

Leveraging Collaborative Partnerships to Enhance NWS and Emergency Management Communications through Exercising

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ABSTRACT: Tabletop exercises examining weather-related hazards are not uncommon but are often built around somewhat generic scenarios that only touch on the meteorological communication environment at a very shallow level. A recent exercise in central Oklahoma sought to change that. A local emergency manager, personnel from a National Weather Service (NWS) forecast office, and a severe weather researcher with a background in exercise design and facilitation worked together to create and deliver a realistic severe weather simulation. Exercise participants were exposed to detailed forecast information via NWSChat—a dedicated communication tool used to connect NWS forecasters, emergency managers, and media members for real-time information sharing. NWS forecasters were able to both actively play in the exercise due to the use of NWSChat and observe how local decision-makers interpreted and utilized the impact-based decision support service (IDSS) graphics and short-term forecast updates. The collaborative approach of developing a detailed scenario with numerous real-world IDSS graphics, along with the use of NWSChat for real-time delivery, resulted in overwhelmingly positive feedback from the participants. The local emergency management office identified numerous areas for improvement in communicating real-time forecast information across their jurisdiction, along with gaps in current plans and resources. Meanwhile, the NWS forecast office had the opportunity to experiment with using the new NWSChat platform in a high-impact severe weather environment before a real-world event took place. Forecasters also gained insight into current IDSS graphic interpretation, noting areas for improved messaging to end users, such as adding storm motion to existing severe weather graphics.

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1. Introduction

Tabletop exercises are an important tool for emergency managers to ensure jurisdictional readiness for future incidents. These exercises often involve multiple agencies or stakeholders representing various parts of a community coming together to examine current plans, policies, and procedures for responding to an incident. The type of incident chosen for the scenario in a tabletop exercise drives the types of questions, discussions, and challenges that the exercise participants will encounter. Weather-related hazards are frequently chosen as the subject of tabletop exercises because of their real-world impacts on jurisdictions. As such, it is important for the weather community to engage with emergency managers (EMs) via exercises to understand how they use information from the National Weather Service (NWS) and other weather information sources. A recent exercise in central Oklahoma capitalized on collaborative partnerships and new technologies to create an experience that benefited both the local jurisdiction and the local NWS Weather Forecast Office (WFO).

2. Exercise design and development

The exercise took place on 31 August 2023 and was staged in the City of Purcell, located in central Oklahoma, along I-35, about 40 mi south of Oklahoma City. As the county seat of McClain County, Purcell is no stranger to severe weather. In 2023 alone, four different tornadoes touched down in areas very near Purcell, including a strong enhanced Fujita 3 (EF-3) tornado in April 2023. These near misses prompted the newly hired emergency management director, along with the long-time fire chief and public works director, to evaluate their community's readiness to respond to a significant tornado event. The significant turnover of city staff in recent years meant that many individuals in leadership or support positions had not experienced a significant severe weather event nor had participated in a multiagency exercise. This realization led to a recommendation for a multiagency tabletop exercise to improve community readiness.

Due to strong relationships developed through intentional partnership efforts, the Purcell EM director reached out to colleagues at the local NWS WFO and at the Cooperative Institute for Severe and High Impact Weather Research and Operations (CIWRO) and the NOAA National Severe Storms Laboratory to be part of the exercise planning team.

Along with recent severe weather and staff turnover, the introduction of NWSChat 2.0 in Slack proved to be a key motivator of this exercise. NWSChat was first introduced in 2008 as a password-protected online tool that allowed NWS forecasters, emergency managers, and members of the media to interact in real time in a closed environment. During severe weather events, NWSChat is utilized to increase situational awareness among all users, provide short-term updates from forecasters, and enable emergency managers to share storm reports from their jurisdiction. The upgrade to a more stable and mobile-friendly platform in summer 2023 increased the tool's functionality. Specifically, the ability to

share graphics along with textual forecast information provides emergency managers with a near one-stop platform for gathering weather-related information and interacting with NWS forecasters. Like with any new tool, however, the actual operational use and best practices for NWSChat 2.0 are still being explored. All members of the planning team agreed that the exercise should rely heavily on NWSChat 2.0. To accomplish this, a separate Slack channel was created specifically for the exercise and only exercise participants were allowed to join the channel.

The goal of the planning team was to make a realistic and detailed severe weather-focused exercise by providing participants with a scenario that was believable and challenging, while also incorporating as much real-world forecast information as possible. Though fictitious, the exercise scenario presented participants with the kind of high-end severe weather day that occasionally impacts central Oklahoma. The scenario also incorporated real-world concerns into the narrative, such as the impact that a local high school football game might have on decision-making and resource availability.

To achieve these goals, the planning team for the exercise delegated roles and responsibilities. The CIWRO/NSSL researcher led the exercise design process, including the development of the scenario, and served as the primary facilitator for the exercise. Given their history with the city and their own experiences with severe weather response, the Purcell fire chief and public works director both provided input for specific areas of preparedness and response that needed to be addressed by the exercise. The Purcell EM director led the logistical planning for the exercise, as well as recruiting city personnel and other relevant entities to participate in the exercise. Finally, NWS forecasters supported the exercise development by creating impact-based decision support service (IDSS) graphics that would tell the story of an evolving and escalating severe weather event. Exercise participants would be given forecast graphics matching current IDSS graphics regularly available from the local Norman NWS WFO. Participants could then make decisions as information became available.

Following standard approaches set by the Federal Emergency Management Agency (FEMA) for exercise design, the planning team developed objectives as a means of ensuring that specific areas of the community's readiness were tested (FEMA 2023). Objectives serve as the building blocks for identifying gaps or vulnerabilities in plans, resources, or personnel. The planning team decided on the following five objectives:

- Establish and maintain situational awareness of both evolving weather conditions and stakeholder needs throughout the exercise timeline
- Demonstrate the ability to establish an effective command structure following a significant incident
- Identify potential resource needs, including a process for resource requests and tracking, based on the scenario present
- Coordinate personnel and facility needs for immediate, short-term response and short-term recovery
- Examine plans for continuity of operations for key city functions in the event of a long-term disruption

3. Exercise facilitation

On the day of the exercise, 51 individuals attended and participated in the activity (see Table 1). Representatives from multiple city agencies were present, including both leadership and frontline workers from fire, law enforcement, public works, parks and recreation, city administration, and city management (see Fig. 1). Outside of public agencies, other stakeholders participated from the local school district, local hospital, ambulance service, and a local tribal nation.

TABLE 1. Overview of exercise participants who were on site the day of the exercise.

Affiliation	Number	Exercise role
City employees and first responders	35	Players
Other local stakeholders	11	Players
NWS personnel	3	Observers (other NWS forecasters participated as players remotely from the WFO)
NSSL/CIWRO	1	Facilitator
State personnel	1	Evaluator

The WFO also committed staff time to participate in the exercise in two ways: three forecasters attended the exercise in person, while other forecasters on duty in the office participated remotely via NWSChat.

Exercise play was divided up into three modules based on three time periods—before storms formed, active severe weather operations, and immediate short-term response. The first module focused on participants receiving a forecast for severe weather and the potential decisions that officials might make based on the information. Forecast graphics consistent with Storm Prediction Center (SPC) Categorical Outlooks and WFO timing forecasts were presented to the participants (Fig. 2).

The second module of the exercise was the point when collaboration with WFO Norman truly became invaluable. A detailed schedule was developed so that forecasters in the WFO would know when to post new information into NWSChat. This created the feel of an evolving scenario with rapid updates being provided to participants from NWS meteorologists. Like in a real-world event, the Purcell EM director monitored NWSChat but did so on a large screen for all participants to view (Fig. 3). Many exercise participants indicated that they did not know that NWSChat existed or what kind of functionality it possessed. As new updates arrived within NWSChat, participants could react to the information with tactical or strategic decision-making. This included straight-forward decisions like recalling personnel or activating outdoor warning sirens, to more complex conversations around



FIG. 1. The semioperational environment for the simulated severe weather exercise hosted on 31 Aug 2023.

Severe Weather Friday Evening

Timing: 4 PM – Midnight

Weather Forecast Office

Norman, OK



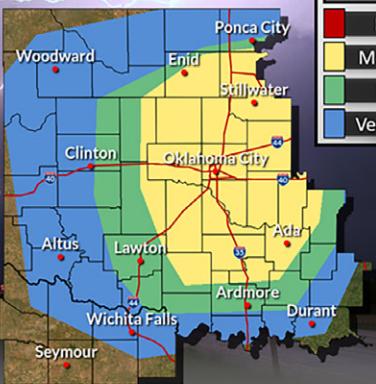
Issued September 15, 2023 3:00 PM CDT

Severe Outlook



Severe Risk
High
Moderate
Enhanced
Slight
Marginal

Tornado Risk



Tornado Potential
High
Medium
Low
Very Low

Main Hazards



Hail up to the size of baseballs



Wind gusts up to 80 mph



Medium tornado risk
A few significant tornadoes possible

When: Friday Evening
4 PM – Midnight

What You Can Do to Prepare

- Have multiple ways to receive warnings.
- Have a plan in place for if a warning is issued for your area.
- Check back for future updates.

weather.gov/norman

NWSNorman

FIG. 2. An example of the simulated forecast graphics shown to participants during the exercise.

resource availability or requesting mutual-aid partnerships. Participants could also ask NWS meteorologists clarifying questions in real time on NWSChat through the Purcell EM director, thus reinforcing this channel as a means of information gathering and situational awareness. The second module included a significant tornado impacting portions of Purcell, as well as a secondary line of thunderstorms impacting the area a few hours later during initial search and rescue efforts (Fig. 4). In both cases, information flow from the NWS to the EM director to frontline responders was critical to coordinate response and keep personnel as safe as possible.



NWS - Norman - [REDACTED] 9:30 AM

Exercise... We are expecting rapid development of thunderstorms just west of the OKC metro (along the Hwy 81 corridor) in the next 1 to 2 hours along a dryline. Satellite trends indicate agitated cumulus clouds and convective-allowing models are fairly aggressive with development in the next hour or so as the cap weakens. These thunderstorms would be supercells and quickly become severe with more than sufficient instability (MLCAPE ~5000 J/kg) and shear (effective bulk shear ~60 knots). Low-level shear (0 to 1 km at 35 knots with a modest low-level jet) is also more than sufficient for tornadoes...some significant (sig tornado parameter is forecast to increase to almost 6)...as they move eastward toward the I-35 corridor this evening.

545PM_StormDevelopment.png ▾



EM - City of Purcell - [REDACTED] 9:32 AM

what are the current conditions like in Purcell as far as wind speed, direction, etc



NWS - Norman - [REDACTED] 9:33 AM

Gusty southeast at 15 mph with gusts to 30 mph.

1 G+

FIG. 3. A screenshot of the exercise Slack channel during the second module, which shows a graphic posted by an NWS forecaster and an EM asking a question about it.

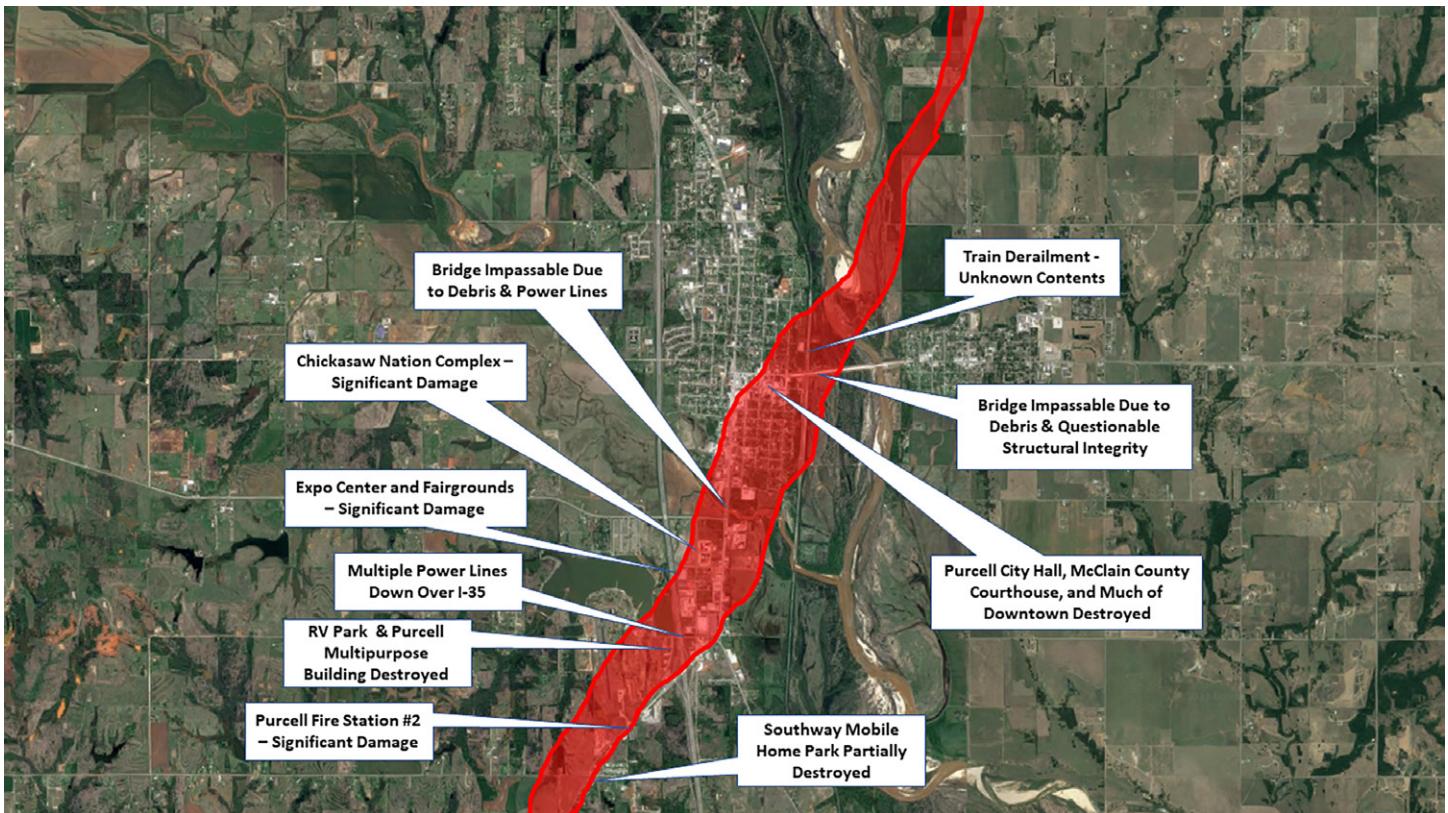


FIG. 4. The simulated tornado track that impacted the City of Purcell during the exercise.

The final module of the exercise focused on the short-term response to a significant tornado impacting the community. Participant discussions revealed that preplanning and information sharing would be critical for a community like Purcell dealing with any kind of significant weather event. Gaps in continuity of business and continuity of government plans, as well as resource limitations of responders, often came to the forefront of discussions. It was agreed that the response to such an event would require wide-ranging regional coordination and personnel coming together from various parts of the state. Even in this stage, however, the need for continued weather information to support response and recovery efforts was apparent.

4. Feedback and lessons learned

Exercise participants gave resoundingly positive feedback to the experience. According to participants, the result was a far more realistic exercise than what many participants had experienced in the past. The participation of both the NWS-WFO and CIWRO/NSSL was seen as validating and affirming of the efforts of the local emergency management agency to increase community readiness. Similarly, the inclusion of NWS and CIWRO/NSSL personnel in all stages of the exercise strengthened the understanding of end-user needs along the communication timeline and illustrated some of the ways in which NWSChat 2.0 can better support end-user needs.

Purcell emergency management was able to bring together a wider cross section of community leaders than in past exercises and had the opportunity to demonstrate the access to information that their close relationship with the NWS Norman office provides. City leaders and stakeholders, likewise, gained a better perspective of the types of forecast information available before and during severe weather events. The types of forecast information that are commonplace in the meteorological and EM community were often unknown to exercise participants not in those fields. While local media was commonly cited as the

primary source of real-time weather information by many of the exercise participants, the awareness of NWSChat as an additional source of information was somewhat revelatory.

Showcasing the real-time effectiveness of NWSChat throughout the course of exercise play was not only a key outcome of the exercise but also revealed an area of needed additional work. While the communication channel for real-time forecast information from the WFO to the local EM was clear, the next step was not. A local strategy for ensuring that information makes its way from the emergency management office to other key decision-makers and stakeholders across the community was an important after-action item. Recognition of this limitation in the current information flow is important for forecasters to acknowledge as well. Further collaborative efforts are likely needed to explore solutions to this potential gap.

Benefits were not limited only to city personnel, however. Staff from WFO Norman reported significant benefits from participation. The three meteorologists participating on-site during the exercise were able to see and hear how forecast information was interpreted and utilized in decision-making by the participants involved in the exercise. Participants also provided feedback, whether solicited or not, on ways to improve current IDSS graphics. For example, a common refrain was that information regarding storm motion was mostly absent from IDSS graphics, but that such information could be extremely helpful in contextualizing emerging threats. WFO Norman staff have since started adding this type of storm motion information to real-world outlook, timing, and watch-to-warning graphics.

Forecasters that participated in the exercise remotely via NWSChat were able to interact with the new Slack platform in a way that would closely resemble a real-world severe weather event. This opportunity proved timely, as a widespread severe weather episode had not yet occurred on the new NWSChat platform. This exercise allowed forecasters to simulate how their interactions with NWSChat users might change based on newly available tools and options in the Slack infrastructure. By having the on-site meteorologists observe how key personnel interpreted and utilized information in NWSChat posts, the WFO was better able to gauge what types of posts participants found useful. One interesting observation was that posts that included more technical meteorological information and jargon were mostly ignored by participants.

This work also demonstrates the potential for research-focused institutions to aid in building partnerships between operational end-user communities and forecasters. When research staff can interact with operational end-user communities, they are more equipped to develop and pursue novel project ideas like the one described here. Outside of real-world events, when there often is no time or bandwidth to experiment and evaluate new techniques, exercise environments can play a significant role in bridging the divide between research and operations across the entire weather enterprise.

Participants from all parties involved encourage others to explore future collaborative efforts to bring local EM offices, local WFO offices, and researchers together to design, develop, and facilitate similar semioperational tabletop exercises. Our recommendations for developing similar exercises are listed below:

- Engage members of the exercise planning team early in the process. Be creative about who might benefit or bring expertise to the exercise design.
- Use real-world concerns that are unique to the community engaged in the exercise. In this case, the inclusion of an important high-school football game in the scenario led to a more complex decision-making process.
- Look for ways that all parties can benefit from exercise play, rather than simply being observers. This exercise presented forecasters from NWS Norman with a chance to test their own tools in real time, rather than only providing static graphics to exercise players.

- Utilize facilitators that have significant subject matter expertise in the topic area to encourage relevant follow-up questions when engaging with participants. This also allows emergency management personnel to participate in the exercise as a player, rather than limiting their role to facilitation.
- Incorporate available technology, like NWSChat, to deliver exercise materials as would happen in a real-world incident. This makes the exercise more operationally relevant than traditional, static tabletop exercise.
- Actively seek out collaboration opportunities between emergency management offices, local WFOs, and research institutions to strengthen relationships before, during, and after real-world incidents.

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Reference

FEMA, 2023: Homeland security exercise and evaluation program. FEMA,
<https://www.fema.gov/emergency-managers/national-preparedness/exercises/hseep>.