

I.	PURPOSE .....	K - 1
II.	SITUATION AND ASSUMPTIONS .....	K - 1
	TORNADO WATCH CHECKLIST .....	K - 1
	Boulder Regional Communications Center .....	K - 1
	Emergency Management Director .....	K - 2
	Agency/Department Heads .....	K - 2
	TORNADO WARNING CHECKLIST .....	K - 2
	Boulder Regional Communications Center .....	K - 2
	Emergency Management Director .....	K - 2
	Agency/Department Heads .....	K - 2
	TORNADO OCCURRENCE RESPONSE CHECKLIST .....	K - 2
	Boulder Regional Communications .....	K - 2
	Emergency Management Office .....	K - 3
	Law Enforcement Fire, Rescue, Emergency Medical .....	K - 3
	Public Information Officers .....	K - 3
	Agencies/Departments .....	K - 3
	City of Boulder Utilities .....	K - 3
	Boulder County Road Maintenance .....	K - 3
	Boulder Community Hospital .....	K - 3
	City of Boulder Housing .....	K - 3
	Boulder County Social Services .....	K - 3
	TORNADO SPECIFICS .....	K - 3
	TORNADO FACTS .....	K - 4
	FUJITA TORNADO SCALE .....	K - 4
	NATIONAL WEATHER SERVICE WATCH AND WARNING SYSTEM .....	K - 4
	EMERGENCY MANAGEMENT MEASURES FOR TORNADO HAZARDS .....	K - 5
	Mitigation .....	K - 5
	Preparedness .....	K - 5
	Response .....	K - 5
	Recovery .....	K - 5
	Appendix 1 - Tornado Watch And Warning Fanout .....	K - 1 - 1

## TORNADO PLAN ANNEX K

### I. PURPOSE

---

The purpose of this annex is to provide Boulder County/City of Boulder with a tornado plan that identifies the threat, establishes an alert and warning system, describes direction and control procedures, and provides checklists of emergency actions.

### II. SITUATION AND ASSUMPTIONS

---

#### A. Situation

Tornadoes are one of nature's most violent and damaging storms, often occurring with little or no warning. Boulder County/City of Boulder has been identified as being vulnerable to the threat of tornadoes and a risk area for potential tornado damage. Boulder County/City of Boulder has a limited outdoor warning capability, and many structures would not survive the sustained effects of tornadic winds. Persons, especially those living in mobile homes or in vehicles, are particularly vulnerable in a tornado.

#### B. Assumptions

The National Weather Service (NWS) will provide tornado **Watches** and **Warnings**, an alerting and status condition of tornadic wind activity .

There will be minimal time to activate sirens, execute callout lists, implement the Emergency Alert System (EAS), the Metropolitan Emergency Telephone System (METS) the Citizens Alert System and activate cable TV audio override.

The Emergency Management Office, in cooperation with the American Red Cross, Boulder County Branch, will provide periodic public education to the community and emergency responders regarding tornado hazards, preparedness and safety measures.

Destruction to public buildings/facilities, and serious disruption of basic utilities may hinder the delivery of essential services.

Access roads and streets may be blocked by debris, delaying emergency fire, law enforcement, and medical response, and necessitating road/highway crews and equipment to provide for clearance and public safety.

The Emergency Management Office will coordinate periodic National Weather Service Spotter training for fire, law enforcement, and St. Vrain and Boulder Valley school district personnel.

#### **Emergency Services Group**

The Emergency Services Group will quickly assess the situation to determine whether all or part of the Emergency Operations Center should be activated.

#### **Tornado Warnings/Watches**

Tornado **Watches** and **Warnings** will be provided by the National Weather Service via the following systems: (See Appendix 1)

1. **NAWAS** (National Warning System) - with drops located at the Boulder Regional Communications Center (BRCC) and the Emergency Management Office.
2. **NOAA Weather Radio** - broadcast over a specialized radio frequency to the general public, and to local, state, federal, and private agencies, and in some areas, those who have a NOAA Weather Radio monitor.
3. **Colorado Crime Information Computer Center (CCIC)** - sent by computer to warning points and law enforcement agencies throughout the state.

On duty fire, police, and school district personnel will deploy to spotting locations to watch for funnel clouds and promptly report any sighting to the Boulder Regional Communications Center which will in turn relay sighting information to the National Weather Service and take appropriate action.

Actual tornado sightings by local emergency response personnel or credible reports of sightings in the City or County of Boulder are sufficient cause to activate the local alerting system and initiate the EAS, METS and Citizens Alert.

\*\*\*\*\*

#### **TORNADO WATCH CHECKLIST:**

**Watch** message is issued by the National Weather Service.

#### **Boulder Regional Communications Center Will:**

\_\_\_\_\_Announce the tornado **Watch** over local radio.

\_\_\_\_\_Request all personnel be on the alert for signs of threatening weather and that they report this

information back to Boulder Regional Communications.

\_\_\_\_\_ Relay any signs of severe weather to the National Weather Service.

**Emergency Management Director Will:**

\_\_\_\_\_ Review operating plans and procedures to ensure prompt and efficient response.

\_\_\_\_\_ Call volunteer spotters and request that they maintain contact and report on direction and intensity of the storm.

\_\_\_\_\_ As weather conditions worsen, make decision to activate the Emergency Operations Center.

\_\_\_\_\_ Continue to monitor NAWAS, NOAA Weather Radio, commercial radio, and the Weather Channel for weather updates.

\_\_\_\_\_ Maintain lists of critical resources available from local government, volunteer agencies, and private industry.

**Agency/Department Heads Will:**

\_\_\_\_\_ Review their own operating procedures for the steps to be taken as severe weather approaches.

\_\_\_\_\_ Ensure that on-duty personnel are notified of the tornado **Watch** and are alert for signs of severe weather.

\_\_\_\_\_ Request that all emergency personnel maintain a lookout on the sky until the tornado **Watch** period has ended, and that pertinent information is relayed to Boulder Regional Communications Center.

\_\_\_\_\_ Ensure that initial response equipment is operational and located in designated locations.

\_\_\_\_\_ Have in place a system to activate off-duty personnel and provide for twenty-four hour staffing.

**TORNADO WARNING CHECKLIST:**

**Warning** message is issued by the National Weather Service.

\_\_\_\_\_ The National Weather Service Office activates and broadcasts a **Warning** message over the

NOAA Weather Radio, and NAWAS.

\_\_\_\_\_ The local media will receive verbal information and retransmit to the public via the Emergency Alert System (EAS) over radio, commercial television and the Weather Channel.

**THE TORNADO WARNING MESSAGE WILL CONTAIN:**

\_\_\_\_\_ Location of the tornado sighting

\_\_\_\_\_ Time of the sighting

\_\_\_\_\_ Direction the tornado is moving

\_\_\_\_\_ Speed of the tornado

\_\_\_\_\_ Boundaries of the area affected

**Boulder Regional Communications Center Will:**

\_\_\_\_\_ Announce the tornado **Warning** over local radio as well as Denver television and radio by activating the METS.

\_\_\_\_\_ Activate the cable television override system and broadcast a **Warning** message.

\_\_\_\_\_ Activate the Citizens Alert Radio System.

\_\_\_\_\_ Activate NOAA weather radio by calling the National Weather Service in Aurora.

\_\_\_\_\_ Activate the outdoor warning system by sounding the **Warning** Sirens.

**Emergency Management Director Will:**

\_\_\_\_\_ Monitor NAWAS, NOAA Weather, and commercial radio and television for weather updates.

**Agency/Department Heads Will:**

\_\_\_\_\_ Ensure that the **Warning** message is given to on-duty personnel.

\_\_\_\_\_ Ensure that personnel take appropriate protective measures.

\_\_\_\_\_ Ensure that initial response equipment is operational and located in designated locations.

\_\_\_\_\_ Have in place a system to activate off-duty personnel and provide for twenty-four hour staffing.

**TORNADO OCCURRENCE RESPONSE CHECKLIST:**

**Boulder Regional Communications Will:**

- \_\_\_\_\_ Confirm that a tornado has touched down resulting in damage/injuries.
- \_\_\_\_\_ Dispatch fire, rescue, medical, or roads and bridge units as appropriate.
- \_\_\_\_\_ Notify regional National Weather Service on confirmation of a tornado touching down with resulting damage. (361-0663)

**Emergency Management Office Will:**

- \_\_\_\_\_ Coordinate damage assessment of public and private property through an assigned damage assessment coordinator.
- \_\_\_\_\_ If damage exceeds local government resources, the County Commissioners or the City Manager will issue a Declaration of Emergency. (Refer to the Basic Plan and Damage Assessment Annex.)

**Law Enforcement Fire, Rescue, Emergency Medical Will:**

- \_\_\_\_\_ Dispatch units to determine extent, area, and intensity of damage.
- \_\_\_\_\_ Activate a **command post** in/near the damaged area, and establish an incident command system to ensure efficient coordination and timely and accurate flow of information between the command post and the Emergency Operations Center.
- \_\_\_\_\_ Maintain response units on standby for deployment as situations dictate.
- \_\_\_\_\_ Provide for physical security controls and limits to access into and within the disaster area.
- \_\_\_\_\_ In coordination with the Emergency Management Director, contact the private sector to obtain needed resources e.g., heavy equipment, generators.
- \_\_\_\_\_ Activate Mutual Aid Agreements/Letters of Understanding with neighboring jurisdictions to request personnel and equipment.

**Public Information Officers Will:**

- \_\_\_\_\_ Coordinate media affairs, press releases and tours of the affected areas.

- \_\_\_\_\_ Coordinate publication and distribution of emergency information for emergency workers and citizens in the affected areas.

- \_\_\_\_\_ Establish a media center separate from the Emergency Operations Center. Provide news media with timely information updates.

**Agencies/Departments Will:**

- \_\_\_\_\_ Direct personnel and resources to respond as appropriate.
- \_\_\_\_\_ When the danger has passed:
  - \_\_\_\_\_ Check presence/status of all personnel.
  - \_\_\_\_\_ Verify that primary communication systems of their backups are operational.
  - \_\_\_\_\_ Assess damage to buildings, other structures, vehicles, and equipment and report to damage assessment coordinator.

**City of Boulder Utilities and Boulder County Road Maintenance Will:**

- \_\_\_\_\_ Prepare for debris clearance and placement of barricades.
- \_\_\_\_\_ Deliver road barriers as required to assist law enforcement.
- \_\_\_\_\_ Clean up roadway areas with emphasis on flow of emergency traffic.
- \_\_\_\_\_ Set up tire exchange to fix flat tires on emergency vehicles and official vehicles in the disaster area.

**Boulder Community Hospital Will:**

- \_\_\_\_\_ Activate emergency medical and mass casualty plans and prepare to receive injured personnel.

**City of Boulder Housing and Boulder County Social Services Will:**

- \_\_\_\_\_ Activate Shelter Annex of the LEOP.
- \_\_\_\_\_ Work to integrate the services available through public and community agencies and churches to provide assistance to disaster victims and workers.
- \_\_\_\_\_ Request the American Red Cross, Boulder

County Branch, activate its system for damage assessment, victim registration, health and welfare messaging, and emergency shelters. (The Red Cross will coordinate with the Salvation Army if their assistance is needed for feeding and other victim assistance services.)

\_\_\_\_\_Request local amateur radio operators assistance with health and welfare messages, and other communications as needed.

**TORNADO SPECIFICS**

Based on preliminary tornado statistics, 1990 was the year of the tornado. In the U.S., a new record was established for tornado frequency when 1,121 tornadoes touched down, killing 53 people. The prior record was 1,102 in 1973. Despite the record, the number of fatalities has markedly decreased in recent years. The lower number of deaths can be credited to improvements in tornado watch and warning programs and to heightened awareness and preparedness measures by governments, businesses and citizens in general.

**TORNADO FACTS**

Tornadoes travel at an average speed of 20 MPH but may reach speeds up to 70 MPH. Most tornadoes move from southwest to northeast, but direction of travel may be erratic and suddenly change. Winds within a tornado, which are the cause of destruction, have been classified as light, moderate, considerable, severe, devastating, or incredible (see Fujita classification scale that follows).

Hail may or may not be associated with a tornado, but the portion of a thunderstorm adjacent to large hail is often where the most violent tornadoes occur.

While most tornado damage is caused by violent winds, most tornado injuries and deaths result from flying debris.

Tornadoes form when cool, dry air sits on top of warm, moist air. In the plains areas of Colorado, Kansas and Oklahoma this often happens in the spring and early summer when cool, dry mountain air rolls east over the plains, over-running warm moist air traveling north from the Gulf of Mexico.

The following table shows the level of tornado activity in Colorado since 1975 as reported by the National Severe Storm Forecasting Center.

**Tornado Occurrences & Path Lengths**

Category	%Occurrence	Mean Path Length (miles)
F0	25.5	1.2
F1	37.3	2.6
F2	2.6	5.4
F3	9.3	10.0
F4	2.0	27.2
F5	0.3	35.5

**FUJITA TORNADO SCALE**

The Fujita tornado scale was developed by T. Theodore Fujita of the University of Chicago and is commonly used to define the severity of tornadoes. There are six categories (F0 - F5) identifiable of wind speed and damage characteristics.

F0 Light Damage (40-72 mph)  
Some damage to chimneys; break twigs and branches off trees; push over shallow-rooted trees; damage signboards; some windows broken; hurricane wind speed begins at 73 mph.

F1 Moderate Damage (73-112 mph)  
Peel surface off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.

F2 Considerable Damage (113-157 mph)  
Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; large trees snapped or uprooted; light-object missiles generated.

F3 Severe Damage (158-206 mph)  
Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off the roads.

F4 Devastating Damage (207-260 mph)  
Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; trees in forest uprooted and carried some distance away.

F5 Incredible Damage (261-318 mph)  
Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 feet,

trees debarked; incredible phenomena will occur.

Most (37.3 percent) tornadoes are in the F1 category with less than 3 percent in the F4 or above. The path length of a tornado will increase with its severity from F0 through F5.

### **NATIONAL WEATHER SERVICE WATCH AND WARNING SYSTEM**

The addition of NEXRAD Doppler radar by the National Weather Service in Colorado has given increased knowledge of tornadic development prior to the visible funnel cloud. The major problems in responding to tornadoes once detected is the short time that it takes for them to develop, and the tremendous forces they contain. The National Severe Storms Forecast Center operated by the National Weather Service uses a combination of surface observations, radar information, satellite photography, weather data, and pilot reports to determine the state of the atmosphere.

A **Watch** is issued when severe thunderstorms and/or tornadoes are **most likely to occur**. This implies that large hail (3/4 inch or greater) and/or damaging winds are likely and the presence of tornadoes are always possible. **Watches** usually apply to a geographic area about 140 miles wide and 200 miles long. All persons in or near the **Watch** area should be alert for signs of threatening weather and make preliminary plans for action including listening to National Weather Service or commercial radio and television broadcasts.

A **Warning** is issued by local National Weather Service offices when tornadoes are indicated by radar or reported by trained spotters or other reliable sources. **Skywarn** is a network of trained spotters such as amateur radio or CB users, or emergency personnel from fire, police or civil defense. **Skywarn** is the backbone of the warning service and can be credited with saving many lives each year. The **Warning** describes the area at risk from a tornado which is determined by the location, size, direction, and speed of movement of the storm.

### **EMERGENCY MANAGEMENT MEASURES FOR TORNADO HAZARDS**

#### **Mitigation**

\_\_\_\_\_ Develop and implement an ongoing public education program emphasizing tornado characteristics, preparedness, personal safety measures, and sheltering requirements or availability.

\_\_\_\_\_ Work cooperatively with county/city zoning and land use officials to promote updated building codes for window size and thickness, roof anchors and mobile home tie-downs.

#### **Preparedness**

\_\_\_\_\_ Maintain current emergency personnel and resource lists including shelters, heavy equipment, barricades and road controls and emergency personnel identification tags.

\_\_\_\_\_ Annually review/update this annex.

\_\_\_\_\_ Periodically review elements of this annex with emphasis on designated tornado shelters and special facilities e.g., schools, churches, shopping centers and nursing homes.

\_\_\_\_\_ Develop tornado **Watch** and **Warning** guides for the population.

\_\_\_\_\_ Identify resources available for property protection.

\_\_\_\_\_ Define roles of community service agencies in providing assistance to victims and rescue workers.

#### **Response**

\_\_\_\_\_ Activate warning systems for appropriate watch/warnings.

\_\_\_\_\_ Establish Command Post for field communications and coordination. Keep Emergency Operations Center informed.

\_\_\_\_\_ Provide emergency response to the injured or displaced and homeless.

\_\_\_\_\_ Gather damage assessment figures for Emergency Operations Center.

\_\_\_\_\_ Assess needs for short-term recovery.

\_\_\_\_\_ Ensure resources available to reinforce damaged property.

\_\_\_\_\_ Broadcast the all-clear!

\_\_\_\_\_ Keep State EOC informed of situation as appropriate.

#### **Recovery**

\_\_\_\_\_ Continue collaboration with community service agencies to promote ongoing individual

assistance to victims.

\_\_\_\_ Prepare documentation for financial, political and historical paperwork.

\_\_\_\_ Have known resources available for reconstruction activities.

### Appendix 1 - Tornado Watch And Warning Fanout



