

# **NATIONAL WEATHER SERVICE PRODUCT DESCRIPTION DOCUMENT (PDD)**

**TYPE: Enhancement to Official Product**

**DATE: January 28, 2013**

Enhanced Product – Tornado Warnings and Associated Follow-up Statements Modified to Emphasize Impacts, Intensity, and Recommended Actions via Bulleted Messages and Coded Tag Lines

Feedback Period: April 1, 2013 – November 30, 2013

## **Part 1 – Mission Connection**

### **1) Product Description**

The Tornado Warning (TOR), Severe Thunderstorm Warning (SVR) and any Severe Weather Statement (SVS) issued as a follow-up to a TOR or SVR, are alphanumeric products issued by NWS offices to provide short-fused warning information on hazardous conditions associated with intense thunderstorms which pose a threat to life and/or real property. In the case of the TOR, the warning forecaster also believes there is compelling evidence the subject storm will spawn one or more tornadoes. These products are prepared by each National Weather Service (NWS) Weather Forecast Office (WFO) for their County Warning Area (CWA) of responsibility.

The TOR is based on scientific evaluation of atmospheric conditions, or an actual observation, indicating tornado development is imminent or occurring. Hazards associated with severe thunderstorms are nearly always attendant to the tornado threat as well – those hazards being winds gusting to 58 mph or greater, and/or hail of one inch (1”) diameter or greater. The SVS is a “follow-up” statement which provides updated information as to the status of storms within a TOR (or SVR) warning area.

This product enhancement attempts to take a positive evolutionary step toward enhancing risk communication and focusing on impact-based information in NWS warnings. This represents the next logical step to address recent service assessment findings (see Purpose section below) and builds on the successful use of coded tag lines which have been appended to Central Region (CR) warnings since 2010. The goal of this experimental project is to enhance the communication of critical short fused warning information by utilizing streamlined, standardized, concise bullets. Enhanced wording will be included to convey information about associated impacts, specific hazards expected, and recommended actions - both within the bullet statements and as part of the tag line codes. Use of tags to explicitly include severity to prompt faster risk assessment by key users and partners also represents a partial migration to CAP compliant formats (minus a certainty expression).

For severe thunderstorms (SVR), forecasters will be presented two options within the WarnGen GUI: (1) a storm (or line of storms) may be identified as a traditional, baseline SVR threat, or (2) cells of interest may be identified as extreme storms, i.e., those for which forecast hail is baseball-size or larger (>2.75”) and/or wind gusts are predicted to

exceed 80 mph (approaching low end EF1).<sup>\*</sup> Invoking the latter choice will trigger inclusion of enhanced verbiage concerning impacts and calls to action. It will also insert a highlight statement such as "This is a very dangerous storm". Finally, the option to include a tag line which explicitly states "TORNADO POSSIBLE" will be available. This messaging which highlights elevated danger may be selected during the issuance of an original warning (SVR) or in a follow-up statement (SVS).

For tornado warnings (TOR), forecasters will be provided three options. The standard or "base" tornado warning represents the first option. The chief improvements for these base warnings – likely the most common type issued through the season – will be bullets which plainly and clearly communicate hazard and impact information, calls to action rephrased by social science partners, and tags which identify whether the tornado is observed or radar-indicated (implied statement of confidence in evidence), predicted hail size, and the option to add strength of non-tornadic thunderstorm-related wind. This warning type will be selected for cases in which there is *credible* evidence of a tornado.

The second type of tornado warning – one for which there is *substantial* evidence of a tornado coincident with a high impact event – will include the phrase "This is a Particularly Dangerous Situation", (PDS), and incorporate enhanced wording within the second warning bullet to identify a high level of risk, description of expected damage and impacts, and promote serious urgency in taking action to seek shelter immediately. The "PDS" warning will also append an explicit damage threat reference in the form of a tag line code "TORNADO DAMAGE THREAT...CONSIDERABLE", rather than simply discriminating between observed or probable.

The third and highest type of tornado warning will be reserved for those rare cases in which a known, violent tornado is likely to produce devastating damage. For these situations, the enhanced wording will include a "TORNADO EMERGENCY" announcement, the recommended action will be brief, clear and extremely urgent (e.g., IF YOU ARE IN OR NEAR LIBERTY...SEEK SHELTER IMMEDIATELY!), and the tag line will read:  
TORNADO DAMAGE THREAT...CATASTROPHIC.

*\* - These are the default thresholds but they may be configured locally.*

## **2) Purpose**

The purpose of this experiment is to improve the communication of crucial decision support and risk assessment information to partners and users within the guidelines of governing policy and the existing operational environment. To this end, a set of Severe Thunderstorm and Tornado Warning templates will be employed to promote clarity of impacts and to more effectively communicate or escalate situational urgency. The proposed warning (and statement) templates each contain a simplified basis statement, a short description of the hazard as a companion to the event tags, information source, and a description of the potential impacts. In addition, when certain thresholds are met or anticipated for severe weather (such as a significant tornado or greater than 80 mph winds) a mechanism exists to issue a warning or statement with enhanced wording.

These modifications denote a meaningful progression in the NWS warning system. Further, they represent concrete actions to address findings and recommendations from recent historic tornado events, most notably that of the historic May 22, 2011 EF5 Joplin, Missouri tornado.

Among the recommendations in the Central Region Joplin Tornado Service Assessment (hereafter, Joplin SA) was a suggestion to explore evolving the warning system to better support effective decision making (*Joplin SA, Recommendation #2*). The report advocates for a simple, impact-based information structure which promotes warning credibility and empowers individuals to quickly make appropriate decisions in the face of adverse conditions.

The assessment recommended that such a system should:

- a) provide a non-routine warning mechanism that prompts people to take immediate life-saving action in extreme events like strong and violent tornadoes
- b) be impact-based more than phenomenon-based for clarity on risk assessment,
- c) be compatible with NWS technological, scientific, and operational capabilities
- d) be compatible with external local warning systems and emerging mobile communications technology
- e) be easily understood and calibrated by the public to facilitate decision making
- f) maintain existing “probability of detection” for severe weather events
- g) diminish the perception of false alarms and their impacts on credibility

All of these objectives are believed to be achievable, but full resolution will require a phased approach. Employing strategies to effectively address some of these factors will require a substantial level of collaboration, planning, and outreach - in addition to several non-trivial technology and policy changes. However, enhancements identified in this PDD can be implemented immediately to begin the desired evolution toward a warning system which better communicates intensity, magnitude of risk, potential impact, and appropriate responsive actions. Core partners in the media, emergency management, academia, and private sector associates, have largely concurred on the value of this initiative. This consensus was enthusiastically confirmed in the December 2011 "Weather Ready Nation - Vital Conversation" meeting in Norman, OK.

### **3) Audience**

The target audience for the product includes: national, state and local emergency managers; media partners; the private weather enterprise; government and military agencies.

### **4) Presentation Format**

Enhanced wording concerning impacts, specific hazards and source of information which prompted the warning will be inserted into the text area beneath the third mandatory bullet (immediately following the time, location and motion of the storm).

A list of “recommended action” phrases will be selectable in the WarnGen GUI. The selection will be inserted into the mandatory section labeled “PRECAUTIONARY/PREPAREDNESS ACTIONS”.

Relevant tags for Tornado, Hail and Wind will be automatically appended to the bottom of severe convective warnings (TOR, SVR) and follow-up statements (SVS) issued by all CR offices that will be participating.

A map showing all Central Region offices can be seen on-line at:  
[http://www.nws.noaa.gov/os/notification/resources/cr\\_wfos.pdf](http://www.nws.noaa.gov/os/notification/resources/cr_wfos.pdf)

## 5) Feedback Method

As a means of soliciting feedback regarding the quality, value and utility of this product, a formal customer survey can be accessed through the following URL:

<http://www.weather.gov/survey/nws-survey.php?code=IBW>

Each participating office agrees to an evaluation period of eight (8) months, at which time feedback regarding this service enhancement will be reviewed for the purpose of determining whether to make the service a permanent part of the official product catalog, to make additional refinements and extend the experiment, or to discontinue it.

## Part II – Technical Description

### 1) Format & Science Basis

Compelling evidence exists to support the capability of NWS forecasters to differentiate the strong/violent tornadoes from the less damaging tornadoes. Nationwide, 68% of NWS warnings for EF0-1 tornadoes achieve at least 12 minutes lead time (a metric of advance notice measured from warning dissemination to verified occurrence). However, the success rate for advance prediction of EF3-5 tornado warnings is substantially better (94%) as is the average lead time (18 minutes). There are clearly exceptions but, in general, performance metrics indicate a statistically significant skill in detecting and predicting catastrophic tornadoes as compared to all tornadoes. Additional training to reinforce the scientific understanding and warning methodologies needed to diagnose those extreme cases will be provided by CRH SSD in preparation for this experiment.

The coded tag lines will be appended to the bottom of every TOR, SVR and SVS products after the double ampersand (&&) directly below the existing TIME...MOT...LOC line and before the double dollar sign (\$\$).

The enhanced wording designed to communicate severity, hazards, and impacts will be inserted into the third mandatory bullet section, which begins “AT <time> CDT...”

The tag lines will be appended to TOR, SVR and appropriate follow-up SVS products, after the double ampersand (&&) and the “Lat/Lon” and “Time/Motion/Location” lines, as follows:

**TORNADO...<descriptor; optional for SVR>**  
**TORNADO DAMAGE THREAT...<descriptor>**  
**HAIL... x.xxIN**

**WIND...xxMPH <optional for TOR>**

**Where x.xx represents the expected maximum hail size in inches, and xx represents maximum expected thunderstorm-induced wind speed.**

EXAMPLE – illustrating a TORNADO EMERGENCY for Joplin, MO:

THE NATIONAL WEATHER SERVICE IN SPRINGFIELD HAS ISSUED A

\* TORNADO WARNING FOR...

NORTHWESTERN NEWTON COUNTY IN SOUTHWEST MISSOURI...  
SOUTHEASTERN CHEROKEE COUNTY IN SOUTHEAST KANSAS...  
SOUTHWESTERN JASPER COUNTY IN SOUTHWEST MISSOURI...  
THIS INCLUDES THE CITY OF JOPLIN...

\* UNTIL 600 PM CDT.

\* AT 514 PM CDT...A TORNADO EMERGENCY FOR THE CITY OF JOPLIN.  
A CONFIRMED LARGE AND DESTRUCTIVE TORNADO WAS LOCATED NEAR  
BAXTER SPRINGS MOVING NORTHEAST AT 40 MPH.

THIS IS A PARTICULARLY DANGEROUS SITUATION.

HAZARD...DEADLY TORNADO AND BASEBALL SIZE HAIL

SOURCE...SPOTTERS AND LAW ENFORCMENT CONFIRMED TORNADO.  
CONSIDERABLE DAMAGE TO HOMES REPORTED IN THE OAKS  
SUBDIVISION.

IMPACT...LIFE THREATING SITUATION. EXTENSIVE DAMAGE TO HOMES  
AND BUILDINGS...UPROOTED TREES AND DEBRIS WILL  
RESTRICT ACCESS INTO MANY AREAS.

\* OTHER LOCATIONS IN THE WARNING...WEBB CITY AND CARTHAGE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

IF YOU ARE IN OR NEAR JOPLIN TAKE COVER IMMEDIATELY!

&&

LAT...LON 3716 9479 3707 9426 3697 9430 3701 9479

TIME...MOT...LOC 2216Z 247DEG 36KT 3708 9470

TORNADO...OBSERVED

TORNADO DAMAGE THREAT...CATASTROPHIC

HAIL...2.75IN

In the above example, the warning includes tornado emergency and PDS wording, specific expectations of hazards and impacts, clarification of existence and severity of

damage, and clear, simple protective action instructions. The tag lines indicate an existing catastrophic tornado and baseball-size hail associated with the storm.

### **Allowable Coded Tag Line Values**

The allowable values for hail and wind tag lines are coded and defined as follows:

#### **Tornado Values for TOR and TOR related SVS**

TORNADO...RADAR INDICATED

TORNADO...OBSERVED

TORNADO DAMAGE THREAT...CONSIDERABLE

TORNADO DAMAGE THREAT...CATASTROPHIC

**For SVR/SVS** the tornado tag line typically will not be appended. However when conditions warrant, the option to identify possible tornado formation will be available in the form of the following tag:

TORNADO...POSSIBLE

#### **Hail Values for TOR/SVR/SVS**

(Flexibility is given to local offices to add other events with 0.75 being the lowest allowable specified value, other than “no hail” and “smaller than three-quarter inch” values. The lowest value of hail size considered to meet “severe thunderstorm” criterion is 1-inch in diameter.)

0.00	Equates to no hail
<.75	Small hail expected
0.75	0.75 inch hail (penny-sized)
0.88	0.88 inch hail (nickel-sized)
1.00	1.00 inch hail (minimal SVR criterion for hail size)
1.50	1.50 inch hail (ping pong ball-sized)
1.75	1.75 inch hail (golf ball-sized)
2.50	2.50 inch (tennis ball-sized)
2.75	2.75 inch hail (baseball-sized)
4.25	4.25 inch hail (softball-sized) or larger and is the highest allowable value

#### **Wind Values for TOR/SVR/SVS**

Dimensions are in MPH. Flexibility is granted to add other events in 5 mph increments, but default template value choices are:

<50	Wind gusts below severe criteria and lowest allowable value (for SVR hail only)
60	60 mph peak wind gust and is the first allowable value above <50 (severe criteria)
70	Used for warnings where wind is expected to be GTE 70 mph but LT 80 mph
80	Used for warnings where wind is expected to be GTE 80 mph but LT 90 mph
90	Used for warnings where wind is expected to be GTE 90 mph but LT 100 mph
100	100 mph or higher peak wind gust and is the highest allowable value (significant structural damage)

**2) Availability**

This enhanced product is available through all distribution channels which currently disseminate TOR, SVR, and SVS warning products.

**3) Additional Information**

Service Assessments for the two most recent major flood and significant tornado events have identified social networks as increasingly popular mechanisms for confirming warning information and prompting reaction decisions. In both Alabama and Joplin, MO, messages received via SMS text, Facebook, Twitter and the like, were found to amplify perceptions of risk and lead to warning response. Therefore, Central Region offices will also explore methods of utilizing social media more effectively – specifically through WFO RSS and Twitter feeds – in an effort to capitalize on the potential to heighten threat awareness, and perhaps motivate receivers to take prompt, protective action.