



# Section 6. Overview of Hazards that Plano Faces

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## Hazards Addressed in This Plan

This Hazard Mitigation Plan for the City of Plano addresses thirteen hazards. They are listed below, along with the section of the plan in which they are addressed:

1. Tornadoes (Section 7)
2. High winds (Section 8)
3. Hail (Section 9)
4. Severe winter/ice storms (Section 10)
5. Poor air quality (Section 11)
6. Expansive soils (Section 12)
7. Lightning (Section 13)
8. Flooding (Section 14)
9. Drought (Section 15)
10. Summer heat (Section 16)
11. Technological accidents/hazardous materials release (Section 17)
12. Explosive blast (Section 18)
13. Disease outbreak/pandemic flu (Section 19)





# Multi-Hazard Risk Assessment Process

## Identification of Prevalent Natural and Man-Made Hazards of Concern

The thirteen hazards addressed in this plan were determined by the multi-step process described below. The Multi-Hazard Risk Assessment process utilized FEMA Publication Numbers 386-2, 386-7, and 426.

The City of Plano reviewed the Interim National Preparedness Goal contained in Homeland Security Presidential Directive 8: *National Preparedness* (HSPD-8), issued December 17, 2003. Mitigation of threats, vulnerabilities and consequences that stem from acts of terrorism and natural disasters is a fundamental principle of this Directive. The Interim National Preparedness Goal established a national vision and priorities to guide efforts at setting readiness benchmarks and targets to strengthen the Nation's preparedness. Accompanying the National Preparedness Goal are fifteen all-hazards planning scenarios (the National Planning Scenarios) for use in national, Federal, State and local homeland security preparedness activities. The City of Plano reviewed the scenarios as planning tools representative of the range of potential terrorist attacks and natural disasters and the related impacts that could potentially face our City and the nation. These national planning scenarios were also used as a reference to help identify the potential scope, magnitude and complexity of potential major events that could impact the City.

A list was developed of all the natural and human-caused hazards that have occurred or could occur in the City of Plano and throughout the North Central Texas region. A total of 27 potential hazards (16 natural hazards and 11 human-caused hazards) were identified through this process (see Tables 6-1 and 6-2 and Appendix D).

## Hazard Analysis

### Analysis of Natural Hazards

The City of Plano conducted research on the 27 potential hazards. City officials reviewed the results of the NCTCOG's "Multi-Hazard Risk Assessment: Forewarnings of Natural Hazards to the Year 2030". They reviewed disaster histories and Geographic Information System (GIS) maps provided by the NCTCOG containing ESRI Shapefiles of numerous regional natural hazards for information on how those hazards may adversely impact the City of Plano. Using the NCTCOG's data, the



City's GIS Department developed Plano-only maps to identify those natural hazards that may threaten the City and determine the location of hazard boundaries.

For flooding, the City used the NCTCOG's countywide flood loss estimation results, which are presented in Chapter 14, Tables 14-6 and 14-7. The NCTCOG's flood loss analysis used flood zone data in FEMA Q3 GIS shapefile format and an "overlay" of feature data as well as demographic and census data in order to gauge general risk, out to the year 2030. The analysis used detailed appraisal district data, including improvement square footage per parcel; detailed block-level U.S. Census Bureau data for the year 2000; detailed Land Use classifications; and demographic economic forecast data to the year 2030.

## Table-Top Exercise

On August 30, 2005, the planning team was provided with a four-hour training session to familiarize team members with the National Preparedness Goal and National Response Plan and Catastrophic Incident Supplement. Team members were briefed on the U.S. Department of Homeland Security (DHS) All Hazards Risk Assessment Process and provided information on man-made chemical, biological, radiological, nuclear and cyber threats and how to mitigate against terrorist attacks.

An analysis was conducted of the potential impact of three scenarios at four critical infrastructure sites in Plano. The scenarios included a hazardous materials release involving chlorine, a biological event involving a pandemic flu, and a range of explosive blasts. The analyses were conducted using the HAZUS model and/or the ALOHA plume model for each scenario for the four sites, including the impacts on buildings, critical functions, and the population. The results of the analysis were presented at a table-top exercise held for planning team members on August 30, 2005.

Planning team members were provided spreadsheets to use as a follow-up to this planning process. The spreadsheets are designed to capture information on the vulnerability of specific buildings to hazards (Level 2 analysis) (see Appendix D).

## Risk Assessment Process for Human-caused Hazards

As outlined in FEMA Publication 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings<sup>1</sup>, the risk assessment process for man-made hazards looks at the threat, asset value and vulnerability to ascertain the level of risk for each critical asset against each applicable threat. Inherent in this is the likelihood or probability of the threat occurring and the consequences of the occurrence. The risk assessment process will result in a relative risk profile. There are three levels of assessing risk for man-made hazards:

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<sup>1</sup> Risk Management Series, December 2003, U. S. Department of Homeland Security, Federal Emergency Management Agency Publication 426.





- Level 1 – Regional (or City-Wide) Risk
- Level 2 – Site Risk
- Level 3 – Building Risk

The City of Plano's Level 1 Risk Analysis for human-caused hazards has been completed. The results of the Level 1 Risk Analysis for the City of Plano are provided in Table 6-2 and in Appendix D (Results of City-Wide Risk Ranking for Natural and Man-Made Hazards). This Level 1 City-wide risk assessment covers both natural and man-made hazards.

The Level 2 and Level 3 Risk Analyses for man-made hazards are forthcoming, to be conducted by City of Plano assessment teams. The Level 2 Site Risk Analysis is currently underway using Appendix E, Level 2 Risk Analysis: Site Risk Ranking Questionnaire for Man-Made Hazards. This questionnaire serves as a guide for the City of Plano assessment teams to use in conducting a Level 2 analysis to assess the vulnerability of specific critical facility sites to man-made hazards. It is intended to help in prioritizing the City's needs and allocating its resources effectively by determining relative levels of risk at the site level.

This results of the Level 2 Site Risk Analysis (Appendix E) will be used preliminarily to rank order sites and provide a first level screening analysis of the more detailed facilities risk profile. The City of Plano's assessment team will assign values and develop the preliminary screening ranking list. The Level 2 Site Risk Analysis examines seven features at each site: asset visibility; target value to potential threat; asset accessibility; asset mobility; target threat of chemical, biological, or radiological hazard; collateral damage potential; and site population capacity. It rates each of the seven features and sums the ratings to determine the overall ranking of the site. The resulting rankings can be used to determine which sites should receive a Level 3 analysis of the buildings on the site.

After the Level 2 Risk Analysis is completed, the City of Plano will conduct a Level 3 Building Risk Analysis. The questionnaire at Appendix F will be used by Plano's assessment teams to conduct the analysis. This Level 3 Risk Analysis is intended to assess the vulnerability of specific buildings to man-made hazards. While no amount of planning or mitigation can remove 100% of the risk from terrorism or technological emergencies, a thorough hazard identification and risk assessment process will help in prioritizing the City's needs and allocating its resources effectively. It will assist in determining relative levels of risk and mitigating risk to individual buildings and the systems contained within them.

The assessment team can use the Level 3 Risk Analysis: Building Risk Ranking Questionnaire (Appendix F) as a screening tool to be developed through interviews with key building staff members (building owner, security, site management, key function representatives). The interviews provide a consensus judgment of the relative risk or vulnerability of functions or systems and should also identify system interdependencies.



The Level 3 Risk Analysis: Building Risk Ranking Questionnaire is used to preliminarily rank order individual building functions and systems for mitigation action and to conduct a facilities risk profile of individual buildings. The City of Plano’s assessment team will assign values and develop the ranking list. It examines asset value, threat rating, and vulnerabilities of site functions and site infrastructure systems to various human-caused hazards (cyber attack, armed attack, vehicle bomb and CBR attack). It requires rating each of these areas and summing the ratings to determine the overall ranking of the building or site.

Appendix G provides a Building Vulnerability Checklist to use in a more detailed Level 3 Risk Analysis of buildings<sup>2</sup>. The checklist is based on one developed by the Department of Veterans Affairs (VA) and compiles many best practices based on technologies and scientific research to consider during the design of a new building or renovation or an existing building. It provides for a consistent security evaluation of designs at various levels. The checklist is used as a screening tool for preliminary design risk assessment. It examines design issues that affect vulnerability. It also helps determine if critical systems would be able to continue to function in order to enhance deterrence, detection, denial and damage limitation, and ensure that emergency systems function during a threat or hazard situation. The checklist is organized into thirteen sections examining vulnerability of specific building systems.

## City-Wide Hazard Ranking Results

Risk is the probability of occurrence (how likely it is that the hazard will impact the City of Plano) multiplied by the consequences of occurrence. The consequences include spatial extent, or where the hazards will affect the City of Plano, and magnitude of impact, or how severe the hazard will be. Magnitude of impact is measured in terms of loss of life or injury and the vulnerability of facilities, especially critical facilities, to being shut down. The 27 hazards facing Plano were ranked according to their likelihood, spatial extent and potential impact on the City. The results of the risk assessment are used to help prioritize which mitigation measures should be adopted, given limited resources, in order to achieve a desired level of protection. Definitions used in the ranking process are presented below.

### Likelihood

Likelihood, or frequency of occurrence, is defined as follows: “Highly likely” means an event is probable in the next year. “Likely” means an event is probable in the next 2 – 3 years. “Possible” means an event is possible in the next 4 – 5 years. “Unlikely” means an event is possible in the next 10 years.

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<sup>2</sup> Checklist taken from Chapter 1, Section 1.6 of FEMA Publication 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings, December 2003.





## Spatial Extent

Spatial extent of the hazard is defined as follows: “Large” means that the hazard is expected to affect more than 50% of property. “Moderate” means that the hazard is expected to affect more than 25% of property. “Limited” means that the hazard is expected to affect 10% or less of property.

## Severity of Impact

Potential severity of impact is defined as follows: “Catastrophic” impacts may result in a high number of deaths and injuries. More than 50% of property in the affect area is damaged or destroyed. There is a complete shutdown of facilities for 30 days or more. “Critical” impacts may result in multiple deaths or injuries. More than 25% of property in the affected area is damaged or destroyed. There is a complete shutdown of facilities for more than one week. “Limited” impacts result in minor injuries only. More than 10% of property in the affected area is damaged or destroyed. There is a complete shutdown of facilities for more than one day. “Minor” impacts involve few, if any, injuries. There is only minor property damage and minimal disruption to the quality of life. Shutdown of facilities is temporary.

Tables 6-1 and 6-2 present the results of the ranking process. As indicated in Table 6-1, upon analysis and completion of the ranking process, it was determined that the City of Plano was at high or medium risk from ten natural hazards which are all addressed in this plan. These include: tornadoes, high winds, hail, severe winter/ice storm, poor air quality, expansive soils, lightning, flooding, drought, and summer heat.

**Table 6-1. Hazard Ranking of Natural Hazards for the City of Plano**

Hazard	Likelihood	Spatial Extent	Potential Impact	Hazard Rating	Ranking
Tornadoes	Likely (2)	Limited (1)	Catastrophic (4)	<b>7</b>	High
High winds	Highly Likely (3)	Large (3)	Minor (1)	<b>7</b>	High
Hail	Highly Likely (3)	Moderate (2)	Limited (2)	<b>7</b>	High
Severe winter/ice storms	Likely (2)	Large (3)	Minor (1)	<b>6</b>	High
Poor air quality	Highly Likely (3)	Moderate (2)	Minor (1)	<b>6</b>	Medium
Expansive soils	Likely (2)	Moderate (2)	Minor (1)	<b>5</b>	Medium
Lightning	Highly Likely (3)	Limited (1)	Minor (1)	<b>5</b>	Medium
Flooding	Highly Likely (3)	Limited (1)	Minor (1)	<b>5</b>	Medium
Drought	Possible (1)	Large (3)	Minor (1)	<b>5</b>	Medium
Summer heat	Likely (2)	Moderate (2)	Minor (1)	<b>5</b>	Medium



Stream bank erosion	Likely (2)	Limited (1)	Minor (1)	<b>4</b>	Low
Dam failures	Unlikely (0)	Limited (1)	Minor (1)	<b>2</b>	Low
Levee failures	Unlikely (0)	Limited (1)	Minor (1)	<b>2</b>	Low
Landslides	Unlikely (0)	Limited (1)	Minor (1)	<b>2</b>	Low
Earthquakes	Unlikely (0)	Limited (1)	Minor (1)	<b>2</b>	Low
Wildland fires	Unlikely (0)	Limited (1)	Minor (1)	<b>2</b>	Low

Although human-caused hazards are not required to be covered in this plan, the City of Plano also ranked eleven human-caused hazards that may potentially impact the City. The rankings are shown below in Table 6-2. The City of Plano chose to address three of these human-caused hazards in this plan -- technological accidents/hazardous materials release, explosive blast, and disease outbreak/pandemic flu. Each of the natural and human-caused hazards is addressed in Sections 7 through 19 of the plan.

**Table 6-2. Hazard Ranking of Human-caused Hazards for the City of Plano**

Hazard	Likelihood	Spatial Extent	Potential Impact	Hazard Rating	Ranking
Technological Accident/Hazardous Materials Release	Highly Likely (3)	Limited (1)	Critical (3)	<b>7</b>	High
Nuclear Attack	Unlikely (0)	Large (3)	Catastrophic (4)	<b>7</b>	High
Explosive Blast Attack	Possible (1)	Moderate (2)	Critical (3)	<b>6</b>	High
Disease Outbreak/Pandemic Flu	Possible (1)	Moderate (2)	Critical (3)	<b>6</b>	High
Chemical Attack	Possible (1)	Limited (1)	Critical (3)	<b>5</b>	Medium
Biological Attack	Possible (1)	Limited (1)	Critical (3)	<b>5</b>	Medium
Radiological Attack	Possible (1)	Limited (1)	Critical (3)	<b>5</b>	Medium
Armed Attack	Possible (1)	Limited (1)	Critical (3)	<b>5</b>	Medium
Cyber Attack	Possible (1)	Limited (1)	Limited (2)	<b>4</b>	Low
Civil Disruption	Possible (1)	Moderate (2)	Minor (1)	<b>4</b>	Low
Kidnapping/Hostage	Possible (1)	Moderate (2)	Minor (1)	<b>4</b>	Low





## Conclusions

The hazard-event profiles and rankings relevant to the City of Plano reveal historic hazard trends and provide a reference point for understanding the potential effects of future hazard events. A review of historic data helps to evaluate hazard-event profiles and answer questions: How often may a particular disaster occur? Who and what are most likely to be affected? How bad can it get? Sections 7 through 19 of this Plan discuss why each hazard is a threat, profile the hazard, identify areas at risk to hazards that have distinct geographic boundaries, identify the people and property at risk and summarize the history of hazard events and potential damages and losses. The results of this study are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in the City of Plano through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis present a current picture of risk in the City of Plano. Updating this risk “snapshot” with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. This ranking provides a systematic framework to compare and prioritize the very disparate hazards that are present in the City of Plano. This final step in the risk assessment provides the necessary information for the mitigation planning team to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the City.
- Setting the stage for risk analysis of specific sites (Level 2) and specific buildings, building functions and systems (Level 3).