Natural Hazard Definitions

Thunderstorm
A weather event producing lighting, which can also include heavy rain, hail and high winds.

High Wind
Sustained surface winds greater than 50 mph, lasting for one hour or longer.

Winter Storm
For Mitigation planning purposes, a winter storm is defined as hazardous winter weather in the form of heavy snow, heavy freezing rain, or heavy sleet, blowing snow, and temperatures below freezing.

Wildfire
A wildfire is an uncontrolled fire spreading through vegetative fuels, threatening and possibly consuming structures and other community assets. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. A *wildland* fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. A wildland-urban interface fire is a wildfire in an area where structures and other human development meet or intermingle with wildland or vegetative fuels.

Drought
A drought is a period of prolonged dryness that depletes both ground and surface water. Droughts are common in New Mexico and the City of Santa Fe. The climate in the City of Santa Fe is arid with average annual precipitation of less than 15 inches per year. This normally meager annual precipitation causes extended periods of scant flow in the State's rivers, and any measurable decrease in precipitation rates can create drought conditions in a relatively short period of time.

Floods
Floods typically results from large-scale weather systems generating prolonged rainfall or from locally intense storms or from snowmelt. For the purposes of mitigation, flooding is referred to as "riverine flooding" and is characterized by a gradual and predictable rise in a river or stream due to persistent precipitation. After the stream or river overflows its banks, the land nearby remains under water for an extended period of time. Flash floods are aptly named: they occur suddenly after a brief but intense downpour; they move quickly and end abruptly. Although the duration of these events is usually brief, the damages can be quite severe.

Flash flooding also produces erosion and mud and debris flows that damage homes and infrastructure. Flash floods result as a secondary effect from other types of disasters, including large wildfires and dam breaks. Wildfires remove vegetative cover and alter soil characteristics, increasing the quantity and velocity of stormwater runoff. Banks and soils previously stabilized by vegetation are quickly eroded by rainwater on unprotected soils. Dam breaks can quickly release large quantities of water into receiving drainage ways.

Earthquakes
Earthquakes result from sudden ground motion or trembling caused by a release of strain accumulated within or along the edge of the Earth's crustal plates. Earthquakes occur most frequently in the boundaries between the great crustal plates that form the earth's outer shell. As these plates move, stress accumulates. Eventually, when faults along or near plate boundaries slip abruptly, an earthquake occurs. Although earthquakes in the U.S. have caused less economic loss annually than other hazards such as floods, they have the potential to cause great, sudden loss in proximity to the epicenter. Within one to two minutes, an earthquake can devastate a city through ground-shaking, surface fault ruptures, and ground failures. Seismic hazards often trigger other devastating events, such as landslides, fires, and damage to dams and levees. Earthquakes can even trigger volcanic eruptions or cause tsunamis in coastal areas.

Landslides
Landslides are the downward and outward movement of slopes. Landslides include a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on and over steepened slopes is the primary reason for a landslide, landslides are often prompted by the occurrence of other disasters. Other contributing factors include the following:

- Erosion by rivers, glaciers, or ocean waves creating over-steepened slopes
- Rock and soil slopes weakened through saturation by snowmelt or heavy rains
- Earthquakes creating stresses that make weak slopes fail

- Earthquakes of magnitude 4.0 and greater shaking the ground
- Volcanic eruptions producing loose ash deposits, heavy rain, and debris flows
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from manmade structures stressing weak slopes
- Floods or long duration precipitation events creating saturated, unstable soils that are more susceptible to failure

Slope material often becomes saturated with water and may develop a debris or mudflow. If the ground is saturated, the water weakens the soil and rock by reducing cohesion and friction between particles. Cohesion, which is the tendency of soil particles to "stick" to each other, and friction affect the strength of the material in the slope and contribute to a slope's ability to resist down slope movement. Saturation also increases the weight of the slope materials and, like the addition of material on the upper portion of a slope, increases the gravitational force on the slope. Undercutting of a slope reduces the slope's resistance to the force of gravity by removing much-needed support at the base of the slope. Alternating cycles of freeze and thaw can result in a slow, virtually imperceptible loosening of rock, thereby weakening the rock and making it susceptible to slope failure. The resulting slurry of rock and mud can pick up trees, houses, and cars, and block bridges and tributaries, causing flooding along its path. Additionally, removal of vegetation can leave a slope much more susceptible to superficial landslides because of the loss of the stabilizing root systems.

Land subsidence *(Sub hazards of land subsidence are sink holes and collapsible soils.)*
Land subsidence is the loss of surface elevation and affects nearly every U.S. state. Land subsidence occurs when large amounts of groundwater have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rock falls in on itself. Subsidence may occur abruptly or over many years. It can occur uniformly over large areas or as localized sinkholes.

Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydro compaction). Land subsidence occurs in nearly every state of the United States Land subsidence is usually not observable because it occurs over a large area. When land subsidence is isolated in a small area, it appears as sinkholes. Land subsidence comprises major events in California, Texas, and Florida, all of which have experienced hundreds of millions of dollars of damage over the years.

Expansive Soils
Expansive soil is also called adobe or clay. It is fine-grained clay that is generally found in areas that historically were a floodplain or lake area. Expansive soil is subject to swelling and shrinkage, varying in proportion to the amount of moisture present in the soil. As water is absorbed into the soil (by rainfall or watering), an expansion takes place. If dried out, the soil will contract, often leaving small fissures or cracks. Excessive drying and wetting of the soil will progressively deteriorate structures over the years. The soil volume may increase by as much as 10% or more and can exert 20,000 psi on foundations.
Expansive soil is found in all states, although the highest concentrations are found in Texas, Colorado , Virginia, North Dakota, Oklahoma, and Montana. One of the most expansive soils, known as adobe, is found in Texas and Colorado. The expansion and contraction of soil beneath a structure tends to exert tremendous pressure and stress, causing severe structural damage. In some cases, entire sidewalks and streets have been lifted, resulting in severe cracking and distortion.

Dam Failure
Dam failure can occur when a dam is overtopped (i.e., when it overflows). Overtopping is especially dangerous for an earthen dam because the downrush of water will erode the dam face and could breach the dam. There are two major dams for the City of Santa Fe: Nicols Dam and McClure Dam, both near Upper Canyon Road in the Santa Fe Watershed.

Tornado
A tornado is an intense rotating column of air, extending from a thunderstorm cloud system. Average winds in a tornado, although never accurately measured, are thought to range between 100 and 200 mph, but some may have winds exceeding 300 mph. The following are NWS definitions of a tornado and associated terms:

- **Tornado** – A violently rotating column of air that is touching the ground
- **Funnel cloud** – A rapidly rotating column of air that does not touch the ground
- **Downburst** – A strong downdraft, initiated by a thunderstorm, which induces an outburst of

straight-line winds on or near the ground. They may last anywhere from a few minutes in small-scale microbursts to periods of up to 20 minutes in larger, longer macro-bursts. Wind speeds in downbursts can reach 150 mph and therefore can result in damages similar to tornado damages.

Extreme Heat

Extreme heat, or heat wave, is defined by the NWS as a temperature of ten degrees or more above the average high temperature for the region, lasting for several weeks. This hazard can be a public safety and public health concern. For the purposes of mitigation planning, the City of Santa Fe is concerned with multiple days of high temperatures exceeding 95 degrees Fahrenheit.

Space Weather

Space weather, or solar activity, can be divided into four main components. Solar flares, coronal mass ejections, high speed solar wind, and solar energetic particles.

Solar flares impact Earth only when they occur on the side of the Sun facing Earth. Because flares are made of photons, these travel out directly from the flare site, so if we can see the flare, we can be impacted by it.

Coronal mass ejections, also called CMEs, are large clouds of plasma and magnetic field that erupt from the Sun. These clouds can erupt in any direction, and then continue on in that direction, plowing right through the solar wind. Only when the cloud is aimed at Earth will the CME hit Earth and therefore cause impacts.

High speed solar wind streams coming from the Sun come from special areas on the Sun known as coronal holes. These holes can form anywhere on the Sun and usually only when they are closer to the equator than to the solar poles do the winds they produce impact Earth.

Solar energetic particles are high energy charged particles, thought to primarily be released by coronal mass ejections. Where the cloud of a CME plows through the solar wind, the solar energetic particles are travelling much faster and because they are charged, must follow the magnetic field lines that pervade the space between the Sun and the Earth. Therefore, only the charged particles that follow magnetic field lines that intersect the Earth will have an impact on Earth.

Human-Caused Hazards

Human-caused hazards include technological hazards (e.g., hazardous material releases) and terrorism. Both of these are distinct from natural hazards in that they result directly from the actions of people. The term technological hazard refers to incidents that can arise from human activities such as the manufacture, storage, transportation, and use of hazardous materials. Technological hazards are assumed to be accidental and their consequences unintended. The term terrorism, on the other hand, encompasses intentional, criminal and malicious acts involving weapons of mass destruction (WMDs), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous material releases; and cyber-terrorism (attacks via computer). Technological and terrorism hazards are interrelated in that facilities and transportation routes that handle hazardous materials may be potential targets.