National Oceanic and Atmospheric Administration and other ambassador organizations to achieve goals they could not meet alone
- Embraced building a "Weather-Ready Nation for All" by addressing vulnerable populations' needs

Since early spring of 2019, a team from Humana's Safety and Security Fusion Center worked closely with NWS Louisville promoting weather safety. In April, the team toured NWS Louisville, during which weather resources were shared and contacts for their needs were established. The Humana Team followed up with NWS Louisville's Service Hydrologist and the Ohio River Forecast Center on questions regarding a flood plan at one of Humana's locations.

In August, Humana hosted a weather safety presentation delivered by NWS Louisville that was broadcast to nearly 1,800 Humana employees across the country. A tour of Humana's Safety and Security Fusion Center was provided as well. Humana has proven its commitment to a Weather-Ready Nation and we look forward to our continued partnership with them in the future.



Humana's Safety and Security Fusion Center

NWS Louisville on YouTube

Tom Reaugh, Lead Forecaster

youtube.com/user/NWSLouisville

In June, Weather-Ready Nation Ambassadors were invited to attend a webinar given by NWS Louisville on the middle Ohio Valley's rich tornado history. The 45-minute long video is now available on our YouTube channel for anyone to view.

In December, forecaster Brian Neudorff produced an excellent video about our chances for a white Christmas. The video was posted on our YouTube channel shortly before the holiday.

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Photo by Matt McClintock, Mount Washington, Kentucky