Local Mitigation Strategy

LMS
Miami-Dade




Whole Community
Hazard Mitigation
Part 4: Appendices




December, 2013

PART 4 - THE APPENDICES

Appendix A: Miami-Dade Resolution Adopting the LMS

Miami Dade County
Board of County Commissioners

Resolution No. R-452-10

Resolution Adopting the Local Mitigation Strategy

On June 6, 2000, the Miami-Dade County Board of County Commissioners formally adopted the Local Mitigation Strategy as official county policy. The Board of County Commissioners renewed their commitment to the LMS on April 20, 2010, after FEMA's approval of the 2010 LMS update.

Approved Mayor
Veto
Override

Agenda Item No. 14(A)(5)
4-20-10

RESOLUTION NO. R-452-10

RESOLUTION ADOPTING THE LOCAL MITIGATION STRATEGY IDENTIFYING AND PRIORITIZING HAZARDS MITIGATION GRANT PROGRAM PROJECTS TO BECOME A PART OF THE STATEWIDE HAZARD MITIGATION STRATEGY

WHEREAS, the Board adopted Resolution No. R-392-98 on March 31, 1998 which approved the initial execution of a Hazards Mitigation Strategy agreement with the Florida Department of Community Affairs (FDCA); and

WHEREAS, the State requires all Local Mitigation Strategy (LMS) programs be approved every five years by the governing board of the agency submitting the plan and Miami-Dade County's first LMS plan was approved in the middle of the 1995-2000 five year cycle; and

WHEREAS, on June 6, 2000 Resolution No. R-572-00 was adopted by the Board and then again on June 7, 2005 via Resolution No. R-710-05 and the year 2010 marks the completion of the last 5 year cycle; and

WHEREAS, the Federal Emergency Management Agency funded a national initiative to help communities develop local mitigation strategies that identify projects to mitigate the effects of natural disasters and to identify sources of funds to address those problems; and

WHEREAS, the State of Florida Department of Community Affairs and/or Florida Division of Emergency Management enters into agreements with Miami-Dade County to provide the funding for the County and municipalities to jointly develop a Local Mitigation Strategy to become a component of the Statewide Mitigation Strategy; and

WHEREAS, the County entered into agreements with local municipalities to establish a unified process for developing the Local Mitigation Strategy and convey funds for participation in the plan development; and

WHEREAS, the Local Mitigation Strategy meets the State agreement requirements and was accomplished with the participation of local governments, the School Board of Miami-Dade

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Resolution No. R-452-10
Agenda Item No. 14(A)(5)
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County, and a broad range of private not-for-profit agencies, businesses and universities coordinated by the Department of Emergency Management; and

WHEREAS, this Board desires to accomplish the purposes outlined in the accompanying memorandum, a copy of which is incorporated herein by reference,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that this Board adopts the Local Mitigation Strategy in substantially the form attached hereto and made a part hereof, an original of which is on file with the Clerk of the Board.

The foregoing resolution was offered by Commissioner Joe A. Martinez who moved its adoption. The motion was seconded by Commissioner Rebeca Sosa and upon being put to a vote, the vote was as follows:

Dennis C. Moss, Chairman aye
Jose "Pepe" Diaz, Vice-Chairman aye

Bruno A. Barreiro	aye	Audrey M. Edmonson	aye
Carlos A. Gimenez	aye	Sally A. Heyman	absent
Barbara J. Jordan	aye	Joe A. Martinez	aye
Dorrin D. Rolle	aye	Natacha Seijas	aye
Katy Sorenson	aye	Rebeca Sosa	aye
Sen. Javier D. Souto	aye		

The Chairperson thereupon declared the resolution duly passed and adopted this 20th day of April, 2010. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By: **DIANE COLLINS**
Deputy Clerk

Approved by County Attorney as to form and legal sufficiency.

Eric A. Rodriguez

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Appendix B: State Letter Approving the Local Mitigation Strategy

STATE OF FLORIDA
DIVISION OF EMERGENCY MANAGEMENT

CHARLIE CRIST
Governor

DAVID HALSTEAD
Director

May 14, 2010

Mr. Raymond Misomali
Miami-Dade County Local Mitigation Strategy Working Group Chair
9300 Northwest 41st Street
Miami, Florida 33178-2414

Dear Mr. Misomali:

Congratulations! The enclosed letter constitutes the Federal Emergency Management Agency's (FEMA) formal approval of the Miami-Dade County Local Mitigation Strategy Plan (LMS) for all of the participating jurisdictions.

The plan has been approved for a period of five years and will expire again on May 5, 2015.

The mitigation planning unit would like to thank you for all of your hard work. It has been a pleasure working with you and we look forward to serving you in the future. If you have any questions regarding this matter, please contact Laura Herbert at 850-922-5580 or laura.herbert@em.myflorida.com.

Respectfully,

Miles E. Anderson, State Hazard Mitigation Officer
Bureau of Recovery and Mitigation
Mitigation Section

MEA/lh

Enclosed: FEMA letters of notification dated May 5, 2010

FLORIDA RECOVERY OFFICE • DIVISION HEADQUARTERS • STATE LOGISTICS RESPONSE CENTER
36 Skyline Drive, Lake Mary, FL 32746-6201 • 2555 Shumard Oak Boulevard, Tallahassee, FL 32399-2100, Tel: 850-413-9969 • Fax: 850-488-1016, www.FloridaDisaster.org • 2702 Directors Row, Orlando, FL 32809-5631

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Appendix C: FEMA Letter Approving the Local Mitigation Strategy

U.S. Department of Homeland Security
FEMA Region IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

May 5, 2010

Mr. David Halstead, Director
Division of Emergency Management
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

Attention: Mr. Miles Anderson

Reference: Miami-Dade County Multi-jurisdictional Local Mitigation Strategy

Dear Mr. Halstead:

We are pleased to inform you that the Miami-Dade County Multi-jurisdictional Local Mitigation Strategy is in compliance with the federal hazard mitigation planning standards resulting from the Disaster Mitigation Act of 2000, as contained in 44 CFR 201.6. The plan is approved for a period of five (5) years, to May 5, 2015.

This plan approval extends to the following participating jurisdictions that provided a copy of their resolution adopting the plan:

Miami-Dade County (unincorporated)	City of Miami Beach
City of Aventura	City of Miami Gardens
Town of Bal Harbor Islands	Town of Miami Lakes
Village of Biscayne Park	Miami Shores Village
City of Coral Gables	City of Miami Springs
Town of Cutler Bay	City of North Bay Village
City of Dural	City of North Miami
Village of El Portal	City of North Miami Beach
City of Florida City	City of Opa-locka
Town of Golden Beach	Village of Palmetto Bay
City of Hialeah	Village of Pinecrest
City of Hialeah Gardens	City of South Miami
City of Homestead	City of Sunny Isles Beach
Indian Creek Village	Town of Surfside
Village of Key Biscayne	City of Sweetwater
Town of Medley	Village of Virginia Gardens
City of Miami	City of West Miami

The approved participating jurisdictions are hereby eligible applicants through the State for the following mitigation grant programs administered by the Federal Emergency Management Agency (FEMA):

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Severe Repetitive Loss (SRL)
- Flood Mitigation Assistance (FMA)

We commend the participants in the Miami-Dade County plan for the development of a solid, workable plan that will guide hazard mitigation activities over the coming years. Please note that all requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted.

For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs. In addition, please be aware that if any of the approved jurisdictions participating in this plan are placed on probation or are suspended from the National Flood Insurance Program, they may be ineligible for certain types of federal funding.

We strongly encourage each Community to perform an annual review and assessment of the effectiveness of their hazard mitigation plan; however, a formal plan update is required at least every five (5) years. We also encourage each Community to conduct a plan update process within one (1) year of being included within a Presidential Disaster Declaration or of the adoption of major modifications to their local Comprehensive Land Use Plan or other plans that affect hazard mitigation or land use and development. When the plan is amended or revised, it must be resubmitted through the State as a "plan update" and is subject to a formal review and approval process by our office. If the plan is not updated prior to the required five (5) year update, please ensure that the draft update is submitted at least six (6) months prior to expiration of this plan.

The State and the participants in the Miami-Dade County plan should be commended for their close coordination and communications with our office in the review and subsequent approval of the plan. If you or Miami-Dade County have any questions or need any additional information please do not hesitate to contact Gabriela Vigo, of the Hazard Mitigation Assistance Branch, at (229) 225-4546, or Linda L. Byers of my staff at (770)-220-5498.

Sincerely,

Robert E. Lowe, Chief
Risk Analysis Branch
Mitigation Division

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Appendix D: Risk Assessment and Hazard Profile

Hazard Vulnerabilities by Municipality for Miami-Dade County

Jurisdiction	Wind	Flood	Excess Temperatures	Agriculture	Drought	Wildfires
Aventura	Yes	Yes	Yes	Yes	Yes	No
Bal Harbour	Yes	Yes	Yes	Yes	Yes	No
Bay Harbor Islands	Yes	No	Yes	Yes	Yes	No
Biscayne Park	Yes	Yes	Yes	Yes	Yes	No
Coral Gables	Yes	Yes	Yes	Yes	Yes	No
Cutler Bay	Yes	Yes	Yes	Yes	Yes	No
Doral	Yes	Yes	Yes	Yes	Yes	Yes
El Portal	Yes	Yes	Yes	Yes	Yes	No
Florida City	Yes	Yes	Yes	Yes	Yes	Yes
Golden Beach	Yes	Yes	Yes	Yes	Yes	No
Hialeah	Yes	Yes	Yes	Yes	Yes	Yes
Hialeah Gardens	Yes	Yes	Yes	Yes	Yes	No
Homestead	Yes	Yes	Yes	Yes	Yes	Yes
Indian Creek Village	Yes	No	Yes	Yes	Yes	No
Key Biscayne	Yes	Yes	Yes	Yes	Yes	No
Medley	Yes	Yes	Yes	Yes	Yes	Yes
Miami	Yes	Yes	Yes	Yes	Yes	No
Miami Beach	Yes	Yes	Yes	Yes	Yes	No
Miami Gardens	Yes	Yes	Yes	Yes	Yes	No
Miami Lakes	Yes	No	Yes	Yes	Yes	No
Miami Shores	Yes	Yes	Yes	Yes	Yes	No
Miami Springs	Yes	Yes	Yes	Yes	Yes	No
North Bay Village	Yes	No	Yes	Yes	Yes	No
North Miami	Yes	Yes	Yes	Yes	Yes	No
North Miami Beach	Yes	Yes	Yes	Yes	Yes	No
Opa-locka	Yes	Yes	Yes	Yes	Yes	No
Palmetto Bay	Yes	Yes	Yes	Yes	Yes	No
Pinecrest	Yes	Yes	Yes	Yes	Yes	No
South Miami	Yes	Yes	Yes	Yes	Yes	No
Sunny Isles Beach	Yes	Yes	Yes	Yes	Yes	No
Surfside	Yes	Yes	Yes	Yes	Yes	No
Sweetwater	Yes	Yes	Yes	Yes	Yes	No
Virginia Gardens	Yes	Yes	Yes	Yes	Yes	No
West Miami	Yes	Yes	Yes	Yes	Yes	No
Unincorporated	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All jurisdictions within the County are susceptible to agricultural hazards since their impact is not limited to crops but also, landscape plants. The most impact, however, is felt in the City of Homestead, the base of agriculture within the county.

Appendix E: Hazard Assessment

This is an excerpt from the ***Miami-Dade County Threat and Hazard Identification and Risk Assessment*** published in 2011.

Miami-Dade County, Florida

THREAT AND HAZARD IDENTIFICATION & RISK ASSESSMENT

Miami-Dade County
Office of Emergency Management
9300 NW 41st Street
Miami, FL 33178-2414
(305) 468-5400
www.miamidade.gov/oem

MIAMI-DADE COUNTY
Delivering Excellence Every Day

VI. HAZARD ASSESSMENT & CONSEQUENCE ANALYSIS

The Miami-Dade County THIRA is an all-hazards document, and provides intelligence and an assessment on all relevant hazards that have and/or may impact the County. These hazards were categorized into four (4) broader categories: Natural, Technological, Crime/Terrorism, and Public Health. The specific hazards listed below are included in this assessment:

NATURAL HAZARDS

- Hurricane & Tropical Storm
- Drought
- Flooding (Inland and Coastal)
- Tornado
- Windstorms
- Hailstorms
- Lightning
- Heavy Rain
- Extreme Heat
- Sinkholes/Erosion

- Tsunami
- Wildland Fire
- Severe Winter Weather (i.e. Winter Storm/Ice Storm)
- Extreme Cold/Freeze
- Volcano (i.e. Ash, Dust)
- Earthquake
- Space (i.e. Meteorites, Solar Flares)

TECHNOLOGICAL HAZARDS
- Hazardous Materials Release
- Dam Failure/Levee/Dike
- Structural Fires
- Transportation Incident (i.e. Highway and/or Rail Incident)
- Contaminated Water Incident
- Electric Utility Failure
- Mass Migration

CRIME/TERRORISM HAZARDS
- Terrorism
- Bomb Threat Incident
- Civil Disobedience/Civil Unrest
- Cyber-Security Incident

PUBLIC HEALTH HAZARDS
- Animal and Plant Disease Outbreak
- Food Borne Illness Incident
- Meningitis
- Plague
- Anthrax
- Pandemic/Epidemic
- Water Contamination

NATURAL HAZARDS

Human populations have been subject to natural hazards for their entire history. Pestilence, plague, drought, floods, severe storms have all taken their toll through the ages. Natural hazards are indeed natural but their reality is that they threaten life, property, and economic stability. The impacts of natural hazards are sometimes predictable. The impact of floods, for example, the extent, the area subject to flooding, and the expected dollar damage have been predicted through flood hazard mapping and computer damage models. However, the impacts of other events are arbitrary and dependent upon a variety of interrelated and compounding factors that increases a community's vulnerability.

This section will discuss the natural hazards that could impact Miami-Dade County. The following natural hazards were included in this assessment:

- Drought
- Extreme Cold/Freeze
- Extreme Heat
- Flooding (Inland and Coastal)
- Hailstorms
- Heavy Rain
- Hurricane & Tropical Storm
- Lightning
- Severe Winter Weather (i.e. Winter Storm/Ice Storm)
- Sinkholes/Erosion
- Space (i.e. Meteorites, Solar Flares)
- Tornado
- Tsunami
- Volcano (i.e. Ash, Dust)
- Windstorms
- Wildland Fire
- Earthquake

DROUGHT

OVERVIEW/INTRODUCTION

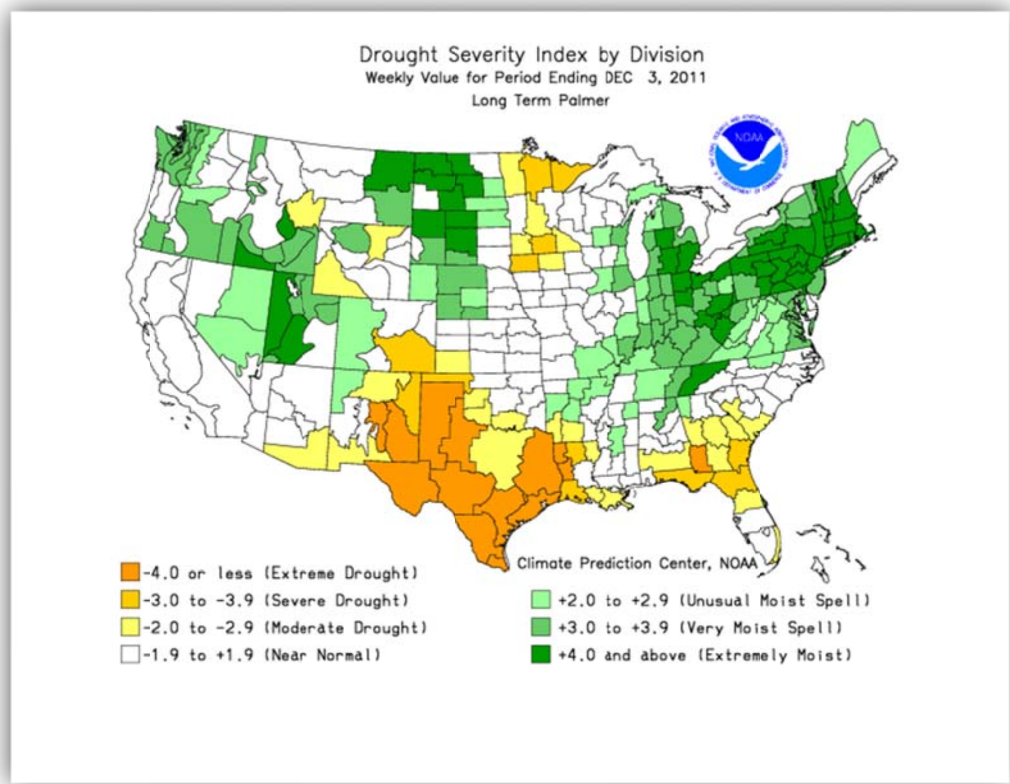
A drought is characterized as an extended period of time or condition with persistent dry weather conditions within a geographic area that typically has rain fall within the region. A drought can however be defined in several different ways depending on the profile.

Droughts can occur in all geographical regions but the type of drought varies significantly from each region. A meteorological drought refers to the normal level of precipitation has a significant measurable drop. An agricultural drought refers to the level of soil moisture drops below the suitable range for agricultural growth. A hydrological drought refers to when the surface water and underground water supply falls below normal. A socioeconomic drought refers to when water shortages seriously interferes with human activity. Whit might be a defined as a drought in one region may not be in another because of the geographical changes.

The severity of the drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area. Droughts can last weeks, months or years and they occur frequently in the United States (US). The US has undergone severe drought conditions multiple times. The 1930's "Dust Bowl" drought affected 70% of the US and devastated the Great Plains states for approximately 7 years with dust storms that destroyed numerous crops and farms. In the 1950's, a five-year drought reduced crop yields by 50% in the southern Great Plains and multiple counties throughout the area were declared federal disaster areas. The 1987-1989 drought which affected 36% of the country, was one of the most expensive natural disasters in U.S. history – "combining the losses in energy, water, ecosystems and agriculture, the total cost of the three-year drought was estimated at $39 billion". The 1988 drought resulted in a drawdown of the Mississippi River that resulted in barge traffic having to be stopped.

Palmer Drought Index

The Palmer Index, developed by Wayne Palmer in the 1960s, uses temperature and rainfall information to formulate dryness. It has become the semi-official drought index. The index is effective in determining long term drought conditions of several months. The index sets normal conditions at 0 with drought conditions in negative values. The index can also be reversed showing the excess of precipitation where the normal conditions at 0 and positive values for amount of rainfall. The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions.



The National Weather Service provides alerts when conditions are favorable for Droughts. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
D0 Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1 Moderate Drought	Some damage to crops, pastures, streams, reservoirs, or wells low, some water shortages developing or imminent, and voluntary water-use restrictions requested.
D2 Severe Drought	Crop or pasture losses are likely, water shortages common and water restrictions imposed.
D3 Extreme Drought	Major crop and pasture losses with widespread water shortages or restrictions.
D4 Exceptional Drought	Exceptional and widespread crop and pasture loss, shortages of water in reservoirs, streams, and wells creating water emergencies.

PROFILE OF DROUGHTS IN MIAMI-DADE

Droughts can be devastating for the host community. As the Drought Center located in Tampa Bay reports, the direct impacts of a drought can include reduced crop, rangeland, and forest productivity; increased fire hazards; reduced water levels; increased livestock and wildlife mortality rates; damage to wildlife and fish habitat; increased problems with insects and diseases to forests and reduce growth. Indirect results can lead to financial hardships for farmers and "increased prices for food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and businesses, migration, and disaster relief programs."

In addition to the impacts of a drought on farming and agriculture, a drought can be related to other hazards. Droughts can be complicated by extreme temperatures because high temperatures increase the amount of evapotranspiration that occurs in plants. Increased evapotranspiration results in higher water loss rates and increases plant damage. The probability of landscape plants loss and extreme crop losses can be increased during a drought if high temperatures are also experienced.

Dead and dry vegetation caused by droughts also provide ample fuel for wildfires Heavy accumulation of fuels, lack of strategic management programs, and inadequate fire-fighting infrastructure has further complicated Miami-Dade risk to wildland-urban interface fires. Drought-related wildfires should be monitored closely by Miami-Dade to ensure the protection of commercial, industrial, agricultural, and residential regions.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	38%	Score	38%	Score	0%	Score	70%	Score	70%	Score	82%

Summary of Drought Events	
Subject	**Local Data**
Number of Hazard Events Since 1950	2
Number of Hazard Events in Past 5 Years	2
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC

HAZARD IMPACT ANALYSIS

Losses from droughts are typically underestimated and inaccurate. Indirect losses from impacts such as farm foreclosures are not often accounted, and direct crop or livestock losses are typically difficult to evaluate due to fluctuations in the commodity markets. It is estimated that the economic loss to the farming and ranching communities due to drought exceed $6 billion.

Florida droughts can negatively impact lives, the environment and the economy. In 2000, the University of Florida's Institute of Food and Agricultural Sciences (IFAS) conducted a phone survey of businesses and households in Broward and Hillsborough counties to assess the droughts impact. The study estimates that the nursery and landscaping industries lost $245 million in sales during the drought. Similarly, horticulture industry sales were negative in all Water Management Districts and the South West Florida Water Management District estimated to have lost $155 million during the drought.

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating Score	29%	Physical Vulnerability Hazard Impact Analysis ►	Impact Rating Score	15%	Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating Score	39%
Special Populations ►	Impact Rating Score	31%	Critical Infrastructure ►	Impact Rating Score	17%	Economic Conditions ►	Impact Rating Score	51%
Cultural Conditions ►	Impact Rating Score	25%	Key Resources ►	Impact Rating Score	6%	Social Conditions ►	Impact Rating Score	37%
Socio-Economic Conditions ►	Impact Rating Score	30%	Building Stock ►	Impact Rating Score	24%	Environmental Conditions ►	Impact Rating Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating Score	54%
						Insured Risk Exposure ►	Impact Rating Score	40%
						Special Properties ►	Impact Rating Score	20%
						Faith-Based ►	Impact Rating Score	38%

EXTREME COLD/FREEZE

OVERVIEW/INTRODUCTION

Extreme cold consists of long periods of below freezing temperatures that sometimes accompany a winter storm. Extreme cold is relative to temperatures in the area in question, therefore, a universal temperature defining extreme cold is not available. However, a significant drop in temperature causing a threat to the safety of the public can be defined as extreme cold. Extreme cold is often correlated with the arrival of a cold front. A cold front is a weather system that moves into a region and replaces existing warmer air with cold air. Since cold air is denser than warm air, a cold front will push cold air under warm air causing warm air to rise higher in the atmosphere and subsequently cool. This often produces cloud cover or precipitation. This weather pattern can remain in a region for a few hours or sometimes as long as a couple of weeks. Cold air will eventually be pushed out by another weather front.

Extreme cold weather is a particularly dangerous hazard for at risk populations. These populations include those who have a difficult time keeping warm or finding a heat source during an extreme cold event. The homeless are particularly at risk as are socio-economically disadvantaged groups who may not have adequate heating. Age groups such as the elderly and infants have limited physiological capability to keep warm. Body warming mechanisms such as "goose bumps" and shivering are restricted in these groups. Outdoor animals and pets are also at risk of extreme cold temperatures.

Extreme cold is responsible for indoor hazards as well as outdoor hazards. Pipes carrying water to households often freeze and expand causing pipes to burst. This will cease water intake to households. Often water will be contaminated during this process. Inadequately heated or insulated homes may resort to heating by kerosene heaters or stoves. These methods of heating are dangerous and contribute to carbon monoxide poisoning and household fires.

Frostbite and hypothermia are two of the main concerns during periods of extreme cold. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Frostbite is damage to body tissue caused by extreme cold. It occurs when the extremities become excessively cold. Frostbite can occur fast (sometimes within minutes) depending on the temperature and wind-chill. As the body cools, blood flow to nerve endings and extremities will decrease causing a loss of feeling and a white or pale appearance. Initial symptoms will occur in the fingers, toes, ear lobes and nose at first then progress to other parts of the body. Hypothermia is an often deadly phenomenon brought on when the body temperature drops to less than 95°F. It can also cause permanent bodily damage to the liver, kidneys and pancreas. Symptoms of hypothermia include uncontrolled shivering, disorientation, loss of memory, slurred speech and exhaustion. Frostbite and hypothermia are both exacerbated by wind chills. Wind chill indexes convey the effects of wind on individuals during cold weather. It causes objects, including the human the body, to cool to the actual temperature at a faster rate; it does not necessarily cool the body to the wind chill temperature. In fact, wind chills will not cause an object’s temperature to be lower than the baseline temperature outside. Wind chills work by blowing away heat generated by the body, which causes the body temperature to go down. The stronger the wind gusts, the greater the effect.

Extreme cold temperatures are seasonal in nature and can occur any time from early fall to mid spring. Since extreme cold is defined by colder than normal temperatures for an extended period of time, it does not necessarily require sub zero temperatures and can occur in relatively tepid weather. Extreme cold is associated with the passage of cold fronts. Cold fronts are systems originating in normally colder regions.

They move quickly into a region at about 15 to 50 kilometers per hour in a southeast to east direction. Cold fronts can remain in an area for periods of time ranging from just a few hours to a couple of weeks. The front will vacate when it is replaced by another weather system. The frequency of extreme cold is dependent on weather patterns within a particular region. Weather patterns are affected by many variables including ocean currents, jet streams, volcanic activity, and man's footprint on the environment. Extreme cold weather is correlated to weather systems that have cold air behind them and can occur several times a season. The magnitude of the cold weather is also affected by many variables including where the cold air weather system originates and whether another system forms that will push the existing system out.

The National Weather Service posts wind-chill advisories and warnings for communities based on the winter temperatures. Wind chill advisories and warnings are set locally and based on typical and expected temperatures for the region. Periods of extreme cold or high winds may necessitate the declaration of wind chill advisories and warnings. A wind chill warning is the more serious of the two declarations. The NWS maintains a wind chill index to illustrate the affects of different speeds of wind. The table is provided below.

Temperature																			
Wind	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98
	Frostbite Times	30 Mins						10 Mins						5 Mins					
	Wind chill is calculated by: Windchill (ºF) = 35.74 0.6215T - 35.75(V^0.16) 0.4275T(V^0.16) Where: T = Air Temperature (F), V = Wind Speed (mph), ^ = raised to a power (exponential)																		

PROFILE OF EXTREME COLD/FREEZE IN MIAMI-DADE

Extreme cold is a common hazard faced by jurisdictions in a higher latitudinal position in the northern hemisphere. Temperature changes and extreme cold can be somewhat mitigated by large bodies of water, as water takes longer to cool and warm than land. However, even though water will stabilize temperatures, changes in air pressure associated with water contribute to winds in the area.

Extreme cold conditions in Florida are considered to be slightly above freezing. Extreme cold can also damage crops and livestock that are unaccustomed to such events or if such events are not typical of the growing season. In addition, extreme cold can cause ice road hazards.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	17%	Score	15%	Score	0%	Score	10%	Score	67%	Score	82%

Summary of Extreme Cold/Freeze Events	
Subject	Local Data
Number of Hazard Events Since 1950	9
Number of Hazard Events in Past 5 Years	1
Number of Catastrophic Events	
Number of Injuries Since 1950	1
Number of Injuries in Past 5 Years	1
Number of Fatalities Since 1950	1
Number of Fatalities in Past 5 Years	1
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	360.930 M
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	29%		Score	15%		Score	34%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	31%		Score	17%		Score	64%

	Impact Rating	Score
Cultural Conditions ▶		25%
Key Resources ▶		6%
Social Conditions ▶		37%
Socio-Economic Conditions ▶		30%
Building Stock ▶		24%
Environmental Conditions ▶		9%
Governmental Conditions ▶		54%
Insured Risk Exposure ▶		16%
Special Properties ▶		20%
Faith-Based ▶		38%

Reference CVR2 Tool for Specific Scores & In-Depth Analysis

EXTREME HEAT

OVERVIEW/INTRODUCTION

Extreme heat is defined as temperatures that are approximately 10 degrees or more above the average high temperature for a given region lasting a prolonged period of time, usually several weeks. Extreme heat occurs when a layer of high atmospheric pressure descends over a geographical area. High pressure causes the air normally located high in our atmosphere to descend, compress, and increase in temperature. This leads to hazy, humid, and muggy air. High pressure systems can reside in an area for weeks as they are resistant to being moved by other weather systems. In addition, high pressure inhibits wind and clouds which normally mitigates the effects of the sun.

Every year, most municipalities experience periods in which the air temperature and humidity creates conditions that could potentially harm human health. Urban areas in particular experience a "heat island" effect. Urban heat island is when an urban area experiences warmer temperatures than its surrounding rural areas. This is caused by large amounts of concrete absorbing heat from the sun during the day. The heat releases at night keeping temperatures high and allowing little time for cooling. This can lead to increased energy demands and stress at-risk populations, especially those without access to air conditioning.

Although extreme heat conditions may not be as notable as other hazards, its consequences can still be devastating. Between 1992 and 2001, deaths from extreme heat in the United States numbered 2,190, compared to 880 deaths from floods and 150 from hurricanes. The average annual number of fatalities directly attributed to extreme heat in the United States is approximately 400.

Extreme heat is typically seasonal in nature with heat waves occurring in the summer months. However, heat waves are associated with high pressure systems and can occur in late spring and early fall as well. For regions in southern latitudes, extreme heat events can occur any time of the year. High pressure systems associated with heat waves can move into an area within a matter of days. These systems are resistant to being moved by other systems and can affect a region for days, weeks, or months. The frequency of extreme heat is dependent on weather patterns within a particular region. Weather patterns are affected by many variables including ocean currents, jet streams, and man's footprint on the environment. Extreme heat is correlated to high-pressure weather systems and can occur several times a season. The magnitude of the hot weather is also affected by many variables including where the system originates, strength and size of the system, the relative humidity and precipitation in the area, and whether another system forms that will push the existing system out.

Heat Index

Heat index is created by the National Weather Service. It is the apparent temperature (i.e. the temperature the human body generally feels) when the air temperature is combined with the relative humidity. The heat index is generally used to determine the effects the temperature and humidity can have on the population. Heat index values are reduced by shady, light wind conditions. Full sunshine conditions can increase heat index values by up to 15 degrees.

Temperature																	
Relative Humidity		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	109	119	124	130	136

45	80	82	84	87	89	93	96	100	104	109	114	114	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	118	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	124	137			
60	82	84	88	91	95	100	105	110	116	123	129	129				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										
Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity																
Caution				Extreme Caution				Danger					Extreme Danger			

The National Weather Service provides alerts when conditions are favorable for Extreme Heat. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alert Procedures	
Alert	Criteria
Heat Advisory	The National Weather Service issues a Heat Advisory within 24 hours of the onset of the following conditions: Heat Index of at least 100o F but less than 105o F for any period of time, or when nighttime lows are above 80o F for any period of time.
Excessive Heat Watch	The National Weather Service issues an Excessive Heat Watch within 24 to 48 hours of the onset of the following conditions: Heat Index of at least 105o F for more than 3 hours per day for 2 consecutive days, or a Heat Index of at least 115o F for any period of time
Excessive Heat Warning	The National Weather Service issues and Excessive Heat Warning within 24 hours of the onset of the following conditions: Heat Index of at least 105o F for more than 3 hours per day for 2 consecutive days, or a Heat Index of at least 115o F for any time period.

In the event of extreme heat, the National Weather Service will issue heat advisories based on heat indices through media messages. The National Weather Service provides assistance to state and local health officials in preparing civil emergency messages in severe heat waves in addition to issuing special weather statements such as who are at most risk, safety rules, and the severity of the hazard. The National Weather Service will also aid state and local authorities on issuing warnings and survival tips. State and local health officials will be responsible to check on vulnerable populations such as the disabled and the elderly. Residents will be notified to remain indoors and refrain from strenuous activities. They will also be reminded to consume fluids often throughout the day and to stay near air conditioning, fans, and so forth.

Exposure to extreme heat can result in various health issues such as sunburn, dehydration, heat cramps, heat exhaustion, and heat stroke. The following table lists some common health hazards that correspond to a certain range of heat index and how dangerous the conditions may be:

Category	Heat Index	Health Hazards
Extreme Danger	130º F- Higher	Heat stroke/ Sunstroke is likely with continued exposure
Danger	105º F- 129º F	Sunstroke, muscle cramps, and/or heat exhaustion with prolonged exposure and/or physical activity.
Extreme Caution	90º F- 105º F	Sunstroke, muscle cramps, and/or heat exhaustion with prolonged exposure and/or physical activity.
Caution	80º F- 90º F	Fatigue possible with prolonged exposure and/or physical activity.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	75%	Score	15%	Score	20%	Score	0%	Score	58%	Score	82%

Summary of Extreme Heat Events	
Subject	Local Data
Number of Hazard Events Since 1950	5
Number of Hazard Events in Past 5 Years	1
Number of Catastrophic Events	
Number of Injuries Since 1950	1
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	1
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating	Score 41%
Special Populations ▶	Impact Rating	Score 68%
Cultural Conditions ▶	Impact Rating	Score 25%
Socio-Economic Conditions ▶	Impact Rating	Score 30%

Physical Vulnerability Consequence & Impact Analysis		
Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating	Score 15%
Critical Infrastructure ▶	Impact Rating	Score 17%
Key Resources ▶	Impact Rating	Score 6%
Building Stock ▶	Impact Rating	Score 24%

Community Conditions Vulnerability Consequence & Impact Analysis		
Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	Score 34%
Economic Conditions ▶	Impact Rating	Score 64%
Social Conditions ▶	Impact Rating	Score 37%
Environmental Conditions ▶	Impact Rating	Score 9%
Governmental Conditions ▶	Impact Rating	Score 54%
Insured Risk Exposure ▶	Impact Rating	Score 16%
Special Properties ▶	Impact Rating	Score 20%
Faith-Based ▶	Impact Rating	Score 38%

Reference CVR2 Tool for Specific Scores & In-Depth Analysis

FLOODING (INLAND AND COASTAL)

OVERVIEW/INTRODUCTION

Flooding especially flash flooding can occur any moment during any time period or season. Elevated river levels combined with additional precipitation can cause serious flooding hazards. Flooding can occur very rapidly as with flash flooding. A creek only 6 inches deep in mountainous areas can swell to a 10-foot deep raging river in less than an hour if a thunderstorm lingers over an area for an extended period of time. Other flooding events occur over a longer period and may last days, weeks, or longer. Flooding caused by dam or levee breaching is rare but can occur very suddenly.

Flooding is the leading cause of disasters worldwide. Each year, more deaths are caused by flooding than any other thunderstorm related hazard. Flooding is a complex hazard because there are several different causal factors. During large meteorological storms the term "100-year flood" may be used in an attempt to simplify the definition of a flood that statistically has a 1-percent chance of occurring in any given year. Likewise, the term "100-year storm" is used to define a rainfall event that statistically has this same 1-percent chance of occurring. In other words, over the course of 1 million years, these events would be expected to occur 10,000 times. But, just because it rained 10 inches in one day last year doesn't mean it can't rain 10 inches in one day again this year.

Global statistics show that floods are the most frequently recorded destructive events, accounting for about 30% of the world's disasters each year. Flooding is a complicated hazard because there are many different factors that contribute to flooding. Also there are several different types of flooding. Flooding is an overflowing of water onto land that is normally dry. It can happen during heavy rains, when ocean waves come onshore, when snow melts too fast, or when dams or levees break. Flooding may happen with only a few inches of water, or it may happen with several feet of water. Flooding can affect many different communities covering several states during a single flooding event. Flooding is a rare hazard that can affect all communities and regional areas of the nation.

Flood Categories

Flood Types	
Category	**Criteria**
River Flooding	A river flood occurs when water levels rise in a river due to excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time, combined rainfall and snow melt, or an ice jam.
Coastal Flooding	Coastal flooding occurs when a hurricane, tropical storm, or tropical depression produces a deadly storm surge that overwhelms coastal areas as it makes landfall. Storm surge is water pushed on shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the average water level 15 feet or more. The greatest natural disaster in the United States, in terms of loss of life, was caused by a storm surge and associated coastal flooding from the great Galveston, Texas, hurricane of 1900. At least 8,000 people lost their lives.
Inland Flooding	When tropical cyclones move inland, they are typically accompanied by torrential rain. If the decaying storm moves slowly over land, it can produce rainfall amounts of 20 to 40 inches over several days. Widespread flash flooding and river flooding can result. In the 1970s, '80s, and '90s, inland flooding was responsible for more than half of the deaths associated with tropical

	cyclones in the United States.
Flash Flooding	A flash flood is a rapid rise of water along a stream or low-lying urban area. Flash flooding occurs within six hours of a significant rain event and is usually caused by intense storms that produce heavy rainfall in a short amount of time. Excessive rainfall that causes rivers and streams to swell rapidly and overflow their banks is frequently associated with hurricanes and tropical storms, large clusters of thunderstorms, supercells, or squall lines. Other types of flash floods can occur from dam or levee failures, or a sudden release of water held by an ice jam. Heavy rainfall in the mountains can cause downstream canyon flooding.

The National Weather Service provides alerts when conditions are favorable for Flooding. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Flood Watch	Atmospheric conditions over a large area, varying in size from multiple counties to multiple states, support the development of heavy rain and/or thunderstorms that are capable of producing flooding. A flood watch implies a longer period of relatively lighter rains, adding up to a large amount of rain. Longer-term flooding implies a slower or steadier rise in the water levels of creeks, streams and larger rivers. Roads can also become flooded, but it is usually more gradual, allowing motorists to monitor conditions more closely.
Flood Warning	A Flood Warning is issued by the National Weather Service when heavy rain has been occurring, and flooding is either occurring or will occur within a specified time, usually within 60 minutes.
Flash Flood Watch	Implies a shorter period of heavier rain. Generally, if flooding is expected within six hours of the onset of rain, a Flash Flood Watch is most appropriate. Flash flooding by definition suggests rapidly rising water, such as a surge of water heading rapidly downstream in a creek or small river. It could also be rapidly rising water on roadways, which can cause motorists to become stranded in vehicles, or even worse, washed into creeks and small rivers due to rapid runoff.
Flash Flood Warning	Atmospheric conditions over a large area, varying in size from multiple counties to multiple states, support the development of heavy rain and/or thunderstorms that are capable of producing flash flooding: A Flash Flood Warning is issued by the National Weather Service when heavy rain has been occurring, and flash flooding is either occurring or will occur within a specified time, usually within 60 minutes.
Urban and Small Stream Advisory	Flooding of small streams, streets and low-lying areas, such as railroad underpasses and urban storm drains is occurring.

PROFILE OF FLOODING IN MIAMI-DADE

The type of flooding that threatens a community is dependent on a variety of factors including terrain, geologic conditions, watershed characteristics, natural features, and human interaction. The characteristics of flooding events differ dramatically in a controlled engineered urban community from that of the more natural rural environment. Miami-Dade County consists of a diverse makeup of both urban and rural regions. 80 percent of Florida residents live along the coast line and are the most susceptible to flooding. Not only is Miami-Dade County susceptible to the categories of flooding referenced in the table above but also in addition to the following:

- Urban flooding is a result of a community's stormwater infrastructure being exceeded by a storm or series of storms. An urban drainage system is comprised of altered natural channels and engineered ditches, storm sewers, retention ponds, and other facilities constructed to store runoff or carry it to a receiving stream or lake. Most stormwater infrastructure systems are designed to handle the amount of water expected during a 10-year storm. Larger storms typically overload the stormwater system producing shallow flooding.

- Overbank Flooding occurs when downstream channels receive more rain from their watershed than it can handle, or a channel is blocked by debris. Excess water overloads the channels and flows out onto the floodplain. Flood depths and duration are dependent on the watershed and riverine system. Generally, the larger the river, the deeper the flood and the longer the duration of the flood. The State of Florida has a network of over 1,700 rivers and streams, many of which begin in the northern portion of the state and travel south toward a larger body of water such as Lake Okeechobee. Ranging from a few feet to a couple of miles wide, these freshwater veins are the lifelines for many of the state's swamps, marshes, lagoons, and estuaries. These water networks transport sediments and nutrients that are essential for wetland habitats and the diverse assemblage of native plant and animal species that depend on them. The southern portion of the state is comprised of hundreds of small streams, canals, and rivers including the Kissimmee River, HillsboroCanal, Fisheating Creek (CaloosahatcheeRiver). Many of the rivers, streams, and canals that flow into Lake Okeechobee are controlled by gates in order to control the water level of the lake. When the lake experiences high water levels, these gates are closed – increasing the risk of overbank flooding.

- Ponding is very typical throughout South Florida and is attributed to the high groundwater table and flat terrain. In flat areas, runoff collects in depressions and cannot drain out, creating a ponding effect. Ponding floodwaters do not move or flow away. Floodwaters will remain in the temporary ponds until they infiltrate the soil, evaporate, or are pumped out. Many of the ponding areas are attributed to the approximate 260,000 acres of wetland scattered throughout Florida. Wetlands are areas of land that have water on the ground's surface or within three 3" of the surface during the growing season. This seasonal fluctuation of the water period is continually affected by the weather, the season, water feeding into and draining from nearby streams, the surrounding watershed and other nearby bodies of water. It should be noted that an area can still be a wetland, even if it doesn't appear to be wet. Wetlands are also known as swamps and marsh.

- Lake Flooding is a result of large bodies of water behaving more like small oceans – generating large waves that cause damage and shoreline erosion from severe storms. Lake Okeechobee is the second largest lake in North America. As coastal storms move inland, high wind and changes in air pressure can push the lake's water toward the shore, generating destructive waves. Additionally, runoff and high floods from flooded riverine systems can cause lake levels to rise. The wide open area (or fetch), allows wind to generate large waves that pose a greater risk than the high water levels.

- Levee and Dike Failures are a real risk in today's post-Katrina world for communities around Lake Okeechobee. A levee or dike is an artificial earthen wall, constructed as a defense along the edge of a body of water, to prevent it from flooding onto adjacent lowlands. Levee flooding is caused by overtopping, failure, or seepage through or under the structure. Levee failures or overtopping can produce dangerous flooding because of the high velocities and large volumes of water released.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

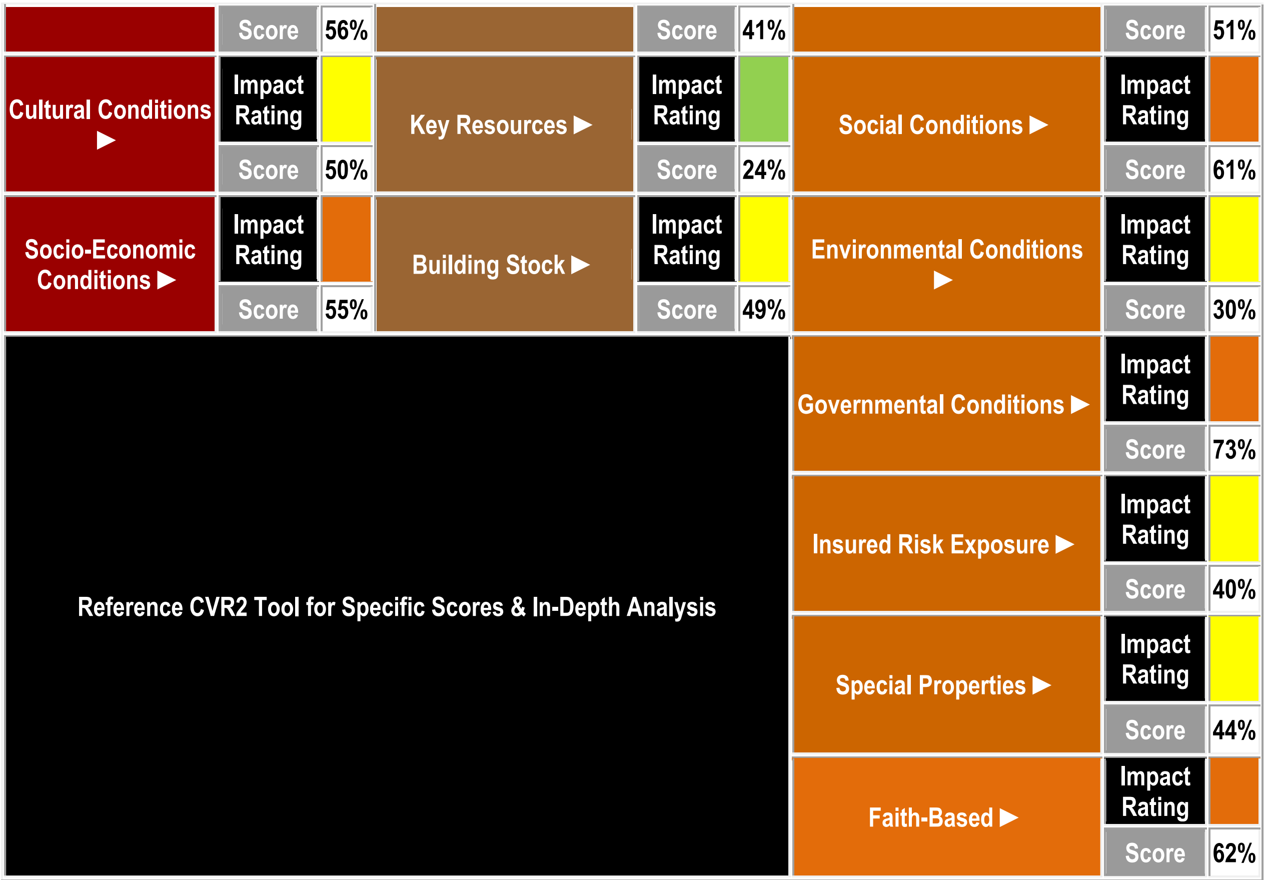
Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	50%	Score	30%	Score	0%	Score	30%	Score	96%	Score	68%

Summary of Flooding Events	
Subject	Local Data
Number of Hazard Events Since 1950	31
Number of Hazard Events in Past 5 Years	9
Number of Catastrophic Events	
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	$500,000,000
Total Property Damage in Past 5 Years	$100,000
Total Crop Damages Sine 1950	$700,000,000
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC and SHELDUS

HAZARD IMPACT ANALYSIS

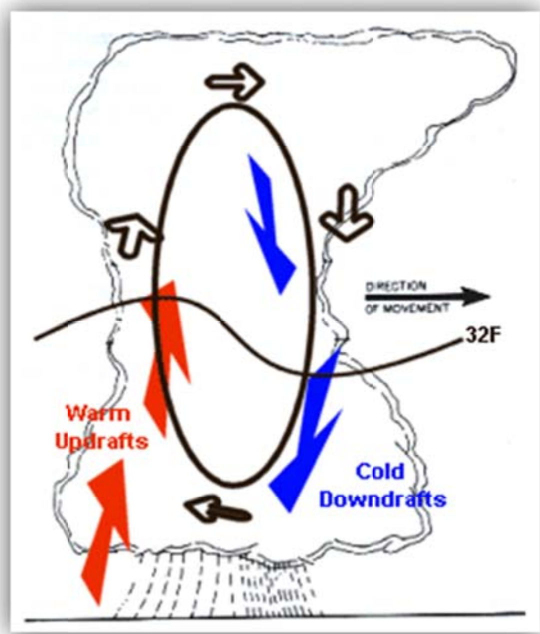
Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	53%		Score	38%		Score	52%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	


Score 56%
Score 41%
Score 51%
Cultural Conditions ▶
Impact Rating
Score 50%
Key Resources ▶
Impact Rating
Score 24%
Social Conditions ▶
Impact Rating
Score 61%
Socio-Economic Conditions ▶
Impact Rating
Score 55%
Building Stock ▶
Impact Rating
Score 49%
Environmental Conditions ▶
Impact Rating
Score 30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis
Governmental Conditions ▶
Impact Rating
Score 73%
Insured Risk Exposure ▶
Impact Rating
Score 40%
Special Properties ▶
Impact Rating
Score 44%
Faith-Based ▶
Impact Rating
Score 62%

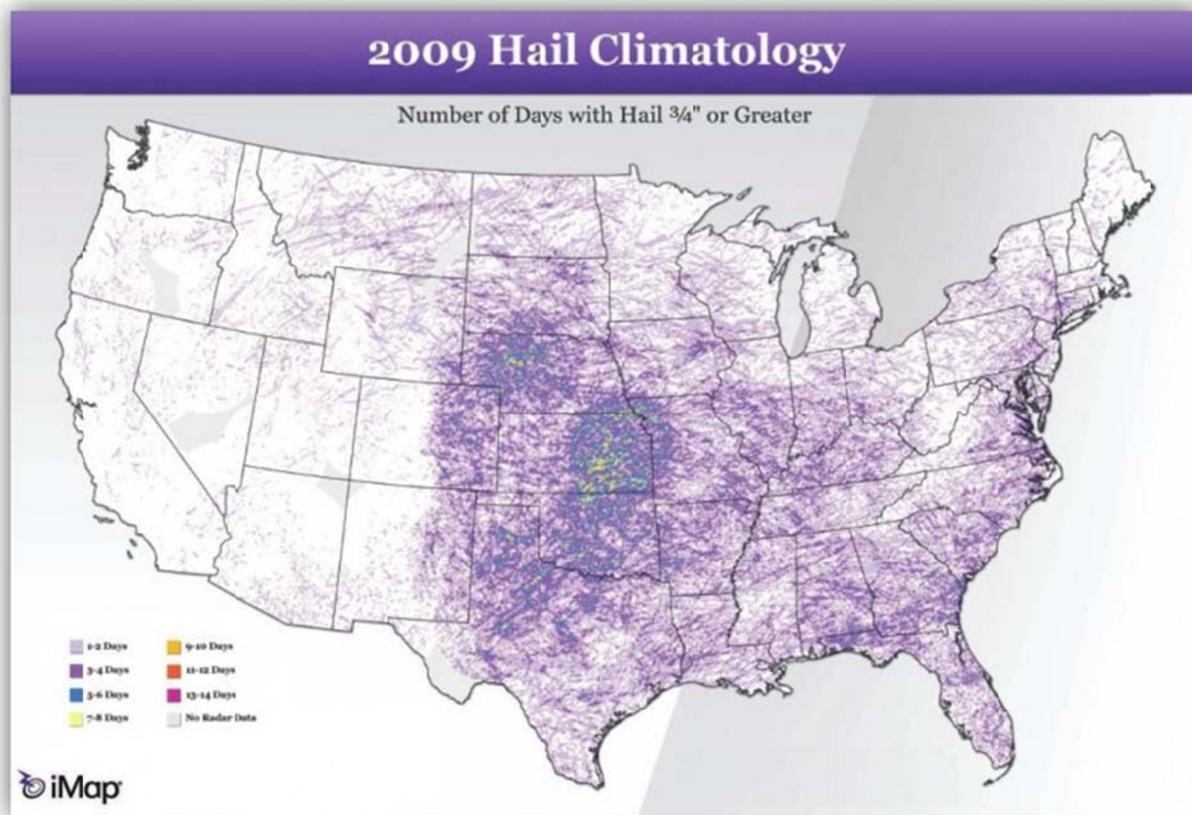
HAILSTORMS

OVERVIEW/INTRODUCTION

Hail is formed in clouds called thunderheads that contain cast amounts of energy from the updrafts and downdrafts within the storm cloud. Hail develops in the main updraft of the storm where most of the moisture resides at 8,000 to 10,000 feet. The moisture within these storm clouds remains in liquid from even at temperatures ranging from -40 degrees Fahrenheit to 32 degrees Fahrenheit. The liquids does not begin to freeze and collect into a hailstone until the moisture collides with ice crystals, dust, salt, or frozen rain drops from the ocean that are present within the storm cloud structure. The cycling of the water particle between the updrafts and downdrafts develops layers of ice and particles to form hailstones. With each cycle the hailstone adds a layer of ice and particles increasing the size and density of the hail. Hailstones range in size from pea size, ¼ inch in diameter, to softball size, 4 ½ inches in diameter. Most hail stones are less than 2 inches in diameter but the largest hailstone on record fell in Nebraska with a 7 inch diameter.



About 24 individuals are injured by hail throughout the United States each year. Rarely is there a fatality caused by hail, the last reported fatality was on March 28, 2000 in Texas. Hail also does a great deal of damage to crops. Costs of damage run into hundreds of millions of dollars annually. While hailstones have been found weighing as much as 1.67 pounds, even much smaller hail can destroy crops, in a matter of minutes.



Hail Size Scale	
Category	Criteria
Pea	1/4 inch in diameter.
Marble	1/2 inch in diameter.
Dime	3/4 inch in diameter.
Nickel	7/8 inch in diameter.
Quarter	1 inch in diameter.
Ping-Pong Ball	1 1/2 inches in diameter.
Golf Ball	1 3/4 inches in diameter.
Tennis Ball	2 1/2 inches in diameter.
Baseball	2 3/4 inches in diameter.
Tea Cup	3 inches in diameter.
Grapefruit	4 inches in diameter.
Softball	4 1/2 inches in diameter.

PROFILE OF HAILSTORMS IN MIAMI-DADE

Hail is a danger that is produced by thunderstorms. Many thunderstorms reach high into the atmosphere where temperatures drop below zero degrees Fahrenheit. When this happens, strong updrafts can push a hailstone high into the cloud where rain and cloud drops can freeze to it. The hailstone then falls back into the lower and warmer part of the cloud, but the updraft often pushes the hailstone back into the freezing temperatures several times, adding a layer of ice each time. Since January of 2008, there have been 157 reported hail storms in Florida with hailstones at least one inch across.

Hailstones rarely cause injury or fatalities but due result in millions of dollars annually in damages to agriculture, residential, and commercial properties.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	56%	Score	5%	Score	10%	Score	20%	Score	50%	Score	82%

Summary of Hailstorm Events	
Subject	Local Data
Number of Hazard Events Since 1950	162
Number of Hazard Events in Past 5 Years	59
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	4
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	1
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	60,000
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	50,000
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact	Impact Rating		Physical Vulnerability Hazard Impact	Impact Rating		Community Conditions Vulnerability	Impact Rating	

Analysis ►	Score	29%
Special Populations ►	Impact Rating	
	Score	31%
Cultural Conditions ►	Impact Rating	
	Score	25%
Socio-Economic Conditions ►	Impact Rating	
	Score	30%

Analysis ►	Score	24%
Critical Infrastructure ►	Impact Rating	
	Score	17%
Key Resources ►	Impact Rating	
	Score	6%
Building Stock ►	Impact Rating	
	Score	49%

Hazard Impact Analysis ►	Score	51%
Economic Conditions ►	Impact Rating	
	Score	51%
Social Conditions ►	Impact Rating	
	Score	61%
Environmental Conditions ►	Impact Rating	
	Score	9%
Governmental Conditions ►	Impact Rating	
	Score	73%
Insured Risk Exposure ►	Impact Rating	
	Score	54%
Special Properties ►	Impact Rating	
	Score	44%
Faith-Based ►	Impact Rating	
	Score	62%

Reference CVR2 Tool for Specific Scores & In-Depth Analysis

HEAVY RAIN

OVERVIEW/INTRODUCTION

Heavy rains occur during the rainy season when there is a shift in wind direction which causes excessive rainfall in many parts of the world including Asia, North America, South America, and Africa. The primary mechanism behind heavy rains is a shift in global wind patterns.

During most of the year, winds blow from land to ocean making the air dry. During certain months of the year, the winds begin to blow from the ocean to the land making the air moist. This moist ocean air is what causes heavy rains over many countries. When combined with the low level moisture, a favorable environment for thunderstorm development is created over areas that are typically dry for much of the year. As rain begins to fall, humidity levels increase over land, triggering more thunderstorms. This cycle continues until land areas cool in early fall and ocean water temperatures reach their peak. This reduces the pressure difference and the moist onshore flow, which in turn ends the wet season.

Heavy rains from the rainy season can replenish the waterways and provide a critical supply of water for agriculture and other economic concerns. The wet seasons can actually fail bringing intense drought and famines to many parts of the world or rain excessively and cause serious flooding.

PROFILE OF HEAVY RAIN IN MIAMI-DADE

Florida's seasonal climatic conditions determined by the monthly or longer weather pattern conditions that exist within a specified area. Northern and Central Florida is categorized as having a subtropical climate, while Southern Florida has a tropical climate with high humidity and precipitation. Florida's main seasons are determined by the amount and changes in precipitation. The rainy season lasts from June to September where 55 percent of the annual rain fall occurs; subjecting Florida to hurricanes, thunderstorms, and tropical cyclones. The rainy season is essential for agricultural development and crop harvest. If heavy rains from a rainy season should fail either a drought or flooding could occur resulting in devastating effects costing millions of dollars depending on the severity.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment *(Refer to CVR2 Tool)*											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	50%	Score	5%	Score	0%	Score	5%	Score	96%	Score	68%

Summary of Heavy Rain Events	
Subject	Local Data
Number of Hazard Events Since 1950	22
Number of Hazard Events in Past 5 Years	9

Number of Catastrophic Events	N/A
Number of Injuries Since 1950	2
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	1
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	$500,000
Total Property Damage in Past 5 Years	$200,000
Total Crop Damages Sine 1950	$200,000
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	32%		Score	32%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	41%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	49%		Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	54%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

HURRICANE & TROPICAL STORM

OVERVIEW/INTRODUCTION

A Tropical Cyclone is a collection of weather systems classified by the varying wind speeds and intensities. A tropical depression, tropical storm, and hurricane are sub-classifications of tropical cyclones. Tropical weather systems form over subtropical or tropical waters with lowered pressure and the combination of wind circulation at the center. A tropical depression is a weather system with a defined surface circulation and maximum sustained surface winds between 23mph – 38mph. A tropical storm develops from a tropical depression. A tropical storm is a weather system with well defined surface circulation and maximum sustained surface winds of 39 mph – 73 mph.

A hurricane develops from a tropical storm. The term hurricane is used for tropical cyclones in the Northern Hemisphere and east of the International Dateline, a line in the middle of the Pacific Ocean that separates two consecutive calendar days. The term typhoon is used for tropical cyclones in the Pacific in the Northern Hemisphere and west of the International Dateline.

A hurricane is a weather system with well defined surface circulation and maximum sustained surface winds of 74 mph or higher. Hurricane seasons differ depending on the region. From June 1 to November 30 runs the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico hurricane season. From May 15 to November 30 runs the Eastern Pacific Basin hurricane season. June 1 to November 30 runs the Central Pacific Basin hurricane season.

Hurricanes are considered one of the most damaging and deadly weather events that occur in the United States with violent winds, waves reaching heights of 40 feet, torrential rains, and flooding. According to the National Oceanic and Atmospheric Administration (NOAA) there are an average 11 tropical storms that form over the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico regions each year, and on average 6 of the tropical storms develop into hurricanes. The United States experience and hurricane strike on land about every year and a half. The strike zone can potentially extend anywhere from Maine and south to Texas, killing 50 to 100 people.

Saffir-Simpson Hurricane Scale

Hurricanes are classified according to the strength of the winds using the Saffir-Simpson Hurricane Scale. The scale categorizes each hurricane based on the intensity at a specific time. The scale is a ranking system from 1 – 5, with 5 being the most serve. The scale also provides examples of the type of damage and impacts in the United States. The following table shows the Saffir-Simpson Scale:

Saffir-Simpson Hurricane Scale	
Category	Criteria
Category I	74 mph - 95 mph winds with 4 ft - 5 ft storm surge and minimal damage. No real damage to building structures. Damage occurs primarily to unanchored mobile homes, shrubbery, and trees. Poorly constructed signs and piers will sustain minor damage. Coastal roads will experience flooding.
Category II	96 mph - 110 mph winds with 6 ft - 8 ft storm surge and moderate damage. Roofing materials, doors, and windows of buildings will sustain damage. Damage to shrubbery and trees will be considerable; some trees will be blown down. Damage to mobile homes, poorly

	constructed signs, and piers will be considerable. Coastal and low-lying escape routes will flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages will break moorings.
Category III	111 mph - 130 mph winds with 9 ft - 12 ft storm surge and major damage. Small residences and utility buildings will sustain some structural damage, and a minor amount of curtain wall (non-load-bearing exterior wall) failures. Damage to shrubbery and trees, with foliage blown off trees will be severe; large trees will be blown down. Mobile homes and poorly constructed signs will be destroyed. Low-lying escape routes will be cut by rising water 3-5 hours before arrival of the center of the hurricane. Flooding near the coast will destroy smaller structures, with larger structures damaged by battering from floating debris. Terrain that is continuously lower than 5 ft above mean sea level will be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences within several blocks of the shoreline will be required.
Category IV	131 mph - 155 mph winds with 13 ft -18 ft storm surge and severe damage. Small residences will sustain more extensive curtain wall failures, and some complete roof structure failures. Shrubs, trees, and all signs will be blown down. Mobile homes will be completely destroyed. Doors and windows will sustain extensive damage. Low-lying escape routes will be cut off by rising water 3-5 hours before arrival of the center of the hurricane. Structures near the shore will sustain major damage to lower floors of structures. Terrain that is lower than 10 feet above sea level will be flooded requiring massive evacuation of residential areas as far inland as 6 miles.
Category V	155 mph winds with 18 ft storm surge and catastrophic damage. Residences and industrial buildings will sustain complete roof failure. Some buildings will collapse completely, with small utility buildings blown over or away. Shrubs, trees, and signs will be blown down. Mobile homes will be completely destroyed. Window and door damage will be extensive and severe. Low-lying escape routes will be cutoff by rising water 3-5 hours before arrival of the center of the hurricane. Lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline will sustain major damage. Massive evacuation of residential areas on low ground within 5-10 miles of the shoreline will be required.

The National Weather Service provides alerts when conditions are favorable for Hurricanes and Tropical Storms. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Tropical Storm Watch	An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are possible within the specified area within 48 hours.
Tropical Storm Warning	An announcement that tropical storm conditions (sustained winds of 39 to 73 mph) are expected somewhere within the specified area within 36 hours.
Hurricane Watch	An announcement that hurricane conditions (sustained winds of 74 mph or higher) are possible within the specified area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of

	the anticipated onset of tropical storm force winds.
Hurricane Warning	An announcement that hurricane conditions (sustained winds of 74 mph or higher) are expected somewhere within the specified area. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical storm force winds.

PROFILE OF HURRICANES & TROPICAL STORMS IN MIAMI-DADE

FIGURE 1

In the past 100 years, there have been approximately 340 hurricanes that have impacted the coast of Florida. Of these hurricanes, 70 hurricanes have impacted regions of Miami-Dade County. Hurricane season for Southern Florida is from June 1 to November 30. Hurricanes can bring storm surges, high winds, tornadoes, flooding, and shore erosion to Miami-Dade. Southeast Florida has the highest probability in the state with every 1 in 6 hurricanes,

The 2011 NOAA hurricane forecast predicted 12 to 18 named storms and 6 to 10 hurricanes and 3 to 6 could become major hurricanes, rated categories 3, 4 or 5. There were three hurricanes with Hurricane Irene being the first of the 2011 Atlantic Hurricane Season. There were 19 named Tropical storms of the 2011 Atlantic Hurricane season.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment

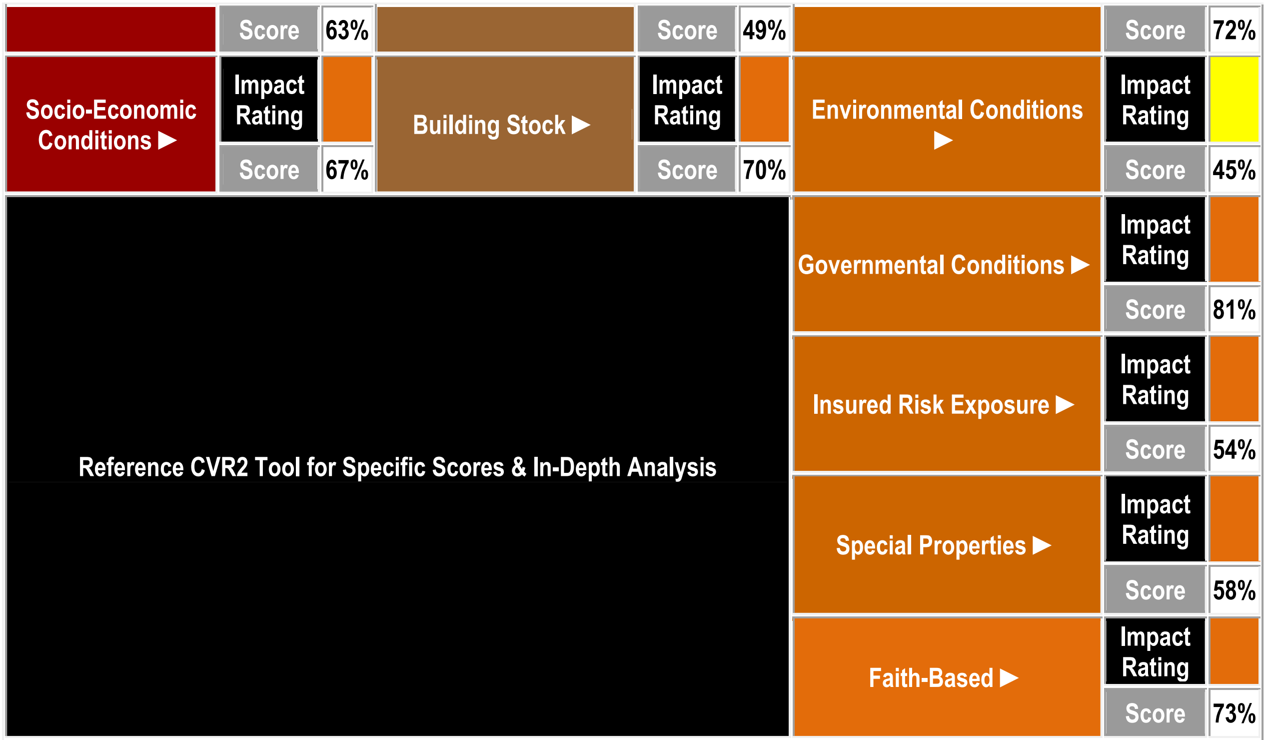
(Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	69%	Score	75%	Score	20%	Score	50%	Score	58%	Score	63%

Summary of Hurricane & Tropical Storm Events	
Subject	Local Data
Number of Hazard Events Since 1950	29
Number of Hazard Events in Past 5 Years	2
Number of Catastrophic Events	
Number of Injuries Since 1950	67
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	15
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	3055581369
Total Property Damage in Past 5 Years	3833
Total Crop Damages Sine 1950	413148144
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

HAZARD IMPACT ANALYSIS

Miami-Dade would be impacted significantly by a category 3 or higher hurricane. Florida not only leads the nation in number of hurricanes making landfall but also the severity of those storms. Wind damage, rainfall and flooding, and storm surge can affect agriculture, industry, commercial and residential regions. However if a hurricane affects the tourism industry in Southeast Florida, for even a short period of time, then Miami-Dade County will feel the indirect affects of decreased revenue.

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	66%		Score	58%		Score	64%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	68%		Score	55%		Score	64%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	


Score
63%
Score
49%
Score
72%
Socio-Economic Conditions ▶
Impact Rating
Score
67%
Building Stock ▶
Impact Rating
Score
70%
Environmental Conditions ▶
Impact Rating
Score
45%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis
Governmental Conditions ▶
Impact Rating
Score
81%
Insured Risk Exposure ▶
Impact Rating
Score
54%
Special Properties ▶
Impact Rating
Score
58%
Faith-Based ▶
Impact Rating
Score
73%

LIGHTNING

OVERVIEW/INTRODUCTION

Lightning is an imbalance between positive and negative charges that form an electrical charge resulting in cloud to cloud lightning. When particles of rain, ice, or show during a storm collide they can increase the imbalance, thus increasing the negative charge, attracting the charge to the positively charge objects on the surface below. The connection between the negatively charged particles and the positively charged particles correct this imbalance with an electrical current between the two charges. The negative charge travels downward toward the positive charge through a series of steps of lengths of 150 feet. When the charge gets within 150 feet of a positively charge object a current is from, transferring electricity resulting in a bolt of lightning.

Typically lightning bolts contain 100 million bolts of electricity and reach temperatures of 50,000 degrees Fahrenheit and can reach over five miles in length. However, each bolt of lightning has up to one billion volts of electricity contained within and temperatures' reaching that five times the surface of the sun makes lightning one of the deadliest and damaging natural phenomena.

As the electrical charge travels the surrounding air is heated causing the air to rapidly expand and vibrate creating the thunder sound that is heard following the lightning. Lightning typically forms in thunder storms but can form in clouds from volcanic eruptions, hurricanes, snow storms, intense forest fires, and nuclear detonations. With the combination of moisture, imbalance of particles and high or low pressure causes clouds formed from the condensation of water vapors rising to build the storm cloud. As the cloud rises reaching heights ranging from 35,000 to 60,000 feet, the moisture forms ice particles. The collision of the ice particles of varying densities causes the imbalance in the electrical charge.

There is an average of 25 million cloud to ground lighting strikes yearly. Lighting can strike anywhere from 5 miles to 10 miles away from the cloud system resulting in over 2,000 individuals being killed yearly and hundreds of individuals suffering from a variety of lasting effects.

Not all lightning is negatively charge. When lightning forms at the top of thunder storms where there is a high level of positively charged particles, in the cirrus anvil, positively charged lightning is created. The form of lightning is the more dangerous of the two because the current that is from lasts longer in duration resulting higher potential of fire from a strike and more individuals being struck.

Lightning Types

Lightning Types	
Category	Criteria
Cloud to Ground	A lightning discharge between cloud and ground initiated by a downward-moving stepped leader.
Ground to Cloud	A lightning discharge between cloud and ground initiated by an upward-moving stepped leader originating from an object on the ground. Ground-to-Cloud lightning strikes are common on tall towers and skyscrapers.
Intracloud	A lightning discharge inside a single storm cloud, jumping between different charge regions in the cloud. All or parts of the actual channel may be obscured inside the cloud, and may or may not be visible to an observer on the ground.

Anvil Crawlers	A lightning discharge with movement that is slow enough that a human observer or normal-speed video camera can see the rapid motion across the sky.
Bolt from the Blue	A lightning discharge that strikes far away from its parent thunderstorm. A 'bolt from the blue' typically originates in the highest regions of a cumulonimbus cloud, traveling horizontally a good distance away from the thunderstorm before making a vertical descent to earth in locations with clear skies.
Sheet	A lightning discharge where the actual lightning channel is either inside the clouds or below the horizon but not visible to the observer.
Bead	The decaying stage of a lightning channel in which the luminosity of the channel breaks up into segments. Nearly every lightning discharge will exhibit beading as the channel cools immediately after a return stroke.
Ribbon	The visual appearance of a photographed lightning flash's individual return strokes being separated by visible gaps on the final exposure. This is typically caused by wind blowing the lightning channel sideways during the exposure.
Cloud to Air	A lightning discharge or a portion of a discharge jumping from a cloud into clear air.
Cloud to Cloud	A lightning discharge between two or more completely separate storm clouds.
Ball	A rare phenomenon described as a floating, illuminated sphere that occurs during thunderstorms. It may move fast, slow or stay stationary, it may be quiet or produce a hissing or crackling noise, it may pass through windows, last from seconds to minutes, and disappear slowly or suddenly either quietly or with a loud bang.

PROFILE OF LIGHTNING IN MIAMI-DADE

Florida is considered the lightning capital in the United States with the highest death rate and injury rate. Since 1959 there have been over 3,696 individuals killed in the United States from lightning strikes with 425 individuals killed in Florida and injuring over another 2,000. Injuries from lightning strikes include but not limited to memory loss, attention deficits, sleep disorders, numbness, dizziness, and weakness are some of the maladies. The leading cause of death and injury from lightning strikes is from misconceptions about lightning. The most common misconceptions are as follows:

- Lightning never strikes the same place twice.
- If it's not raining or there aren't clouds overhead, you're safe from lightning.
- Rubber tires on a car protect you from lightning by insulating you from the ground.
- A lightning victim is electrified. If you touch them, you'll be electrocuted.
- If outside in a thunderstorm, you should seek shelter under a tree to stay dry.
- If you are in a house, you are 100% safe from lightning.
- If thunderstorms threaten while you are outside playing a game, it is okay to finish it before seeking shelter.
- Structures with metal, or metal on the body (jewelry, cell phones,Mp3 players, watches, etc), attract lightning.
- If trapped outside and lightning is about to strike, I should lie flat on the ground.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	75%	Score	5%	Score	20%	Score	5%	Score	96%	Score	82%

Summary of Lightning Events	
Subject	Local Data
Number of Hazard Events Since 1950	102
Number of Hazard Events in Past 5 Years	16
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	124
Number of Injuries in Past 5 Years	8
Number of Fatalities Since 1950	35
Number of Fatalities in Past 5 Years	3
Total Property Damage Since 1950	209641.38
Total Property Damage in Past 5 Years	115000
Total Crop Damages Sine 1950	7536.22
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: SHELDUS

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	15%		Score	29%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	

	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	54%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

SEVERE WINTER WEATHER (I.E. WINTER STORM/ICE STORM)

OVERVIEW/INTRODUCTION

Severe winter weather refers to winter storm events including blizzards and ice storms. These hazards can happen independently of one another or at the same time. A major winter storm can last for several days. Winter weather hazard events occur when excessive amount of snowfall or other related winter weather, such as severe ice storms, high winds, and cold temperatures affect residents' safety, transportation, and ability to work and deliver goods.

Severe winter weather poses a threat to the lives and safety of individuals exposed. This hazard is responsible for dozens of deaths a year due to exposure to the elements. It can lead to complications such as hypothermia and frostbite after prolonged exposure. This can result in the loss of fingers and toes or cause permanent kidney, pancreas, and liver injury, and death. Travel becomes dangerous due to slick and wet conditions on the roads. Many travelers become stranded in their cars due to improperly winterized vehicles. Critical infrastructure can be destroyed including communication and utility towers and flooding can occur from coastal surges, runoff from melted snow and ice, and blocked sewage systems. Hazards such as carbon monoxide poisoning and household fires are increased in improperly ventilated homes during severe winter weather events. The loss of utilities stress resources and puts vulnerable populations at risk. Fallen trees and debris block access to emergency vehicles, knocks down power lines, and cause additional hazards for pedestrians and residents.

Extreme Winter Weather is seasonal in nature and can occur any time temperature and atmospheric conditions are right. Depending on the geographic latitude on the jurisdiction in question, winter weather events can occur anywhere from late September to early May, but it is not necessarily limited to those months. As with some natural hazards, severe winter weather alerts can be anticipated. Although weather patterns are impossible to predict exactly, the National Weather Service tracks weather and provides warnings up to 3 to 7 days in advance. The duration of a winter weather event is also highly variable. Some extreme weather events have last as long as 3-4 days while others have been over within a period of hours.

Weather is influenced by many factors including man's footprint on the environment, natural climatic cycles, volcanic activity, and jet stream and ocean current patterns such as El Nino and La Nina. These factors will vary the atmospheric conditions conducive to winter weather resulting in some winters with multiple storms and others with few or no storms. The exact impact of these factors has yet to be determined. In addition to affecting the frequency of storms, the magnitude of storms is also affected by multiple factors. Some severe winter weather events have led to storms lasting multiple days and dumping multiple feet of snow and several inches of ice.

The National Weather Service provides alerts when conditions are favorable for Severe Winter Weather. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Winter Weather Advisories	Are issued for accumulations of snow, freezing rain, freezing drizzle, and sleet which will cause significant inconveniences and, if caution is not exercised, could lead to life-

	threatening situations.
Winter Strom Watch	Alerts the public to the possibility of a blizzard, heavy snow, heavy freezing rain, or heavy sleet. Winter Storm Watches are usually issued 12 to 48 hours before the beginning of a Winter Storm.
Winter Storm Warning	Issued when hazardous winter weather in the form of heavy snow, heavy freezing rain, or heavy sleet is imminent or occurring. Winter Storm Warnings are usually issued 12 to 24 hours before the event is expected to begin.

PROFILE OF SEVERE WINTER WEATHER IN MIAMI-DADE

Severe winter weather is a rare occurrence in Florida but not improbable. The earliest recorded occurrence of snow or sleet occurred in 1774. The latest occurrence of snow or sleet in the spring fell on January 2010, as a cold front brought scattered snow flurries along with widespread sleet and freezing rain, especially in the northern and central portions of the state. The state record for snowfall is 5 inches, set in northern Florida during January 1800. The earliest recorded snow fall was during the Late November 2006 Nor'easter on November 21 across central Florida.

As mentioned, severe winter weather can occur during ice and snow events. Ice storms are one of the most dangerous types of winter storms. Ice storms typically occur when precipitation falls from above freezing (32 degrees Fahrenheit) temperatures and comes in contact with air or surfaces that are below freezing. During ice storms, ice accumulates on the ground surfaces, power lines and trees. Ice causes dangerous conditions on the ground reducing traction and rendering slick surfaces. These conditions are dangerous to pedestrians as many injuries occur from falling on the slick surfaces. This is especially dangerous for the elderly as their limited mobility and agility is further reduced on slick surfaces. In addition, the elderly are prone to injuries from tripping accidents as their bone mass diminishes with age.

Ice also creates dangerous conditions for vehicles. Downed trees and power lines cause roadway-blocking debris. Automobile accidents increase on slick surfaces. This leads to the use of more first responder resources. However, transportation is also limited for emergency vehicles by the dangerous conditions. As ice accumulates on surfaces, extra weight is added to the structure. As little as one inch of ice has the capability to devastate infrastructure. Excess ice is often the cause of downed power lines, communication towers and trees. High speed winds that often accompany ice storms put extra stress on trees and utility lines. Downed power lines put residents at risk of electrocution and homes without power can resort to unsafe methods of heating their home. Indoor heaters are often misused increasing the chance of fire and carbon monoxide poisoning.

Ice can accumulate and blocks sewage runoff grates. Rain, freezing rain, and sleet often accompany ice storms, which increase the risk of floods. As flooding progresses, conditions only become more slick and dangerous for pedestrian and vehicle travel. In extreme cases, floods can lead to the spillage of hazardous materials that can contaminate water supplies. When ice storms are accompanied by cold temperatures, the homeless and those without adequate heating in their homes are at risk. Although cold temperatures are required for ice storms, they do not have to occur during extreme cold. Temperatures within a few degrees of freezing are sufficient for ice storms to occur.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	5%	Score	15%	Score	0%	Score	20%	Score	75%	Score	82%

NOTE: There have been 0 major snow events in Miami-Dade County.

Summary of Severe Winter Weather Events (includes Extreme Cold Events)	
Subject	Local Data
Number of Hazard Events Since 1950	19
Number of Hazard Events in Past 5 Years	5
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	6
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	$168,617,163.00
Total Crop Damages in the Last 5 Years	$82,422,500.00
Number of Presidential Declarations	

Source: SHELDUS

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	37%		Score	15%		Score	35%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%

Category	Impact Rating	Score
Socio-Economic Conditions ▶	Impact Rating	Score 30%
Building Stock ▶	Impact Rating	Score 24%
Environmental Conditions ▶	Impact Rating	Score 9%
Governmental Conditions ▶	Impact Rating	Score 73%
Insured Risk Exposure ▶	Impact Rating	Score 16%
Special Properties ▶	Impact Rating	Score 20%
Faith-Based ▶	Impact Rating	Score 38%

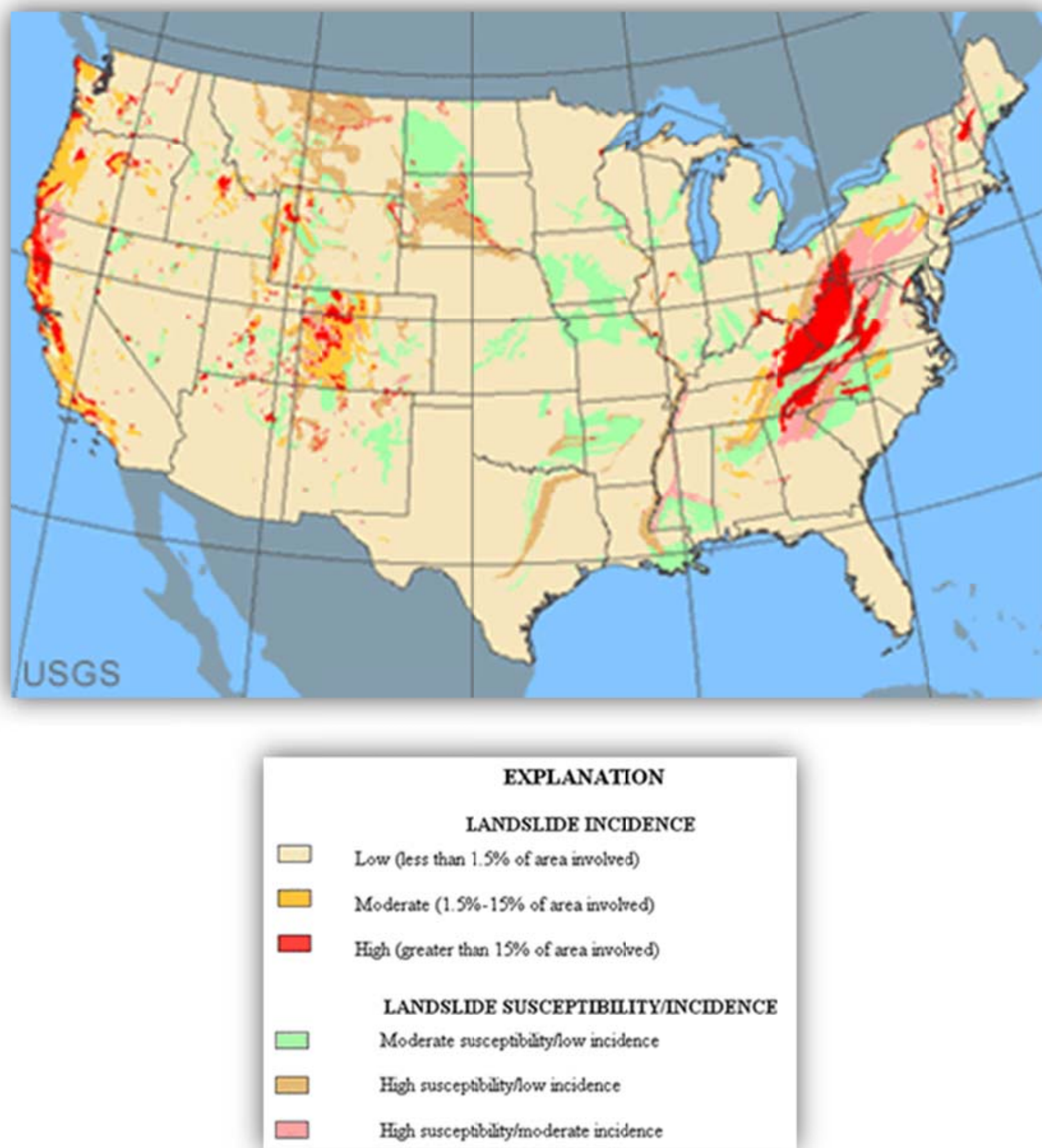
Reference CVR2 Tool for Specific Scores & In-Depth Analysis

SINKHOLES/EROSION

OVERVIEW/INTRODUCTION

Land subsidence is the lowering of the land-surface elevation from changes that take place underground. 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 (hydrocompaction).

Landslides are a process of downward and outward movement of slope-forming materials including rock, soil, artificial fill, or a combination of these. The materials may move by falling, toppling, sliding, spreading, or flowing. Landslides can occur in all 50 states depending on the environments and conditions. The primary regions for landslides are the coastal and mountainous areas of California, Oregon, and Washington, the mountainous and hilly regions of the Eastern United States, and Alaska and Hawaii also experience all types of landslides.



Although landslides are primarily associated with mountainous regions, they can also occur in areas of generally lowlands. In lowland areas, landslides occur as roadway and building development, river bluff failures, collapse of mine-waste piles, and a wide variety of slope failures associated with quarries and open-pit mines.

Landslide Types

Landslide Types	
Category	Criteria
Rotational Slide	This is a slide in which the surface of rupture is curved concavely upward and the slide movement is roughly rotational about an axis that is parallel to the ground surface and transverse across the slide.
Translational Slide	The landslide mass moves along a roughly planar surface with little rotation or backward tilting.
Block Slide	Is a translational slide in which the moving mass consists of a single unit or a few closely related units that move downslope as a relatively coherent mass.
Fall	Falls are abrupt movements of masses of geologic materials, such as rocks and boulders, that become detached from steep slopes or cliffs. Separation occurs along discontinuities such as fractures, joints, and bedding planes, and movement occurs by free-fall, bouncing, and rolling. Falls are strongly influenced by gravity, mechanical weathering, and the presence of interstitial water.
Topple	Toppling failures are distinguished by the forward rotation of a unit or units about some pivotal point, below or low in the unit, under the actions of gravity and forces exerted by adjacent units or by fluids in cracks.
Debris Flow	A debris flow is a form of rapid mass movement in which a combination of loose soil, rock, organic matter, air, and water mobilize as a slurry that flows downslope. Debris flows include less than 50% fines. Debris flows are commonly caused by intense surface-water flow, due to heavy precipitation or rapid snowmelt, that erodes and mobilizes loose soil or rock on steep slopes. Debris flows also commonly mobilize from other types of landslides that occur on steep slopes, are nearly saturated, and consist of a large proportion of silt- and sand-sized material. Debris-flow source areas are often associated with steep gullies, and debris-flow deposits are usually indicated by the presence of debris fans at the mouths of gullies. Fires that denude slopes of vegetation intensify the susceptibility of slopes to debris flows.
Debris Avalanche	This is a variety of very rapid to extremely rapid debris flow.
Earthflow	Earthflows have a characteristic "hourglass" shape. The slope material liquefies and runs out, forming a bowl or depression at the head. The flow itself is elongate and usually occurs in fine-grained materials or clay-bearing rocks on moderate slopes and under saturated conditions. However, dry flows of granular material are also possible.
Mudflow	A mudflow is an earthflow consisting of material that is wet enough to flow rapidly and that contains at least 50 percent sand-, silt-, and clay-sized particles. In some instances, for example in many newspaper reports, mudflows and debris flows are commonly referred to as "mudslides."

Creep	Creep is the imperceptibly slow, steady, downward movement of slope-forming soil or rock. Movement is caused by shear stress sufficient to produce permanent deformation, but too small to produce shear failure. There are generally three types of creep: seasonal, where movement is within the depth of soil affected by seasonal changes in soil moisture and soil temperature; continuous, where shear stress continuously exceeds the strength of the material; and progressive, where slopes are reaching the point of failure as other types of mass movements. Creep is indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences, and small soil ripples or ridges.
Lateral Spread	Lateral spreads are distinctive because they usually occur on very gentle slopes or flat terrain. The dominant mode of movement is lateral extension accompanied by shear or tensile fractures. The failure is caused by liquefaction, the process whereby saturated, loose, cohesionless sediments are transformed from a solid into a liquefied state. Failure is usually triggered by rapid ground motion, such as that experienced during an earthquake, but can also be artificially induced. When coherent material, either bedrock or soil, rests on materials that liquefy, the upper units may undergo fracturing and extension and may then subside, translate, rotate, disintegrate, or liquefy and flow. Lateral spreading in fine-grained materials on shallow slopes is usually progressive. The failure starts suddenly in a small area and spreads rapidly. Often the initial failure is a slump, but in some materials movement occurs for no apparent reason. Combination of two or more of the above types is known as a complex landslide.

Sinkhole
A sinkhole is a hole that forms in the Earth's surface as a result of the chemical weathering of carbonate rocks like limestone, as well as salt beds or rocks that can be severely weathered as water runs through them and erosion. The process happens through the gradual dissolve and removal of water.

Sinkholes vary in size but can range anywhere from 3.3 to 980 feet in diameter and depth. They can also form gradually over time absorbing rock. As the rock is removed, caves and open spaces develop under the surface. Once the open spaces become too large to support the weight of the land above them, the surface soil collapses, and a sinkhole is created. Sinkholes can be found all over the world and recently outsized ones have opened in Guatemala, Florida, and China. Depending on location, sinkholes are sometimes also called sinks, shake holes, swallow holes, swallets, dolines or cenotes.

Sinkhole Types

Sinkhole Types	
Category	Criteria
Collapse Sinkholes	Collapse sinkholes are the most dramatic of the three sinkhole types; they form with little warning and leave behind a deep, steeply sided hole. Collapse occurs because of the weakening of the rock of the aquifer by erosion and is often triggered by changes in water levels in the Floridan aquifer.
Subsidence Sinkholes	The progression of a subsidence sinkhole is shown below. Rainwater percolates through overlying sediments and reaches the limestone, dissolving the rock and gradually weakening its structural integrity. Gradually subsiding sinkholes commonly form where slow dissolution takes place, mostly along joints in the limestone. These sinkholes tend to form naturally and are not greatly affected by human activities.

Solution Sinkholes	Solution sinkholes form where the overburden is absent and the limestone is exposed at land surface. This type of sinkhole usually forms as a bowl-shaped depression with the slope of its sides determined by the rate of subsidence relative to the rate of erosion of the walls of the depression from surface runoff. Surface runoff may also carry sand and clay particles into the depression, which may form a relatively impermeable seal in the bottom. A marsh of lake forms when water is ponded because infiltration is restricted by the clayey seal. The gently rolling hills and shallow depressions typical of solution-subsidence topography are common over large parts of Florida

Weathering and erosion slowly erode the Earth's surface. The processes are definitively independent, but not exclusive. Weathering is the mechanical and chemical hammer that breaks down and sculpts the rocks. Erosion transports soil, mud, rock and other particles by the ocean currents, wind, water, or ice by downward or down-slope movement in response to gravity or by living organisms.

PROFILE OF LANDSLIDE/MUDSLIDES/SINKHOLES/EROSION IN MIAMI-DADE

Sinkholes are a common hazard in Florida because the state is underlain by limestone, which can be slowly dissolved by weak natural acids in rain. The formation of sinkholes often occurs following extreme rainfall, especially after a prolonged dry period.

More than 80 percent of the identified subsidence in the United States is a consequence of human impact on subsurface water, and is an often overlooked environmental consequence of our land and water-use practices. The increasing development of our land and water resources threatens to exacerbate existing land-subsidence problems and initiate new ones.

Two broad types of sinkholes occur in Florida. Collapse sinkholes form quickly by the collapse of an underground cavity created by bedrock dissolution. This is usually the result of excessive pumping of groundwater. Solution sinkholes form gradually by the subsidence of cover sediments into the voids of dissolved bedrock. This is typically caused by the drainage of organic soils.

- Pumping of Groundwater: Groundwater is nearly everywhere below the surface of the Earth, where it fills the pore spaces and fractures in rock at levels below the water table. The zone beneath the water table is called the saturated zone. Groundwater flows into the saturated zone by percolation downward from rainfall on the surface. Surface bodies of water, like streams, lakes, and swamps, are areas where the water table is exposed at the surface. During the wet season the water table is generally higher because recharge exceeds discharge. During dry seasons the water table is depressed because discharge exceeds recharge.

  Excessive groundwater pumping is the primary cause of most land subsidence occurrences in Florida. Excessive pumping lowers the water table and drains caverns that formed just below the water table. When the water table was high, the water helped to support the ceiling of the cavern. As the water table is lowered, the support is removed causing the ceiling of the cavern to collapse and create a sinkhole.

- Drainage of Organic Soils: Land subsidence invariably occurs when soils rich in organic carbon are drained for agriculture or other purposes. This causes microbial decomposition and readily converts organic carbon to carbon-dioxide gas and water. Although most of the rich organic soils are located in Alaska, there is also a significant amount of organic soils in the Florida Everglades. The drainage of the Florida Everglades' organic soils is causing rapid subsidence at 1 to 3 inches per year, threatening agricultural production and potable water infrastructure. The $960 million (2005 estimate) agricultural industry of South Florida has a finite life expectancy because of the ongoing subsidence and current water/land management practices.

HAZARD ASSESSMENT

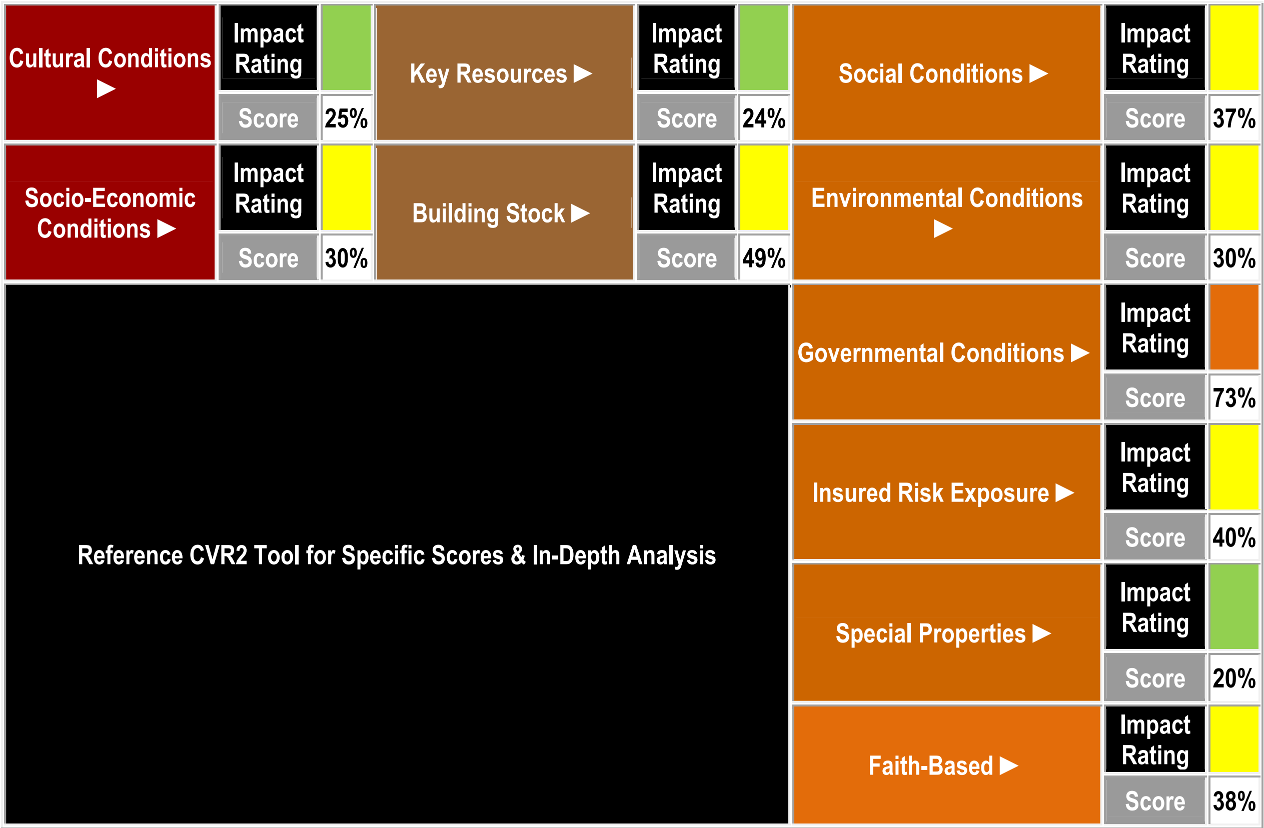
(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	50%	Score	10%	Score	5%	Score	15%	Score	50%	Score	82%

Summary of Landslide/Mudslide/Sinkhole/Erosion Events	
Subject	Local Data
Number of Hazard Events Since 1950	N/A
Number of Hazard Events per Decade Since 1950	N/A
Number of Hazard Events in Past 5 Years	N/A
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	N/A
Number of Injuries in Past 5 Years	N/A
Number of Fatalities Since 1950	N/A
Number of Fatalities in Past 5 Years	N/A
Total Property Damage Since 1950	N/A
Total Property Damage in Past 5 Years	N/A
Total Crop Damages Sine 1950	N/A
Total Crop Damages in the Last 5 Years	N/A
Number of Presidential Declarations	N/A

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	29%		Score	38%		Score	41%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	31%		Score	41%		Score	51%


Cultural Conditions ▶
Impact Rating
Score 25%
Key Resources ▶
Impact Rating
Score 24%
Social Conditions ▶
Impact Rating
Score 37%
Socio-Economic Conditions ▶
Impact Rating
Score 30%
Building Stock ▶
Impact Rating
Score 49%
Environmental Conditions ▶
Impact Rating
Score 30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis
Governmental Conditions ▶
Impact Rating
Score 73%
Insured Risk Exposure ▶
Impact Rating
Score 40%
Special Properties ▶
Impact Rating
Score 20%
Faith-Based ▶
Impact Rating
Score 38%

SPACE (I.E. METEORITES, SOLAR FLARES)

OVERVIEW/INTRODUCTION

Astronomical Occurrence refers to changing conditions on the sun, including a variety of phenomenon, such as solar flares, coronal mass ejections, solar wind, sunspots, coronal holes, and prominences. Activity on the sun, such as solar flares or coronal mass ejections, causes increases in radiation levels in space. This increased radiation can be felt on Earth as either electromagnetic radiation or plasma particles and can influence a variety of systems. Solar flares, coronal mass ejections, and solar winds can also create geomagnetic storms. In addition to Astronomical Occurrence, this hazard includes entities entering the Earth's atmosphere such as meteorites.

Geomagnetic storms are caused by solar flares, coronal mass ejections, and/or solar wind. Solar radiation storms can occur when solar flares release extremely high energy particles. Solar flares are bursts of energy released from the sun. As they radiate out through space, the energy can be released in any manner throughout the electromagnetic spectrum. Solar flare energy can occur as radioactive waves (from gamma to x-rays), as visible light, or as radio waves. Solar flares are often associated with sunspots; the intensity of these activities occurring on a cyclical basis. If a solar flare results in the release of protons, an increase in radiation occurs on Earth's surface. These storms cause disruptions in the Earth's magnetic field.

Interplanetary space is dominated by solar wind, which varies around the sun with changing conditions. These winds influence the Earth's magnetic field. As the interplanetary interface between Earth and space extracts energy from the solar wind, geomagnetic storms can be produced.

A meteorite is a small particle of matter that originates in the solar system and reaches the surface of the earth without being completely vaporized. Meteor showers result in between 50,000 and 100,000 tons of space dust and meteorites falling on the planet every year.

Geomagnetic Storms

The effects of a geomagnetic storm on Earth can range from minor impacts that do not noticeably interfere with systems to major impacts that have significant effects. During a geomagnetic storm, navigation systems can provide inaccurate information and affect GPS systems. Geomagnetic storms can interfere with satellites, causing disruptions in communications and can interfere with the delivery of electricity by damaging transmission equipment. Extreme geomagnetic storms cause widespread voltage control problems; some grid systems may collapse causing blackouts and transformers may experience damage. The high-energy particles can penetrate the earth's atmosphere and impact people residing at high elevation locations.

Geomagnetic Storms	
Category	Criteria
G1 Minor	Weak power grid fluctuations can occur.
G2 Moderate	Long duration storms may cause transformer damage.
G3 Strong	Voltage corrections may be required, false alarms may be triggered in power systems. Intermittent satellite navigation and low frequency radio navigation problems may

	occur. High frequency radio may be intermittent.
G4 Severe	Widespread voltage control problems and some protective systems could trip out key assets on the grid. High frequency radio propagation sporadic, satellite navigation degraded, low frequency navigation disrupted.
G5 Extreme	Widespread voltage control problems and protective system problems in power systems. Grid systems may collapse or blackouts could occur. Transformers may be damaged. Frequency radio navigation could fail.

Solar Radiation Storms	
Alert	Criteria
G1 Minor	Minor impacts on high frequency radio in polar regions.
G2 Moderate	Infrequent single-event satellite upsets.
G3 Strong	Minor problems with satellite systems. Degraded high frequency radio propagation.
G4 Severe	Satellite operations may be disrupted. High frequency radio communications may be blacked out. Possible navigation errors.
G5 Extreme	Satellites may be rendered useless. High frequency radio communications may be blacked out. Possible navigation errors.

PROFILE OF SPACE IN MIAMI-DADE

Geomagnetic storms and solar radiation storms occur in conjunction with solar activity. Solar storms activities occur in cycles, peaking approximately once every 11 years. Even with an 11-year cycle, the probability of getting an extreme event capable of significant damage is low.

Miami-Dade County has not been subject to solar radiation and there has not been interference with technological components of communication or electrical systems. However, there is the probability for solar radiation storms to impact the region. The magnitude of the impacts to technological components increases in proportion to our dependence on these systems. Damage caused by a meteorite reaching land is dependent on how large it is and where it lands.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment *(Refer to CVR2 Tool)*											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	1%	Score	20%	Score	0%	Score	0%	Score	N/A	Score	68%

Summary of Space Events	
Subject	Local Data
Number of Hazard Events Since 1950	0
Number of Hazard Events per Decade Since 1950	0
Number of Hazard Events in Past 5 Years	0
Number of Catastrophic Events	0
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	0

HAZARD IMPACT ANALYSIS

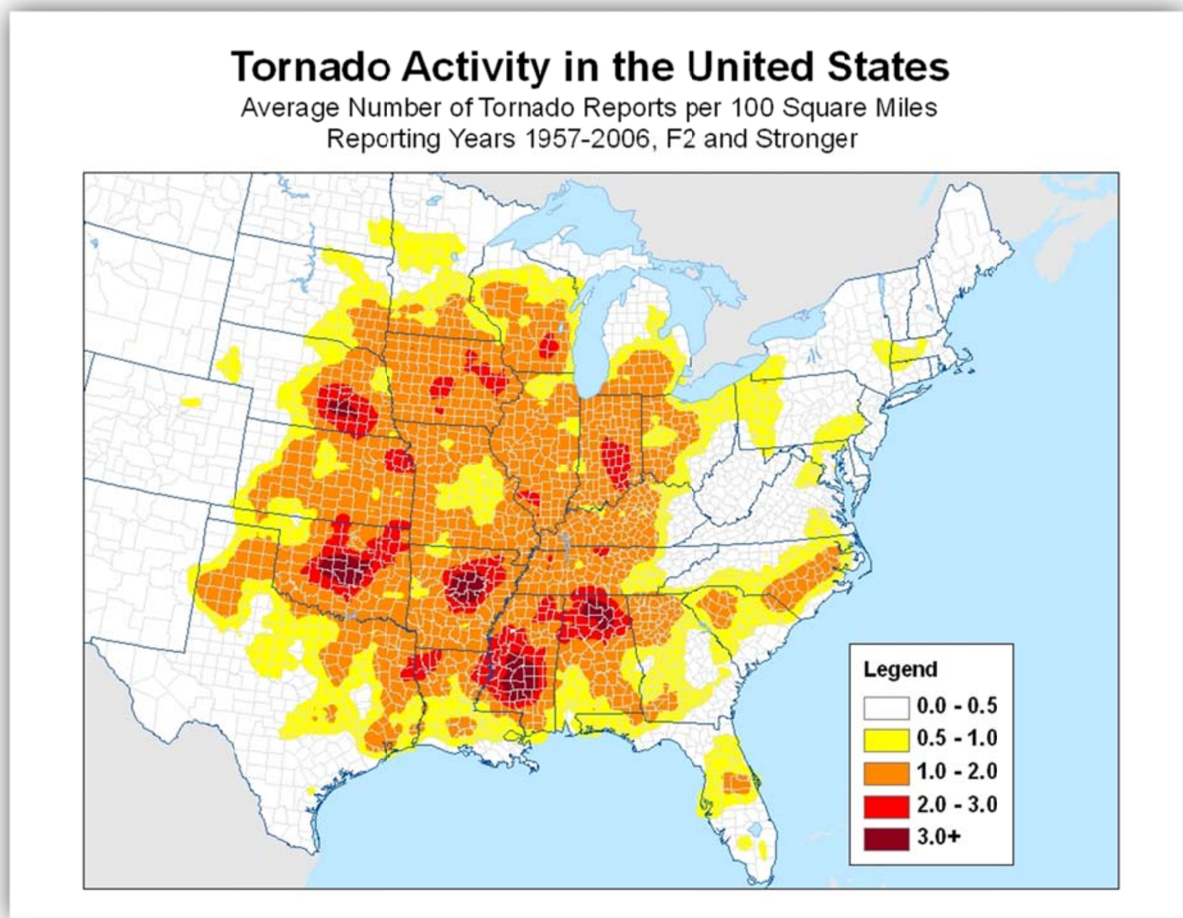
Social Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Physical Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Community Conditions Vulnerability Consequence & Impact Analysis	Impact Rating	Score
Social Vulnerability Hazard Impact Analysis ▶		29%	Physical Vulnerability Hazard Impact Analysis ▶		23%	Community Conditions Vulnerability Hazard Impact Analysis ▶		29%
Special Populations ▶		31%	Critical Infrastructure ▶		41%	Economic Conditions ▶		26%
Cultural Conditions ▶		25%	Key Resources ▶		6%	Social Conditions ▶		37%
Socio-Economic Conditions ▶		30%	Building Stock ▶		24%	Environmental Conditions ▶		9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶		54%
						Insured Risk Exposure ▶		16%

[redacted]	Special Properties ▶	Impact Rating	
		Score	20%
	Faith-Based ▶	Impact Rating	
		Score	38%

TORNADO

OVERVIEW/INTRODUCTION

Tornadoes are one of nature's most violent storms. A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one mile wide and 50 miles long. A majority of tornadoes, however, have wind speeds of 112 mph or less.



Tornadoes occur as part of strong thunderstorms that develop in unstable atmospheric conditions. The strongest tornadoes form with supercells, rotating thunderstorms with a well-defined radar circulation called a mesocyclone. One in three supercells experience a decent of clouds or funnel cloud. These thunderstorms can also produce damaging hail and severe straight-line winds even without a tornado occurrence.

Most tornadoes are below the EF-3 scale and last less than ten minutes. There have been rare occasions where tornadoes have traveled far enough to effect areas of multiple states. They can have different cone shapes and some contain two or more subvortices. Tornadoes can be from twenty feet in width to larger than a mile on the ground and are transparent until the vortex fills with water vapor, dust, dirt, or debris.

According to the NOAA National Severe Storms Laboratory: Thunderstorms develop in warm, moist air in advance of eastward-moving cold fronts. These thunderstorms often produce large hail, strong winds, and tornadoes. Tornadoes in the winter and early spring are often associated with strong, frontal systems that form in the Central States and move east.

Tornado Strength	% of Tornadoes	Deaths	Lifetime	Winds
Weak	69%	5%	1-10 minuts	< 110 mph
Strong	29%	30%	20 minutes	110-205 mph
Violent	70%	2%	can exceed 1 hour	> 205 mp

Enhanced Fujita (EF) Scale

On February 1, 2007, the National Weather Service adopted "Enhanced Fujita (EF) Scale". The EF Scale evaluates and categorizes tornado events by intensity. Both the original Fujita Scale and the EF Scale estimate the intensity of a tornado (3-second gust speed) based on the magnitude of damage. The original scale had a lack of damage indicators and with the increasing standards for buildings, rating of tornadoes was becoming inconsistent. The EF Scale evaluates tornado damage with a set of 28 indicators (see NOAA website). Each indicator is a structure with a typical damage description for each magnitude of a tornado.

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-206	162-209	3	138-167	3	136-165
4	207-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

The National Weather Service provides alerts when conditions are favorable for tornadoes. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Tornado Watch	This is issued by the National Weather Service when conditions are favorable for the development of tornadoes in and close to the watch area. Their size can vary depending on the weather situation. They are usually issued for a duration of 4 to 8 hours. They normally are issued well in advance of the actual occurrence of severe weather. During the watch, people should review tornado safety rules and be prepared to move a place of safety if threatening

	weather approaches. A Tornado Watch is issued by the Storm Prediction Center (SPC) in Norman, Oklahoma. Prior to the issuance of a Tornado Watch, SPC will usually contact the affected local National Weather Forecast Office (NWFO) and they will discuss what their current thinking is on the weather situation. Afterwards, SPC will issue a preliminary Tornado Watch and then the affected NWFO will then adjust the watch (adding or eliminating counties/parishes) and then issue it to the public. After adjusting the watch, the NWFO will let the public know which counties are included by way of a Watch Redefining Statement. During the watch, the NWFO will keep the public informed on what is happening in the watch area and also let the public know when the watch has expired or been canceled.
Tornado Warning	This is issued when a tornado is indicated by the WSR-88D radar or sighted by spotters; therefore, people in the affected area should seek safe shelter immediately. They can be issued without a Tornado Watch being already in effect. They are usually issued for a duration of around 30 minutes. A Tornado Warning is issued by your local National Weather Service office (NWFO). It will include where the tornado was located and what towns will be in its path. If the tornado will affect the nearshore or coastal waters, it will be issued as the combined product--Tornado Warning and Special Marine Warning. If the thunderstorm which is causing the tornado is also producing torrential rains, this warning may also be combined with a Flash Flood Warning. If there is an ampersand (&) symbol at the bottom of the warning, it indicates that the warning was issued as a result of a severe weather report. After it has been issued, the affected NWFO will followed it up periodically with Severe Weather Statements. These statements will contain updated information on the tornado and they will also let the public know when warning is no longer in effect.

PROFILE OF TORNADOES IN MIAMI-DADE

Florida tornadoes occur in the greatest number during June, July and August. These are typically small, short- lived events that can produce minor damage and seldom take lives. Florida's most deadly tornado outbreaks occur in the spring. Most of the nation's large killer tornadoes tend to occur in the late afternoon and early evening hours, due to the afternoon buildup of heat in the lower atmosphere that lingers into the early nighttime hours. However, Florida is different. Tornado climatology shows that strong to violent tornadoes are just as likely to occur after midnight as they are in the afternoon. This unique feature makes these tornadoes more dangerous, because most people are asleep after midnight and do not receive warnings relayed by commercial radio or television.

Hurricanes and tropical storms often produce tornadoes but this is not always the case. There are great differences from storm to storm, not necessarily related to tropical cyclone size or intensity. Hurricane-spawned tornadoes tend to occur in small, low-topped supercells within the outer bands, NNW through ESE of the center -- mainly the northeast quadrant. Occasionally a tornado will happen in the inner bands as well, but the large majority still form outside the hurricane force wind zone. Because tornado-producing circulations in hurricane supercells tend to be smaller and shorter-lived, they are harder to detect on Doppler radar, and therefore more difficult to warn at risk communities.

Tropical systems can produce waterspouts. Waterspouts are common along the southeast U.S. coast -- especially off Southern Florida and the Keys -- and can happen over seas, bays and lakes. They are smaller and weaker than the most intense tornadoes, but still can be quite dangerous. Waterspouts can overturn small boats, damage ships, create significant damage when hitting land, and kill people. The National Weather Service will often issue special marine warnings when waterspouts are likely or have been sighted over coastal waters or tornado warnings when waterspouts can move onshore.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	44%	Score	20%	Score	10%	Score	15%	Score	75%	Score	68%

The prevalence of tornadoes in South-Central Florida is significant. Miami-Dade ranks fourth in the state with eighty-six (86) reported tornadoes from 1971 to 2002. Broward County (88 tornadic events) and Palm Beach County (87 tornadic events) rank second and third, respectively. Based on data from 1950 –2011, there has been 31 tornado events in Miami-Dade that have resulted in 158 injuries, 1 death and $202 million in damage. The following table summarizes these events.

Summary of Tornado Events (F1)	
Subject	Local Data
Number of Hazard Events Since 1950	31
Number of Hazard Events per Decade Since 1950	
Number of Hazard Events in Past 5 Years	2
Number of Catastrophic Events	
Number of Injuires Since 1950	158
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	1
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	$201.973 M
Total Property Damage in Past 5 Years	$170K
Total Crop Damages Sine 1950	$170 K
Total Crop Damages in the Last 5 Years	$0
Number of Presidential Declarations	

Historical Tornado Events (F1) in Miami-Dade (1950-2011)							
Location	Date	Time	Magnitude	Deaths	Injuries	Property	Crop

						Damage	Damage
Miami-Dade	06/17/1959	2050	F3	0	77	$2.5 M	$0
Miami-Dade	11/09/1962	0300	F1	0	1	$25 K	$0
Miami-Dade	10/14/1964	1410	F1	0	0	$250 k	$0
Miami-Dade	06/08/1966	1100	F1	0	0	$0 k	$0
Miami-Dade	02/19/1968	0400	F2	0	21	$3 K	$0
Miami-Dade	02/19/1968	0415	F1	0	0	$25 k	$0
Miami-Dade	06/07/1968	1310	F1	0	1	$250 K	$0
Miami-Dade	06/25/1968	1640	F1	0	0	$0 K	$0
Miami-Dade	03/05/1970	1530	F1	0	0	$3 K	$0
Miami-Dade	06/22/1971	1400	F2	0	0	$25 K	$0
Miami-Dade	12/20/1973	1315	F2	0	9	$2.5 M	$0
Miami-Dade	12/20/1973	1330	F1	0	0	$250 K	$0
Miami-Dade	07/04/1975	1314	F1	0	1	$25 K	$0
Miami-Dade	05/25/1980	1005	F1	0	0	$25 K	$0
Miami-Dade	07/15/1980	1320	F1	0	0	$25 K	$0
Miami-Dade	08/21/1980	1405	F1	0	0	$25 K	$0
Miami-Dade	05/07/1981	1615	F1	0	0	$25 K	$0
Miami-Dade	03/06/1982	0145	F1	0	4	$2.5 M	$0
Miami-Dade	05/27/1982	1130	F1	0	0	$2.5 M	$0
Miami-Dade	03/17/1983	0705	F2	0	0	$2.5 M	$0
Miami-Dade	01/15/1991	1435	F1	0	3	$250 K	$0
Miami-Dade International Airport	01/03/1996	0807	F1	0	9	$1.2 M	$0
Sw 25th Ave / s4th Street	05/12/1997	1253	F1	0	12	$525 K	$0
Miami-Dade International Airport	02/02/1998	2022	F2	0	6	$175 M	$0
Miami Opa Locka Airport	03/09/1998	0600	F1	0	0	$1 M	$0
Koa;eaj	10/03/2000	1200	F1	0	0	$20 K	$0
Homestead	01/02/2002	0340	F1	0	0	$50 K	$0
North Miami Beach	03/27/2003	0515	F1	0	0	$75 K	$0
Miami	03/27/2003	1746	F2	1	14	$8 M	$0
Franjo	06/01/2007	2045	F1	0	0	$20 K	$0
Hialeah	08/14/2008	1330	F1	0	0	$150 K	$0
TOTALS:				1	158	$201.973 M	$0

Source: NCDC

HAZARD IMPACT ANALYSIS

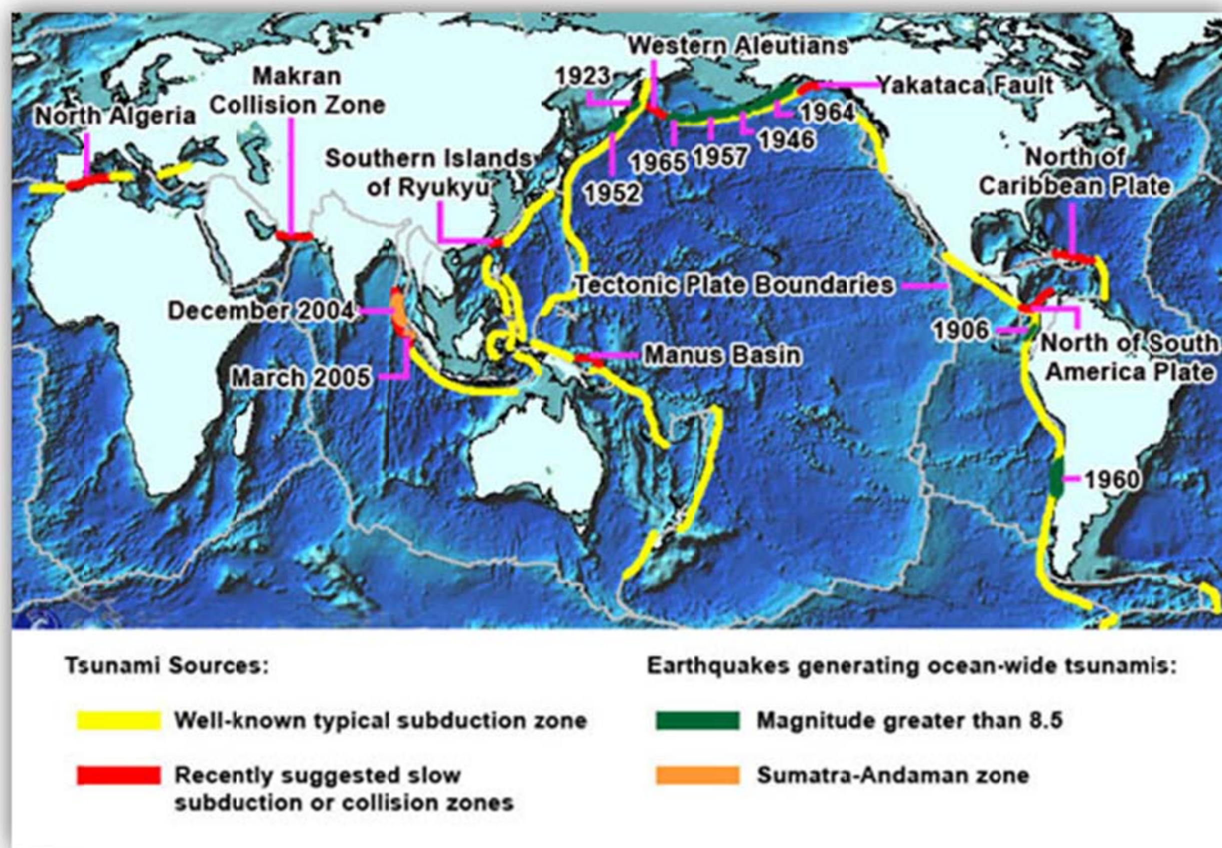
The impact of a tornado is relative to its intensity and location. Even a weak tornado can cause significant damage if it strikes a densely developed area. Comparing Florida to other states that are affected by tornadoes is only a point of reference as it only takes one large tornado or a series of smaller tornadoes to truly devastate a community. The East Central Florida Tornado Outbreak of 22-23 February clearly demonstrates this fact. In under four hours it caused: almost half the fatalities, 42; close to one-tenth the injuries, 260; and almost one-fifth the cost (approximately $100 million) as the preceding statewide totals for tornado damage over a thirty-five year period.

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	53%		Score	42%		Score	53%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	41%		Score	64%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	50%		Score	24%		Score	61%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	55%		Score	62%		Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	40%
						Special Properties ▶	Impact Rating	
							Score	44%
						Faith-Based ▶	Impact Rating	
							Score	62%

TSUNAMI

OVERVIEW/INTRODUCTION

A tsunami is a series of ocean waves with long wavelength and period generated by sudden displacement of the ocean floor. The displacement can be caused by earthquakes, landslides, volcanic eruptions, nuclear explosions, and even impacts from meteorites, asteroids, and comets can all generate tsunamis. Tsunamis are often confused with tidal waves which are the natural daily ocean tides and movements. The time between long wavelength and period can be several minutes or over an hour. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high. The velocity of a tsunami depends on the ocean waters. In 15,000 feet of water the waves travels at approximately 475 mph. In 100 feet of water the velocity drops to approximately 40 mph. In the deep ocean, the tsunami wave may only be a few inches high and a hundred miles or more in length. Waves can exceed velocities of 600 mph but when the wave reaches the coastline waters the velocity diminishes and the height of the wave increases to exceed heights of 100 feet. The deep ocean tsunamis can neither be seen from the air nor felt aboard ships or rarely reach heights of over 3 feet, but when a wave reaches the coast it can strike with devastating force.



Tsunamis rarely become great, towering breaking waves. When a tsunami reaches coastal shores the wave appears as rapidly advancing or receding tide as a series of breaking waves. The first wave may not be the largest in the series of waves. One coastal area may see no damaging wave activity while in another area destructive waves can be large and violent. The flooding of an area can extend inland by 1,000 feet or more, depending on the height and velocity of the wave, covering large regions of land with water and debris. Flooding tsunami waves tend to carry loose objects and people out to sea when they retreat.

There are on average two tsunamis occurring each year throughout the world and approximately every 10 years a devastating ocean wide tsunami occurs. Tsunamis can occur anytime of the year and are not contingent on climate and geography. Although a tsunami cannot be prevented, the impact of a tsunami can be mitigated through community preparedness, timely warnings, and effective response.

The Tsunami Warning System (TWS) in the Pacific, comprised of 26 participating international Member States, has the functions of monitoring seismological and tidal stations throughout the Pacific Basin to evaluate potentially tsunamigenic earthquakes and disseminating tsunami warning information. NOAA has primary responsibility for providing tsunami warnings to the Nation, and a leadership role in tsunami observations and research.

Magnitude Scale

Tsunami Scale	
Category	Criteria
6.5 - 7.5	Tsunami Information Bulletin Tsunami Information Bulletin Supplement
7.6 - 7.8	Fixed Regional Tsunami Warning Fixed Regional Tsunami Warning Supplement Fixed Regional Tsunami Warning Cancellation
> 7.9	Expanding Regional Tsunami Warning Expanding Regional Tsunami Warning Supplement Expanding Regional Tsunami Warning Cancellation
Tsunami	Pacific Ocean-wide Tsunami Warning Pacific Ocean-wide Tsunami Warning Supplement Pacific Ocean-wide Tsunami Warning Cancellation

The National Weather Service provides alerts when conditions are favorable for Tsunami. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Tsunami Warning	A tsunami warning is issued by PTWC when a potential tsunami with significant widespread inundation is imminent or expected. Warnings alert the public that widespread, dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after arrival of the initial wave. Warnings also alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic

	information.
Tsunami Watch	A tsunami watch is issued to alert emergency management officials and the public of an event which may later impact the watch area. The watch area may be upgraded to a warning or canceled based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are normally issued based on seismic information without confirmation that a destructive tsunami is underway.
Tsunami Information	Tsunami information, issued in a Tsunami Information Bulletin, is to inform that an earthquake has occurred and to advise regarding its potential to generate a tsunami. In most cases there is no threat of a destructive tsunami, and the information is used to prevent unnecessary evacuations as the earthquake may have been strongly felt in coastal areas. The information may, in appropriate situations, caution about the possibility of a destructive local tsunami for coasts located near an earthquake epicenter (usually within 100 km). Because it takes 10-20 minutes for PTWC initial bulletins to be issued, they are typically not effective for a local tsunami that can be onshore in just minutes. In such situations, however, the information can be useful to local authorities so they can at least investigate if a tsunami has occurred and if so quickly initiate recovery procedures. Supplemental tsunami information may be issued if, for example, a sea level reading showing a tsunami signal is received.
Tsunami Warning Cancellation	A cancellation indicates the end of the damaging tsunami threat. A cancellation is usually issued after an evaluation of sea level data confirms that a destructive tsunami will not impact the warned area. A cancellation will also be issued following a destructive tsunami when sea level readings indicate that the tsunami is below destructive levels and subsiding in most locations that can be monitored by PTWC.

PROFILE OF TSUNAMIS IN MIAMI-DADE

The risk of a tsunami striking Florida is considered to be relatively low. The website for the National Oceanographic and Atmospheric Administration lists the following states as being especially vulnerable to tsunamis, in addition to the U.S. Caribbean Islands: Hawaii, Alaska, Washington, Oregon, and California. There is currently no tsunami warning system for the east coast of the United States. Since 1775 there have been three tsunamis that have hit Florida's coastline. There were a few recorded deaths and minimal damaged caused. A tsunami has yet to strike Miami-Dade County, however there is still the probability of a tsunami but unlikely.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	13%	Score	30%	Score	15%	Score	10%	Score	25%	Score	68%

Summary of Tsunami Events	
Subject	Local Data
Number of Hazard Events Since 1950	0
Number of Hazard Events per Decade Since 1950	0
Number of Hazard Events in Past 5 Years	0
Number of Catastrophic Events	0
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	0

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	37%		Score	24%		Score	36%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	49%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	54%
						Insured Risk Exposure ▶	Impact Rating	
							Score	40%

[redacted]	Special Properties ▶	Impact Rating	
		Score	20%
	Faith-Based ▶	Impact Rating	
		Score	38%

VOLCANO (I.E. ASH, DUST)

OVERVIEW/INTRODUCTION

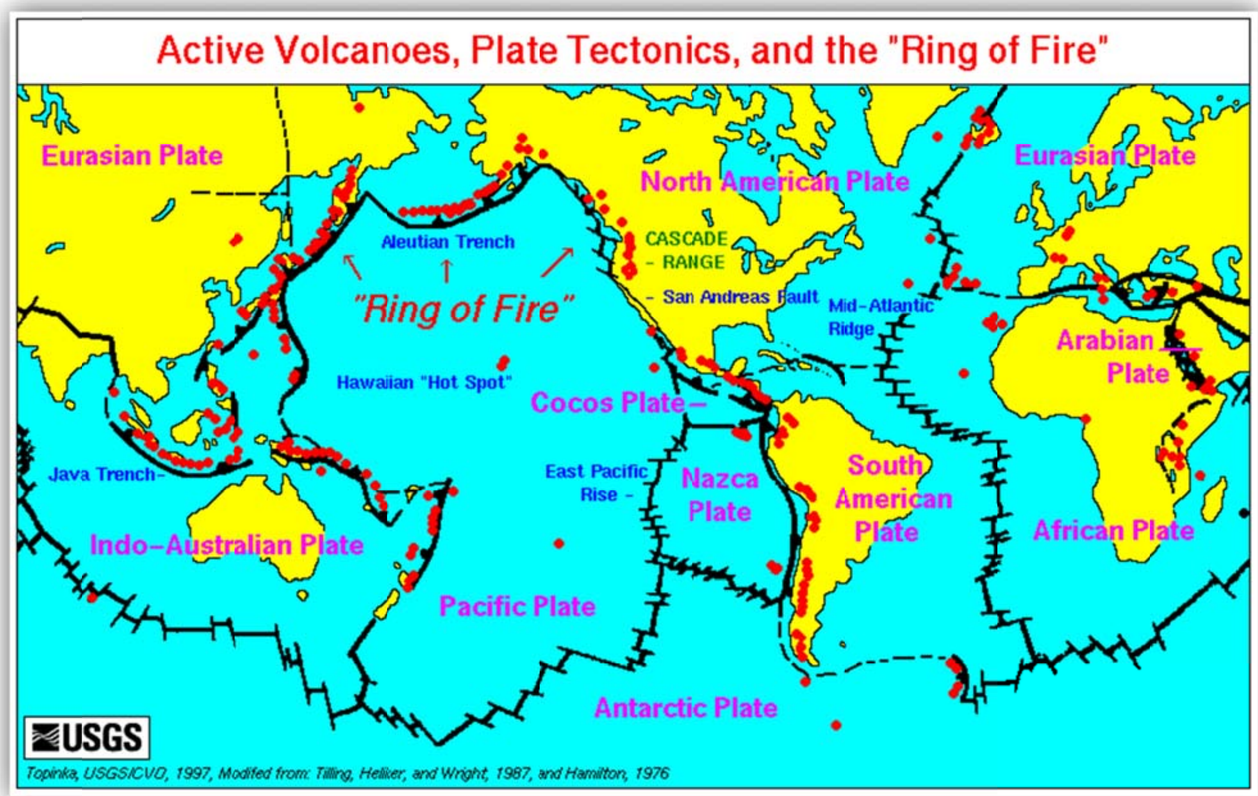
Volcanoes are categorized as vents on the Earth's surface where molten rock, debris, and gases from the planet's interior are released. Eruptions occur when magma and large amounts of gasses build up under the surface. Volcanic eruptions can be explosive, expelling lava, rocks and ash into the air. Less gas and more magma usually means a less dramatic eruption, often causing streams of lava to ooze from the vent.

The volcanic mounds are what remains of the material after an eruption has occurred and has collected and hardened around the vent. This can happen over a period of weeks or millions of years after the eruption or multiple eruptions.

A large eruption can be extremely dangerous for people living near a volcano. Lava flows can reach temperatures of 2,000 degrees Fahrenheit or more. Boulders of hardening lava can rain down on villages. Mud flows from rapidly melting snow can strip mountains and valleys bare and bury towns. Ash and toxic gases can cause lung damage and other problems, particularly for infants and the elderly. Scientists estimate that more than 260,000 people have died in the past 300 years from volcanic eruptions and their aftermath.

Volcanoes tend to exist along the edges between tectonic plates, massive rock slabs that make up Earth's surface. About 90 percent of all volcanoes exist within the Ring of Fire along the edges of the Pacific Ocean.

About 1,900 volcanoes on Earth are considered active, meaning they show some level of activity and are likely to explode again. Many other volcanoes are dormant, showing no current signs of exploding but likely to become active at some point in the future. Others are considered extinct.



Types of Volcanoes

Types of Volcanoes	
Category	Criteria
Shield Volcanoes	Shield volcanoes are large volcanoes with broad summit areas and low-sloping sides because the extruded products are mainly low viscosity basaltic lava flows. Shield volcanoes have summit calderas formed by piston-like subsidence. Subsidence occurs when large volumes of lava are emptied from underground conduits; withdrawal of support leads to collapse. Many smaller pit craters also occur along fissure zones on the flanks of the volcanoes. These form by collapse due to withdrawal of magma along conduits.
Cinder Cones	Cinder cones are mounds of basaltic fragments. Streaming gases carry liquid lava blobs into the atmosphere that rain back to earth around the vent to form a cone. The lava blobs commonly solidify, or partially solidify, during flight through the air before landing on the ground. They are called "bombs." If gas pressure drops, the final stage cinder cone construction may be a lava flow that breaks through the base of the cone.
Composite Volcanoes	Composite volcanoes are built by multiple eruptions, sometimes recurring over hundreds of thousands of years, sometimes over a few hundred. Andesite magma, the most common but not the only magma type, tends to form composite cones. Although andesitic composite cones are built mostly of fragmental debris, some of the magma intrudes fractures within the cones to form dike or sills. In this way, multiple intrusive events build a structural framework of dikes and sills that knits together the voluminous accumulation of volcanic rubble. Such a

	structure can stand higher than cones composed only of fragmental material. Composite cones can grow to such heights that their slopes become unstable and susceptible to collapse from the pull of gravity
Domes	Lava domes form by the slow extrusion of highly viscous silica-rich magma. Most domes are rather small, but can exceed 25 cubic km in volume. Domal extrusions may end up as rather slow-moving lavas but many begin explosively, forming reamed-out explosion pits blanketed by pyroclastic debris. The explosive activity wanes as the gas content decreases. With lowered gas pressures, the magma extrudes slowly as viscous lava that forms thick stubby flows, or domes that are spinal or dome-shaped. As a dome enlarges, its margins slowly creep outward as a lava flow with steep cliff-like margins and a rubbly surface. If protrusion occurs on a steep slope, dome margins can collapse in a dangerous mass of hot rubble that can form pyroclastic flows. Domes can be solitary volcanoes, form in clusters, grow in craters or along the flanks of composite cones
Calderas	Calderas are circular to oblong depressions formed by collapse along arcuate fractures associated with extrusion of pyroclastic materials. Their diameters are many times larger than those of associated vents. They may attain diameters up to 60 km across. The largest estimated volume of erupted products is over 3500 cubic kilometers, and deposits are known to have covered 25,000 square km. The frequency of such voluminous eruptions is very low. Those with volumes of 500 cubic km have a frequency of about 100,000 years.

The United States Geological Survey USGS alerts when conditions are favorable for Volcanic Eruptions. The following table provides information on the different alerts for the:

United States Geological Alerts	
Alert	Criteria
Normal	Typical background activity of a volcano in a non-eruptive state. After a change from a higher level: Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.
Advisory	Elevated unrest above known background activity. After a change from a higher level: Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Watch	Heightened pr escalating unrest with increased potential for eruptive activity or a minor eruption underway that poses limited hazards.
Warning	Highly hazardous eruption underway or imminent.

PROFILE OF VOLCANOES IN MIAMI-DADE

Modern geologists claim that no volcano exists in the state of Florida. There is a history of sightings and investigations into the Walkulla Volcano dating back to the 1800's. The Wakulla Volcano was given the name from sightings of prominent smoke column and bright lights coming from the swaps in Wakulla County. One explanation is that the active volcano was in the swamp lands of Walkulla County but disappeared after the Charleston Earthquake in 1886. There is no evidence to support any of the theories or explanations to the origins to the smoke and lights but the Mystery of the Walkulla Volcano has become folklore.

HAZARD ASSESSMENT

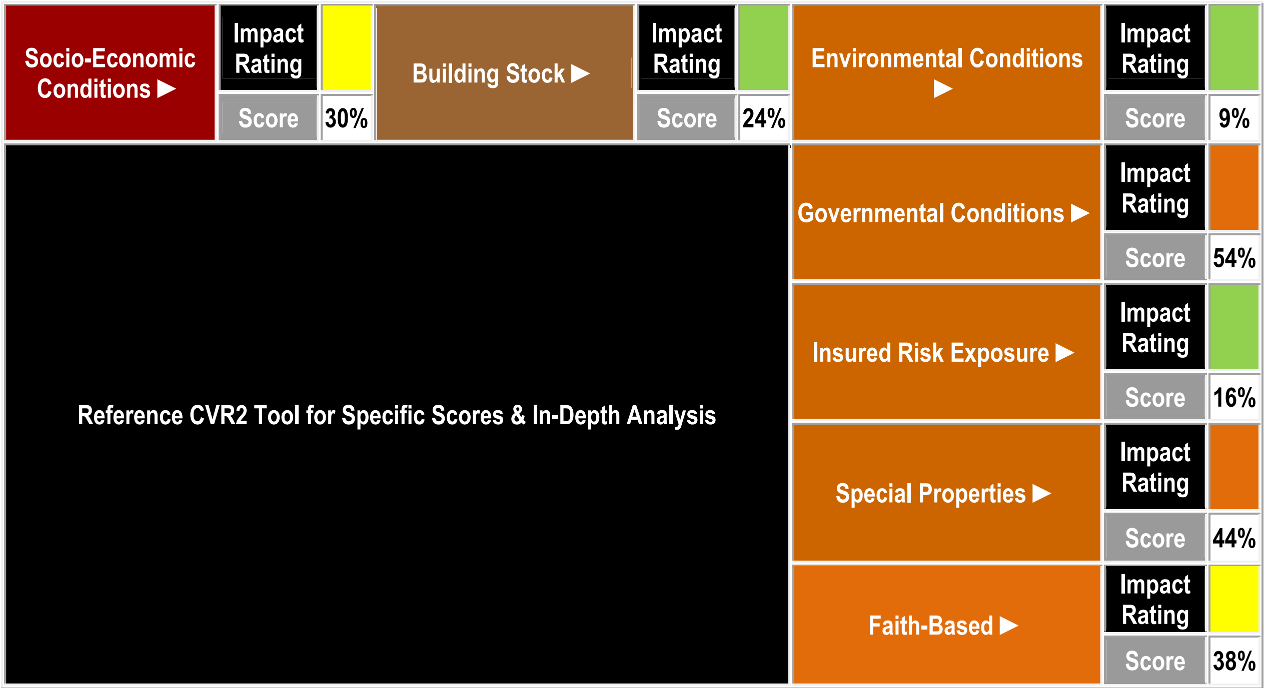
(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	1%	Score	0%	Score	0%	Score	10%	Score	N/A	Score	85%

Summary of Volcano Events	
Subject	Local Data
Number of Hazard Events Since 1950	0
Number of Hazard Events per Decade Since 1950	0
Number of Hazard Events in Past 5 Years	0
Number of Catastrophic Events	0
Number of Injuries Since 1950	0
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	0
Total Property Damage in Past 5 Years	0
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	0

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	37%		Score	15%		Score	32%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%


Socio-Economic Conditions ▶
Impact Rating
Score
30%
Building Stock ▶
Impact Rating
Score
24%
Environmental Conditions ▶
Impact Rating
Score
9%
Governmental Conditions ▶
Impact Rating
Score
54%
Insured Risk Exposure ▶
Impact Rating
Score
16%
Special Properties ▶
Impact Rating
Score
44%
Faith-Based ▶
Impact Rating
Score
38%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis

WINDSTORMS

OVERVIEW/INTRODUCTION

High winds are commonly associated with severe thunderstorms, tornados, or large barometric pressure gradients. Severe storms are prevalent March through November. Several characteristics that are associated with thunderstorms include lightning, hail, strong winds, tornados and flash flooding. Wind, tornado, and flood hazards are discussed in detail in dedicated sections of this report.

Gales or extremely strong winds are common from September through April. The most likely cause of strong winds in the spring and summer are thunderstorms along or near frontal boundaries. Two scenarios that produce winds strong enough to generate significant damage are severe storms and barometric pressures changes. A large barometric pressure gradient, or rapid change in pressure, which causes a swift movement of air parcels and strong wind result. These two wind scenarios can occurs simultaneously as is the case in most storms with gust fronts or well-defined squall lines.

Derechos are widespread, violent storms that have a long duration and cover a large geographic area with constant speeds of 60 to 70 mph with gusts of hurricane strength. Some tornadoes have occurred with derechos, but they are often referred to as gustanados. Derechos are often recognized on Doppler radar from their bow echo features and can be observed on the ground by a very large and sudden wall of clouds that have a well defined organized front.

Beaufort Wind Scale

The Beaufort Wind Scale is a standardized scale that measures the sustained wind intensity and the respective characteristics. The following table summarizes the Beaufort Wind Scale for significant winds.

Beaufort Wind Scale	
Category	Criteria
0 Calm	On Water: Sea surface smooth and mirror-like. On Land: Calm, smoke rises vertically.
1 Light Air	On Water: Scaly ripples, no foam crests. On Land: Smoke drift indicates wind direction, still wind vanes.
2 Light Breeze	On Water: Small wavelets, crests glassy, no breaking. On Land: Wind felt on face, leaves rustle, vanes begin to move.
3 Gentle Breeze	On Water: Large wavelets, crests begin to break, scattered whitecaps. On Land: Leaves and small twigs constantly moving, light flags extended.
4 Moderate Breeze	On Water: Small waves 1-4 ft. becoming longer, numerous whitecaps. On Land: Dust, leaves, and loose paper lifted, small tree branches move.
5 Fresh Breeze	On Water: Moderate waves 4-8 ft taking longer form, many whitecaps, some spray. On Land: Small trees in leaf begin to sway.
6 Strong Breeze	On Water: Larger waves 8-13 ft, whitecaps common, more spray. On Land: Larger tree branches moving, whistling in wires.
7 Near Gale	On Water: Sea heaps up, waves 13-20 ft, white foam streaks off breakers. On Land: Whole trees moving, resistance felt walking against wind.
8 Gale	On Water: Moderately high (13-20 ft) waves of greater length, edges of crests begin to

	break into spindrift, foam blown in streaks. On Land: Whole trees in motion, resistance felt walking against wind.
9 Strong Gale	On Water: High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility. On Land: Slight structural damage occurs, slate blows off roofs.
10 Storm	On Water: Very high waves (20-30 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility. On Land: Seldom experienced on land, trees broken or uprooted, considerable structural damage.
11 Violent Storm	On Water: Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced. On Land: N/A
12 Hurricane	On Water: Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced. On Land: N/A

The National Weather Service provides alerts when conditions are favorable for Windstorms. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria
Wind Advisory	Sustained winds ≥ 40 mph for at least 2 hours or any gust between 58 mph to 74 mph.
Lake Wind Advisory	Winds sustained at 20 mph or higher for 3 hours or more, or any gusts to 30 mph or higher.
High Wind Watch	Conditions are favorable for high winds in and close to the watch area in the next 12 to 48 hours.
High Wind Warning	Sustained winds ≥ 40 mph for at least 2 hours or any gust ≥ 58 mph.

PROFILE OF WINDSTORMS IN MIAMI-DADE

Windstorms are not typically a singular event but are associated with severe thunderstorms, hurricanes, tropical storms, tornadoes, and derechoes. The rainy season for Southern Florida is from June 1 to November 30, when windstorms are the most prevalent.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment *(Refer to CVR2 Tool)*											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index		Index		Index Rating		Index Rating	

					Rating		Rating						
Score	50%	Score	10%	Score	10%	Score	15%	Score	75%	Score	82%		

Summary of Windstorm Events	
Subject	Local Data
Number of Hazard Events Since 1950	90
Number of Hazard Events in Past 5 Years	11
Number of Catastrophic Events	N/A
Number of Injuries Since 1950	30
Number of Injuries in Past 5 Years	1
Number of Fatalities Since 1950	6
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	$6,000,000
Total Property Damage in Past 5 Years	$150,000
Total Crop Damages Sine 1950	$600,000
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	37%		Score	42%		Score	45%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	41%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	24%		Score	61%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	62%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	

[redacted]		Score	40%
	Special Properties ▶	Impact Rating	
		Score	44%
	Faith-Based ▶	Impact Rating	
		Score	38%

WILDLAND FIRE

OVERVIEW/INTRODUCTION

A wildfire is a naturally occurring event, ignited by lightning and fueled by grasses, brush, and trees. Wildfires help to control the buildup of woody debris, improve soil conditions, reduce weedy and invasive plants, reduce plant disease, and maintain the habitat conditions thus providing a healthy ecosystem. However, as Florida communities grow and expand they push into wildfire-prone areas, aggravating the delicate ecosystem and increasing the risk of fires. This interaction is called the urban-wildland interface fire.

An urban-wildland interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels (FEMA). An urban-wildland interface fire is typically ignited by human activities including campfires, uncontrolled burns, smoking, vehicles, trains, equipment use, and arsonists. People start more than four out of every five wildfires, usually as debris burns, arson, or carelessness.

Florida accounts for 5% of the nation's wildfires in a given year. Since 1998, more than 15,000 Florida wildfires have burned over one million acres destroying over 750 structures. Florida wildfires are an example of the increasing threat of fires from the Urban-Wildland Interface.

Wildfire behavior is based on three primary factors: fuel, topography, and weather. The type and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. Fuels are the most important factor in determining fire behavior in Florida, due to the large amounts of vegetative growth from the long growing season, ample sunshine, significant annual rainfall. The amount of fuel consisting of dry woody debris dramatically increases following a hurricane. The continuity of fuels, expressed in both horizontal and vertical components is also a factor, in that it expresses the pattern of vegetative growth and open areas.

Topography affects the movement of air (and thus the fire) over the ground surface. The slope and terrain can change the rate of speed at which fire travels. Topography is the least important factor in Florida, because of the generally flat layout of the land. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity, and wind (both short and long term) affect the severity and duration of wildfires (FEMA). Most Florida wildfires occur during Florida's dry season, from January to May. Weather phenomena such as El Nino and La Nina events further complicate the delicate balance of these three essential components to wildfire. The deluge of rainfall that occurs during El Nino events creates excessive vegetative growth. El Nino is followed by La Nina, which creates drought conditions and excessive heat. As a result, the abundant vegetative growth dies off and provides ample fuel for wildfires.

Fire Danger Levels

The National Fire Danger Rating System (NFDRS) is a system that allows local agencies to estimate today's or tomorrow's fire danger. It integrates the effects of existing and expected fire danger factors into one or more qualitative value that reflects an area's fire protection needs. It links local agencies readiness level to the potential fire problems for that particular day.

Fire Danger Levels	
Level	Criteria
Low	Ignition: Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires. Spread: Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. Spotting: There is little danger of spotting. Control: Easy
Moderate	Ignition: Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Spread: Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Spotting: Short-distance spotting may occur, but is not persistent. Control: Fires are not likely to become serious and control is relatively easy.
High	Ignition: All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Spread: Fires spread rapidly. High-intensity burning may develop on slopes or in concentrations of fine fuels. Spotting: Short-distance spotting is common. Control: Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High	Ignition: Fires start easily from all causes. Spread: Immediately after ignition, spread rapidly and increase quickly in intensity. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels. Spotting: Spot fires are a constant danger; long distance spotting likely. Control: N/A
Extreme	Ignition: Fires start quickly and burn intensely. All fires are potentially serious. Spread: Furious spread likely, along with intense burning. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Spotting: Spot fires are a constant danger; long distance spotting occurs easily. Control: Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

The National Weather Service provides alerts when conditions are favorable for Wildland Fires. The following table provides information on the different alerts for the National Weather Service:

National Weather Service Alerts	
Alert	Criteria

Fire Weather Watch	Conditions are favorable for red flag conditions in and close to the watch area in the next 12 to 48 hours.
Red Flag Warning	Iis issued for weather events which may result in extreme fire behavior that will occur within 24 hours. Red Flag criteria occurs whenever a geographical area has been in a dry spell for a week or two, or for a shorter period, and the National Fire Danger Rating System (NFDRS) is high to extreme and if there is a sustained wind average 15 mph or greater, a relative humidity less than or equal to 25 percent, and a temperature of greater than 75 degrees F.

PROFILE OF WILDLAND FIRES IN MIAMI-DADE

Miami-Dade County possess a unique set of characteristics that make much of the state highly susceptible to wildfire: an abundance of wildlands, the presence of residents into these wildlands, and the intermingling of the built environment within wildland areas. Florida's wildland vegetation evolved in a fire ecosystem allowing it to thrive by the natural maintenance characteristics of fire. Fine fuels, which are easily ignited and spread fire rapidly, are abundant throughout Florida. The lack of managed fire in much of the wildlands has promoted an accumulation of these fuels that will burn with such intensity as to hamper suppression efforts. The communities throughout Florida face a complex problem that is compounded by increasing fire intensities due to accumulation of vegetative materials, continued residential growth into wildland fire-prone areas, and increasing firefighting costs. One of the necessities of profiling the risk of wildfire is to understand the most susceptible ecosystems of Southern Florida.

The scrub ecosystem consists of dense vegetation with sandy and dry soils. The scrub ecosystem is typically found isolated in other pine ecosystems. Intense wildfires occur every 10 to 100 years. During dry conditions, scrub pine is one of the most dangerous ecosystems for homes and homeowners with regard to wildfire hazard. The thick vegetation causes an ignited wildfire to produce a lot of heat. The high heat increases the amount and dispersal distance of firebrands making structures near a scrub pine wildfire susceptible to the air-borne embers. Homeowners living within or near the scrub pine ecosystem need to utilize hazard reduction strategies, including the creation of defensible space.

Flatwood ecosystems dominate Florida. Most pines planted for commercial use function similar to the pine flatwoods natural ecosystem with respect to fire. The separation of tree crowns and under story vegetation keeps fire on the ground at low intensities and prevents spread into the crown. Fire frequency in pine flatwoods is typically one to eight years. If fire is excluded from these areas for longer periods, under story shrubs, invading hardwoods and vines can greatly increase the risk of crown fire.

Dry prairie ecosystems have scattered, isolated trees with shrubs typical of the pine flatwood ecosystem. The lack of tree canopy or crowns supports the rapid growth of shrubs and herbaceous plants, which can burn readily during the dry season. Fire frequency is one to four years in dry prairies. Dry prairie fires can spread rapidly depending on the weather and moisture content of the vegetation.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment *(Refer to CVR2 Tool)*					
Frequency/Probability	Magnitude/Scale	Casualty &	Damage	Hazard-Specific	Hazard-Specific

Assessment		Assessment		Fatality Assessment		Assessment		Mitigation Assessment		Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	38%	Score	15%	Score	5%	Score	10%	Score	63%	Score	68%

Summary of Wildland Fire Events	
Subject	Local Data
Number of Hazard Events Since 1950	16
Number of Hazard Events in Past 5 Years	1
Number of Catastrophic Events	0
Number of Injuries Since 1950	2
Number of Injuries in Past 5 Years	0
Number of Fatalities Since 1950	0
Number of Fatalities in Past 5 Years	0
Total Property Damage Since 1950	$3,000,000
Total Property Damage in Past 5 Years	$30,000
Total Crop Damages Sine 1950	0
Total Crop Damages in the Last 5 Years	0
Number of Presidential Declarations	

Source: NCDC and SHELDUS

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	57%		Score	42%		Score	51%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	68%		Score	41%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	50%		Score	24%		Score	61%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	55%		Score	62%		Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	

[redacted]		Score	81%
	Insured Risk Exposure ▶	Impact Rating	
		Score	54%
	Special Properties ▶	Impact Rating	
		Score	44%
	Faith-Based ▶	Impact Rating	
		Score	38%

EARTHQUAKE

OVERVIEW/INTRODUCTION

Earthquakes also known as 'seismic events' are sudden slippages or movements in a portion of the earth's crust accompanied by a series of vibrations. The ground shaking is caused by the sudden release of accumulated strain by an abrupt shift of rock along a fracture or fault in the earth, by volcanic or magmatic activity, or by other sudden stress changes in the earth's crust. The hypocenter of an earthquake is the location beneath the earth's surface where the rupture of the fault begins. The epicenter of an earthquake is the location directly above the hypocenter on the surface of the earth.

Earthquakes occur on faults. A fault is a fracture or zone of fractures between two blocks of rock. Faults allow the blocks to move relative to each other. This movement occurs rapidly during an earthquake. Faults may range in length from a few millimeters to thousands of kilometers. Most faults produce repeated displacements or repeated earthquakes over long time periods. During an earthquake, the rock on one side of the fault suddenly slips with respect to the other. The fault surface can be horizontal or vertical or some arbitrary angle in between. Geologists use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults.

Faults which move along the direction of the dip plane are dip-slip faults and described as either normal or reverse (thrust), depending on their motion. Faults which move horizontally are known as strike-slip faults and are classified as either right-lateral or left-lateral. Faults which show both dip-slip and strike-slip motion are known as oblique-slip faults. Normal faults are a dip-slip fault in which the block above the fault has moved downward relative to the block below. This type of faulting occurs in response to extension and is often observed in the Western United States Basin and Range Province and along oceanic ridge systems.
Thrust fault is a dip-slip fault in which the upper block, above the fault plane, moves up and over the lower block. This type of faulting is common in areas of compression, such as regions where one plate is being sub-ducted under another as in Japan. When the dip angle is shallow, a reverse fault is often described as a thrust fault. Strike-slip fault is a fault on which the two blocks slide past one another. The San Andreas Fault is an example of a right lateral fault. A left-lateral strike-slip fault is one on which the displacement of the far block is to the left when viewed from either side. A right-lateral strike-slip fault is one on which the displacement of the far block is to the right when viewed from either side.

Aftershocks are earthquakes that follow the largest shock of an earthquake sequence. They are smaller than the main shock and within 1-2 rupture lengths distance from the main shock. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the main shock, the larger and more numerous the aftershocks, and the longer they will continue.

It is estimated that there are 500,000 detectable earthquakes in the world each year. 100,000 of those can be felt, and 100 of them cause damage. Geologists have identified regions where earthquakes are likely to occur in the United States. Earthquakes happen daily around the world. Currently there is no known time or season for earthquakes or seismic activity. Earthquakes and seismic activity has a very rapid and unpredictable onset. Current technology cannot predict an earthquake and is limited to real-time seismic surveillance. The duration of an earthquake is related to its magnitude but not in a perfectly strict sense. There are three ways to think about the duration of an earthquake. The first is the length of time it takes for the fault to fully rupture. The second is the length of time shaking is felt at any given point. Earthquakes can last from seconds to minutes. The third way to think about duration is the aftershock period after the main seismic event. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the main shock, the larger and more numerous the aftershocks, and the longer they will continue. Earthquakes occur daily around the world, and it is estimated that there are 500,000 detectable earthquakes in the world each year.

Modified Mercalli Intensity Scale

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. The Modified Mercalli (MM) Intensity Scale is the common intensity scale used in the United States. This scale is composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the non-scientist than the magnitude because intensity refers to the effects actually experienced at that place. The following is an abbreviated description of the 12 levels of Modified Mercalli intensity.

Modified Mercalli Intensity Scale	
Levels of Intensity	Observed Earthquake Effects
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Richter Magnitude Scale
The Richter magnitude scale, is used as an indicator of the force of an earthquake, measures the magnitude, intensity, and energy released by an earthquake. Each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value. It is important to note that the Richter Magnitude Scale is NOT used to express damage.

National Weather Service Alerts	
Magnitude	Earthquake Effects
<2.0	Micro earthquakes, not felt.
2.0 - 2.9	Minor earthquakes, enerally not felt, but are recorded.
3.0 - 3.9	Minor earthquakes, often felt, but rarely causes damage.
4.0 - 4.9	Light earthquakes, noticeable shaking of indoor items, rattling noises, and significant damage is unlikely.
5.0 - 5.9	Moderate earthquakes, can cause major damage to poorly constructed buildings over small regions, and possible slight damage to well-designed buildings.
6.0 - 6.9	Strong earthquakes, can be destructive in areas up to about 99 miles across in populated regions.
7.0 - 7.9	Major earthquakes, an cause serious damage over larger regions.
8.0 - 8.9	Great earthquakes, can cause serious damage in regions several hundred miles across.
9.0 - 9.9	Great earthquakes, devastating in areas several thousand of miles across.
10<	Massive earthquakes, never recorded, widespread devastation across vast regions.

PROFILE OF EARTHQUAKES IN MIAMI-DADE

Southern Florida does not have documented active fault lines and those that have occurred are most likely a result of the small percentage (10%) of earthquakes that occur outside of fault zones. However, there have been several large earthquakes that have occurred outside of the state which resulted in the state's most significant tremors. The active fault lines located near Charleston, South Carolina and the Caribbean have produced several quakes that were felt throughout Florida. A belt of mostly seaward-facing faults borders the northern Gulf of Mexico including westernmost Florida. The Gulf Coast faults are divided in four large groups because they number in the hundreds. The gulf-margin faults in Alabama and Florida have low seismicity.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment *(Refer to CVR2 Tool)*					
Frequency/Probability Assessment	Magnitude/Scale Assessment	Casualty & Fatality Assessment	Damage Assessment	Hazard-Specific Mitigation Assessment	Hazard-Specific Capability Assessment

Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	5%	Score	5%	Score	0%	Score	5%	Score	N/A	Score	68%

The USGS database shows that there is a 0.279% chance of a major earthquake within 50 kilometers of Miami, Florida within the next 50 years. The largest earthquake within 100 miles of Miami, Florida was a 3.2 Magnitude in 1992.

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	24%		Score	29%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	49%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	54%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

TECHNOLOGICAL HAZARDS

In many respects, life in the 21st century is dependent on technology. Life's basic requirements of food, shelter, and clothing are no longer available except through manufactured means. Food production, housing, heating, and transportation to our work locations are all dependent upon technology.

Miami-Dade County is part of an industrialized region of the nation and has a very dynamic and complex infrastructure. It has important transportation networks; an international airport; large wholesale centers for the exchange and distribution of goods; and is a major economic power in the state of Florida. The County's infrastructure, large residential population, and highly industrialized nature make it vulnerable to technological hazards.

Unlike natural hazards that are often forecast, technological hazards are sudden and unexpected. Technological hazards include hazardous materials releases, large-scale fires, structural failures, transportation incidents, and utility failures. In many cases, the risks are minimized through engineered safety mechanisms, but in others the risk is magnified due to aging infrastructure and security vulnerabilities. Technological hazards can result in incidents that range in size from those that are easily contained, to those that can overwhelm Miami-Dade County's ability to respond. Technological hazards pose a credible risk to the County and this will continue to do so due to our society's growing dependence on technology.

The following technological hazards were included in this assessment:

- Hazardous Materials Release
- Dam Failure/Levee/Dike
- Structural Fires
- Transportation Incident (i.e. Highway and/or Rail Incident)
- Contaminated Water Incident
- Electric Utility Failure
- Mass Migration

DAM AND LEVEE FAILURE

OVERVIEW OF WATER CONTROL FAILURE

Levee and Dike Failures are a real risk in today's post-Katrina world for communities around Lake Okeechobee. A levee (or dike) is an artificial earthen wall, constructed as a defense along the edge of a body of water, to prevent it from flooding onto adjacent lowlands. Levee flooding is caused by overtopping, failure, or seepage through or under the structure. Levee failures or overtopping can produce dangerous flooding because of the high velocities and large volumes of water released.

Dam Failure

A dam failure is defined as an uncontrolled release of the reservoir. The causes of dam failures can be divided into three groups: dam overtopping, excessive seepage, and structural failure of a component. Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that can lead to failure. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage amounts can cause significant flooding downstream. Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including the use of improper construction materials and construction practices;
- Negligent operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion; and
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, which can weaken entire structures.

Dams are complicated structures, and it can be difficult to predict how a structure will respond to distress. "… the modes and causes of failure are varied, multiple, and often complex and interrelated, i.e., often the triggering cause may not truly have resulted in failure had the dam not had a secondary weakness. These causes illustrate the need for careful, critical review of all facets of a dam" (Safety of Existing Dams, 1983).

Levee Failure

Man-made levees can fail in a number of ways. The most frequent (and dangerous) form of levee failure is a levee breach. A levee breach is when part of the levee actually breaks away, leaving a large opening for water to flood the land protected by the levee. A breach can be a sudden or gradual failure that is caused either by surface erosion or by a subsurface failure of the levee. Sometimes levees are said to fail when water overtops the crest of the levee.

PROFILE OF DAM AND LEVEE FAILURE INCIDENT IN MIAMI-DADE

- Refer to the following sections in the Vulnerability Index and Assessment: Water Control Structures

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	6.25%	Score	10%	Score	12.5%	Score	12.5%	Score	46%	Score	63%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	15%		Score	40%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	17%		Score	37%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	45%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	24%		Score	45%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%

	Faith-Based ►	Impact Rating	
		Score	38%

ELECTRIC UTILITY FAILURE

OVERVIEW AND INTRODUCTION

An electric power outage (also power failure or power loss) is the loss of the electricity supply to a geographic area. The area of an outage (scale) can range from a single facility or neighborhood to a multi-state region. The length of the outage (scope) is determined by combination of factors to include the scale of the outage, weather, and redundant equipment and capacity. The scale of the outage often directly affects the scope as often occurs during a hurricane; the greater number of down utility poles, wires, and transformers the longer the repair and restoration time.

A power outage can be described as a blackout if power is lost completely or as a brownout if the voltage level is below the normal minimum level specified for the system. The reasons for a power outage can for instance be a defect in a power station, damage to a power line or other part of the distribution system, a short circuit, or the overloading of electricity mains. 'Load shedding' is a common term for a controlled way of rotating available generation capacity between various districts or customers, thus avoiding total wide area blackouts.

Power outages are particularly serious for hospitals and other critical facilities and operations. Our society is extremely reliant upon life-critical medical devices, communications, and electronic information all of which require reliable (uninterrupted) electric power. This reliance on electric power has forced hospitals, data and telecommunications centers, and financial and trading institutions to have arrays of back-up batteries and emergency power generators. These generators, which are typically powered by diesel fuel, but should be ideally powered by natural gas where available, are configured to start automatically, as soon as a power failure occurs.

SUMMARY OF POWER UTILITY FAILURE IN MIAMI-DADE

The entire energy system is complex and consists of three major parts: generation, transmission, and distribution. The control and communication between these parts are extremely important as the failure of one part could disrupt the entire system. The energy system is reliant upon the following factors: continual maintenance, equipment replacement and redundancy, and additional high-load capacity. These factors have to be carefully balanced against operating cost and profit i.e. these initiatives are expensive but the costs cannot be readily push down to the consumer due to public pressure and opinion.

The Florida Reliability Coordinating Council (FRCC) was formed on September 16, 1996. The FRCC is one of nine regional electric reliability councils under North American Electric Reliability Corporation (NERC) authority. FRCC's offices are located in Tampa, Florida. The FRCC region lies within the Eastern Interconnection and serves almost all of Florida, with the exception of a portion of the Florida Panhandle below Alabama. FRCC members include investor-owned utilities, cooperative utilities, municipal utilities, one federal power agency, power marketers and independent power producers. Due to the geographical and electrical configuration of Florida, the state has been divided into two areas - Area 2 includes Orlando, Tampa, St. Petersburg and Miami (central and south Florida). Area 1 includes western and northern Florida.

The FRCC's real-time and next day Reliability Coordinator function is located at Florida Power and Light's System Control Center. The main responsibilities, as defined in detail in the FRCC Security Process

Document, are to ensure the reliable operation of the FRCC (Florida) electrical transmission grid and support power transfers for native loads and Merchant transactions.

The Florida Public Service Commission has adopted the FRCC Generating Capacity Shortage Plan. This plan recognized that there might be times when generating capacity is tight or falls below consumer demand due to periods of abnormal weather or events of multiple unanticipated generating outages. The plan:

1. Provides for early identification of situations that could lead to electricity shortages
2. Coordinates actions among utilities, regulators, and state and local emergency agencies
3. Establishes a communication network to assist consumers during an electricity shortage
4. Issues appeals for voluntary conservation

The shortage plan has four stages:

Generating Capacity Advisory: A "Generating Capacity Advisory" is similar to a hurricane watch. It is intended to give early warning of potential electricity shortfalls and bring utilities, emergency management officials, the Governor and the Florida Public Service Commission to a state of readiness. The Advisory is primarily for information purposes. It automatically kicks off utility tracking activities, and it initiates inter-utility and inter-agency communication. While advisories do not usually require public action, general information about the potential problem can be distributed to consumers to forewarn them of conditions if necessary. A generating capacity advisory is triggered by:

1. A forecast of extreme temperatures around the state
2. A public conservation appeal by an individual utility
3. A disruption of the gas pipeline(s) serving the FRCC Region may threaten to adversely affect the generation capacity in the FRCC Region.

Temperature thresholds have been set for each city in the region and when a predetermined number of cities exceed their temperature triggers, an advisory is declared for that area. The temperatures are important since severe weather (hot or cold) can be accompanied by significant increases in electric demand. An advisory also is declared when any individual utility plans to or calls for voluntary conservation from its customers. At times the problem may be local and may not require or allow statewide assistance. Even in this circumstance, the advisory sensitizes all utilities to the problem and heightens awareness in case the event escalates into a potential statewide problem.

Generating Capacity Alert: The second stage of the plan is a "Generating Capacity Alert." It is based on a reserve margin - the difference between available statewide resources and the amount of peak electric demand projected for that day. An alert will be called when the:

1. Reserves fall below the size of the largest generating unit in the state (currently a little more than 900 MW)
2. Disruption of the gas pipeline(s) serving the FRCC Region will adversely affect the generation capacity in the FRCC Region.

The reason for this trigger is that when reserves fall below this level, loss of that size unit to an unexpected mechanical failure could lead to blackouts somewhere since insufficient backup is available.

The alert starts actions to increase reserves. For example, available emergency supply options would be explored. Additionally, utilities can reduce electric demand through load management programs. These programs give utility dispatchers control over certain appliances and electrically powered equipment according to pre-arranged customer agreements. Through remote control equipment and installation of special switches on appliances (such as electric water heaters, air conditioning/heating systems and pool pumps), the dispatcher can cycle appliances on and off as needed during a peak demand period. Close to 1500 MW of load management is available statewide. Utilities also can ask consumers to implement voluntary conservation measures.

Some utilities have industrial or commercial customers on interruptible service. Under this agreement, the customer gets lower priced energy in exchange for the utility's right to interrupt their electricity on short notice to lower electric demand. The difference between load management and interruptible service is that the first selectively cycles specific appliances on and off for short periods of time, while the second cuts off service to the industrial load entirely.

Typically, industrial customers on interruptible service have backup power (either they own small generators or are co-generators) and are able to supply their own electric needs for these periods. A little more than 1100 MW of interruptible load is available statewide.

Generating Capacity Emergency: A "Generating Capacity Emergency" occurs when firm load is lost or, in other words, blackouts occur or are inevitable somewhere in Florida. Rolling blackouts, manually activated by utilities, are a last resort to avoid system overload and possible equipment damage. Without them, the electric system could experience an automatic shutdown that would result in more widespread and longer blackouts. By the time rolling blackouts are used, utilities would have exhausted every available means to balance supply and demand.

Prior to rolling blackouts, actions include bringing all generating units to full capability, starting all units that are available, purchasing energy from outside the state, reducing non-essential electric use at utility facilities, using load management, cutting off interruptible customers, reducing voltage within established safe limits, and issuing appeals to consumers for emergency cutbacks of electricity use and voluntary conservation.

At this stage of the shortage plan, actions and information are coordinated among utilities, emergency agencies, the Governor, the Florida Public Service Commission, and the media. Frequent status reports are provided to agencies and the media. The Division of Emergency Management would consider using the Emergency Broadcast System (EBS) to inform citizens of events and to direct them to available shelters if conditions warranted.

Recognizing the consequences of a loss of electricity, individual utility emergency plans include provisions for special facilities critical to the safety and welfare of citizens such as hospitals, fire and police departments, mass transit, communication services, water supply and sanitation facilities, and national defense installations. Every effort is made to maintain power to these facilities, but utilities recommend that emergency facilities or anyone with critical equipment should install emergency or portable generating equipment.

Although the state shortage plan is set up to give consumers advance warnings, there can be circumstances (such as the sudden loss of the transmission lines that connect Florida to the rest of the U.S., or the loss of multiple generating units) where blackouts suddenly could occur without the opportunity to issue warnings.

When the power goes out during rolling blackouts, consumers should immediately turn off major appliances and the heating or air conditioning system. Once power is restored, appliances can be returned to use gradually as needed. This prevents sudden power drain as electricity is restored and avoids the possibility of an overload that could knock out power on a local electrical supply circuit.

System Load Restoration: "System Load Restoration" is the last phase of the plan and is instituted when rolling blackouts have been terminated and power supply is adequate. It is the recovery stage and concerted efforts are made to provide frequent system status reports. Messages to consumers would focus on the timing and location of facility repairs, appropriate safety information and consumer self-help instructions. Phone lines at utilities are exceptionally busy at these times and consumers are urged to wait until power has been restored in their neighborhood before calling to report individual service problems.

Florida Power and Light - Description of Existing Resources: FPL's service area contains approximately 27,650 square miles and has a population of approximately 8.5 million people. FPL served an average of 4,318,739 customer accounts in thirty-five counties during 2005. These customers were served from a variety of resources including: FPL-owned fossil and nuclear-generating units, non-utility owned generation, demand side management, and interchanged / purchased power.

The existing FPL generating resources are located at fourteen generating sites distributed geographically around its service territory an also include partial ownership of in one unit located in Georgia and two units located in Jacksonville, Florida. The current generating facilities consist of four nuclear steam units, three coal units, eleven combined cycle units, seventeen fossil steam units, forty-eight combustion gas turbines, one simple cycle combustion turbine, and five diesel units. FPL's bulk transmission system is comprised of 6,470 circuit miles of transmission lines. Integration of generation, transmission, and distribution system is achieved through FPL's 542 substations in Florida.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	75%	Score	30%	Score	0%	Score	0%	Score	67%	Score	65%

Summary of Structural Fire Events		
Date	Location	Event Description
Significant Local Events		
2005	South Florida (including Miami)	Hurricane Wilma caused loss of power for 3.2 million customers in South Florida and Southwest Florida, with hundreds of thousands of customers still powerless a week later and full restoration not complete until November 11.
2005	South Florida (including Miami)	1.3 Million People in South Florida lost power due to downed trees and power lines caused by the then category 1 Hurricane Katrina. Most customers affected were without power for four days, and some customers had no power for up to one week.
2004	South Florida (including Miami)	5 million people in Florida were without power at one point due to Hurricane Frances, one of the most widespread outages ever due to a hurricane.

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	23%		Score	35%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	41%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact	

[redacted]		Rating	
		Score	38%

HAZARDOUS MATERIALS RELEASE

OVERVIEW AND INTRODUCTION

Hazardous materials are materials that if released, can pose a threat to human health or the environment. Hazardous material releases can cause long/short term health effects, damage to property, expensive cleanup/contractor costs, serious injury, and even death. Hazardous materials are stored and transported throughout Southern Florida area in various quantities. The storage of hazardous materials ranges from residential storage of household products to bulk storage of large volumes for industrial purposes. Hazardous materials are transported by various methods such as railcars, barges, and trucks. For purposes of this study, only those locations where the bulk storage of hazardous materials is present will be addressed because the amount of bulk storage material affects its potential risk.

The release of a hazardous material during handling would most likely be the initial responsibility of the facility or carrier. If the release could not be contained by the facility or carrier, then resources would need to be mobilized to remediate the release. For example, if a hazardous materials release occurred from a barge, contractor support would be needed to contain the release with vacuum trucks, boom, and skimmers. In addition, if a tanker containing sulfuric acid overturned on the highway, resources would be needed to clean up the spill and air monitoring support would be needed to assure the neighboring community that they are not at risk from the inhalation of acidic fumes from the release.

Once a hazardous material release is recognized, immediate action must be taken to respond to the release to preserve health and safety and reduce the impact to the neighboring community and the environment. Hazardous material releases in highly populated areas could result in evacuation or “shelter-in-place” situations. A hazardous material release may be a rare occurrence, but one major release could have a significant impact on Miami-Dade.

PROFILE OF HAZARDOUS MATERIAL RELEASE VULNERABILITY IN MIAMI-DADE

Fixed Facilities

Hazardous materials being used or stored at industrial facilities and in buildings is defined as a fixed facility hazardous material release hazard. Fixed facilities include industrial facilities that store hazardous materials required for their processing or facilities that store hazardous materials that result from an industrial process. An uncontrolled release or mishandling of hazardous materials from a fixed facility may result in possible injury or fatality, severe financial loss or liability, contamination, and disruption of critical infrastructure

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, was enacted in November 1986 to enable state and local governments to adequately prepare and plan for chemical emergencies. Facilities that have spilled hazardous substances, or that store, use, or release certain chemicals are subject to various reporting requirements. Common EPCRA topics include: emergency planning; hazardous chemical inventory reporting; chemical information; toxic chemical release reporting; risk management plans, and the toxics release inventory (TRI) database. The TRI database includes facilities that manufacture (including importing), process, or otherwise use a listed toxic chemical above threshold quantities. Facilities covered by EPCRA must submit an emergency and hazardous chemical inventory form to the Local Emergency Planning Committee (LEPC), the State Emergency Response Commission (SERC) and the local fire department annually. This report, also called a Tier I or

Tier II, includes basic information including facility identification; employee contact information for emergencies and non-emergencies; and site specific information including facility description, chemical types and descriptions, releases or incidents, and chemical storage capacity, capabilities, and locations.

Transport

Hazardous Materials Freight Transport		
Freight Movement	Tonnage	Percent
Florida Intrastate		
Rail	3.775M tons	67.2
Truck	1.764M tons	31.6
Air	4,300 tons	0.1
Water	40,000 tons	0.7
Interstate to/from Florida		
Rail	572,000 tons	31.2
Truck	512,000 tons	35.0
Air	4,000 tons	0.2
Water	657,000 tons	33.6

A hazardous material is a substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Transported hazardous materials are classified into one of nine hazard classes. The hazard class is the category of a hazard assigned to a hazardous material according to 49 CFR 173 and the HMT. If a material falls into any of the following classes it is considered a hazardous material:

- Class 1 – Explosives
- Class 2 -- Gases
- Class 3 -- Flammable Liquids (and Combustible Liquids)
- Class 4 -- Flammable Solids; Spontaneously Combustible Materials; Dangerous when Wet Materials
- Class 5 -- Oxidizers and Organic Peroxides
- Class 6 -- Toxic Materials and Infectious Substances
- Class 7 -- Radioactive Materials
- Class 8 -- Corrosive Materials
- Class 9 -- Miscellaneous Dangerous Goods

The transportation of hazardous materials occurs by various modes, but in Florida 98.8% of all freight movement is either rail or truck. A 1998 report by the U.S. Department of Transportation entitled Hazardous Materials Shipments states that over 800,000 shipments of hazardous materials are estimated to occur within the United States per day, resulting in a total of 3.1 billion tons shipped annually. Of the 3.1 billion tons shipped annually, 42.9% is transported by truck, 4.4% by rail, 37.9% by pipeline, 14.7% by water, and 0.05% by air. In the State of Florida, the majority of intrastate freight movement is by rail. Interstate freight movement is distributed among rail, truck, and water modes. The following charts reflect the movement of freight by mode and tonnage.

Truck

Although rail transports larger gross tonnage of hazardous materials, the number of truck traffic counts carrying hazardous materials shipments is greater. This is due to the larger volumes involved in a single rail shipment. The majority of hazardous materials transport is conducted on Federal or State highways. Miami-Dade County has heavy freight truck traffic on any of its four federal highways or fifty-three state highways. Florida's Intrastate Highway System conveys most truck hazardous materials shipments.

Railway

In South Florida, over 5,601 tons of hazardous materials are shipped via railroad throughout the state of Florida with 64% of these shipments originating and terminating within the state. Florida's rail system includes 2, 871 miles with CSX Transportation owning and/or leasing 56.3% (1,616 miles). The most siginficant railines in Miami-Dade are:

- CSX Transportation
- Florida East Coast Railway
- South Florida Rail Corridor

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	50%	Score	5%	Score	12.5%	Score	12.5%	Score	50%	Score	55%

Summary of Events		
Date	**Location**	**Event Description**
Significant Local Events		
2011	Miami-Dade	On March 23, 2011 an large fire near the Miami International Airport's fuel farm broke out threatening six fuel tanks with a holding capacity of six million gallons. The fuel farm fire required the mobilization of over 40 units and 100 firefighters, and caused the cancellation of 36 flights and countless number of delayed flights.
2006	Florida	9 railway, 552 highway, and 29 undeclared transit hazardous material release incidents totaling $2.2M in damage occurred in Florida in 2006. Twenty-four of these incidents were considered serious by the US Department of Transportation.
2006	Daytona	2 municipal workers died and another was seriously injured while using a cutting torch

	Beach	to remove a steel roof over a storage tank containing highly flammable methyl alcohol (methanol) at the Bethune Point Wastewater Plant, owned and operated by the City of Daytona Beach.
1998	Stock Island, Key West	A Dion Oil Company (Dion) driver was on top of a straight-truck cargo tank checking the contents of its compartments and preparing to transfer cargo from a semitrailer cargo tank when explosive vapors ignited within the straight-truck cargo tank. The ignition caused an explosion that threw the driver from the top of the truck. The fire and a series of at least three explosions injured the driver and destroyed the straight truck, a tractor, the front of the semitrailer, and a second nearby straight-truck cargo tank. Damage was estimated at more than $185,000.
1988	Collier County	A cylinder containing a mixture of methyl bromide and chloropicrin was punctured following the overturn of a tractor/semitrailer.
Regional Events		
2005	Graniteville, SC	Human error caused a railroad switch to be left open. As a result, two trains collided and a car carrying chlorine gas ruptured. Approximately 90 tons of chlorine gas was released; ten people died and more than 250 peopled were treated for chlorine exposure. Residents within one mile of the crash were forced to evacuate for two weeks. Norfolk Southern estimates that clean-up cost between $30 and $40 million.

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	53%		Score	24%		Score	40%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	50%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	55%		Score	40%		Score	45%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%

[redacted]	Insured Risk Exposure ▶	Impact Rating	
		Score	40%
	Special Properties ▶	Impact Rating	
		Score	20%
	Faith-Based ▶	Impact Rating	
		Score	38%

MASS MIGRATION

OVERVIEW OF MASS MIGRATION

Mass migration refers to the migration of a large group of people from one geographical area to another. Mass migration is distinguished from individual or small scale migration; it is also different from seasonal migration, which occurs on a regular basis. Mass migration is not always voluntary, sometimes including forced migration and refugees.

MASS MIGRATION THREAT TO MIAMI-DADE

Miami-Dade County has a history of mass immigration from the Caribbean basin, particularly Cuba and Haiti. A large uncontrolled influx of immigrants has the potential of significantly disrupting the social and economic stability in Miami-Dade County by overwhelming the delivery of essential services such as medical response and public safety. Armed violence abroad may also precipitate spontaneous mass immigration to south Florida. While the federal government has the primary responsibility for assuming control of mass immigration emergencies, Miami-Dade County may have to provide humanitarian effort including: shelter, food, water, medical, and other social services.

The control of immigration into the United States is the responsibility of the United States Department of Homeland Security (DHS). The Department of Homeland Security has created the OPLAN Vigilant Sentry Plan. OPLAN Vigilant Sentry describes the basic organization and structure by which Homeland Security Task Force – Southeast (HSTF-SE) will deploy resources and direct multi-agency operations to address a potential and full-scale mass migration event. This plan is outlined in the County's Change in Caribbean Government Plan and is located in Volume III of the CEMP.

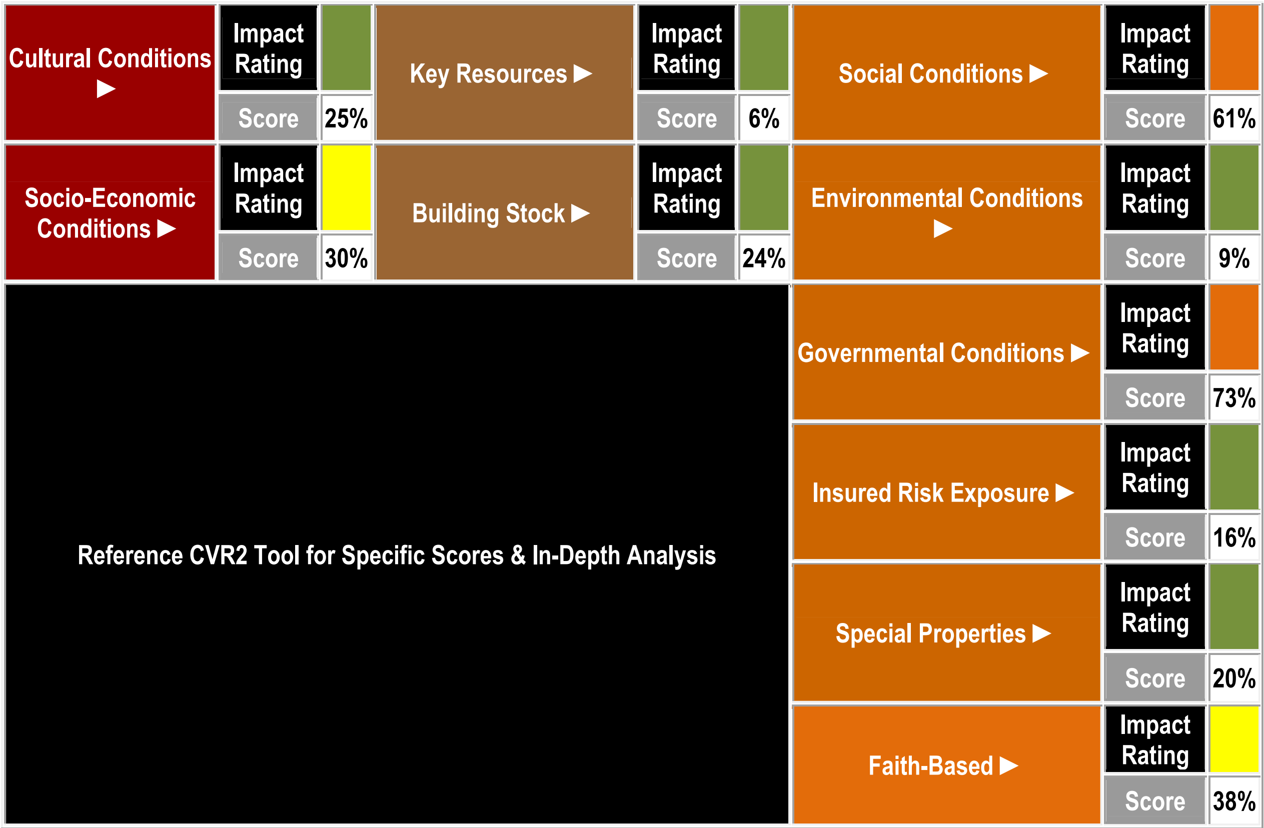
HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	25%	Score	0%	Score	0%	Score	0%	Score	38%	Score	55%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	37%		Score	15%		Score	35%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	56%		Score	17%		Score	26%


Cultural Conditions ▶
Impact Rating
Score
25%
Key Resources ▶
Impact Rating
Score
6%
Social Conditions ▶
Impact Rating
Score
61%
Socio-Economic Conditions ▶
Impact Rating
Score
30%
Building Stock ▶
Impact Rating
Score
24%
Environmental Conditions ▶
Impact Rating
Score
9%
Governmental Conditions ▶
Impact Rating
Score
73%
Insured Risk Exposure ▶
Impact Rating
Score
16%
Special Properties ▶
Impact Rating
Score
20%
Faith-Based ▶
Impact Rating
Score
38%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis

NUCLEAR POWER PLANT INCIDENT

OVERVIEW OF NUCLEAR POWER PLANT INCIDENT

A nuclear power plant is a thermal power station in which the heat source is one or more nuclear reactors. As in a conventional thermal power station the heat is used to generate steam which drives a steam turbine connected to a generator which produces electricity. Nuclear power plants are usually considered to be base load stations, which are best suited to constant power output.

Nuclear reactors can fail in a variety of ways. Should the instability of the nuclear material generate unexpected behavior, it may result in an uncontrolled power excursion. Normally, the cooling system in a reactor is designed to be able to handle the excess heat this causes; however, should the reactor also experience a loss-of-coolant accident, then the fuel may melt or cause the vessel it is contained in to overheat and melt. This event is called a nuclear meltdown. After shutting down, for some time the reactor still needs external energy to power its cooling systems. Normally this energy is provided by the power grid to that the plant is connected, or by emergency diesel generators. Failure to provide power for the cooling systems can cause serious accidents.

As of March 1, 2011, there were 443 operating nuclear power reactors spread across the planet in 47 different countries. In 2009 alone, atomic energy accounted for 14 percent of the world's electrical production. Break that down to the individual country and the percentage skyrockets as high as 76.2 percent for Lithuania and 75.2 for France In the United States, 104 nuclear power plants supply 20 percent of the electricity overall, with some states benefiting more than others.

SUMMARY OF MIAMI-DADE'S NUCLEAR POWER PLANT INCIDENT VULNERABILITY

The Turkey Point Nuclear power plant is located in the southeastern portion of Miami-Dade County adjacent to Biscayne Bay and approximately 10 miles south of Cutler Ridge. Nine of the ten areas within the ten-mile Emergency Planning Zone (EPZ) are inside Miami-Dade County. All of Miami-Dade County is within the 50-mile Emergency Planning Zone. The Florida Division of Emergency Management (DEM) has the overall responsibility for the coordination of any response to a nuclear power plant emergency by federal, state or local agencies. Miami-Dade County's immediate responses for protecting its residents in the event of a nuclear power plant emergency are contained in the Turkey Point Procedure which can be found in Volume III of the CEMP.

For additional information, refer to:

- Energy Sector
- Terrorism

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	18.8%	Score	25%	Score	6.3%	Score	6.3%	Score	81%	Score	54%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	53%		Score	38%		Score	58%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	56%		Score	41%		Score	64%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	
	Score	50%		Score	24%		Score	61%
Socio-Economic Conditions ►	Impact Rating		Building Stock ►	Impact Rating		Environmental Conditions ►	Impact Rating	
	Score	55%		Score	49%		Score	55%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating	
							Score	81%
						Insured Risk Exposure ►	Impact Rating	
							Score	40%
						Special Properties ►	Impact Rating	
							Score	44%
						Faith-Based ►	Impact Rating	
							Score	62%

STRUCTURAL FIRES

OVERVIEW/INTRODUCTION

Structural fire and failure has been a reoccurring hazard for many centuries. As improvements to building construction and codes improve to protect its integrity, older buildings are aging and becoming more vulnerable and susceptible to these hazards. Today's environment of large office and commercial buildings, coupled with urban sprawl, further complicate this risk. Historical large-scale fires and structure failures fueled the development and enforcement of stricter fire and building codes. Despite these fire codes and safety measures, structural failures and fires still occur today.

Structural Construction Types

There are five types of building construction. Each of the five types of construction have a fire resistance rating specified by the International Building Codes. Listed below are the different types of construction used for fire resistance and fire fighting.

Structural Construction Types	
Type	Criteria
Type I: Fire Resistive	Typically used in high-rises. The material comprising the structure is either inherently able to withstand significant exposure to fire (concrete), or in which a fire resistive covering is applied to steel structural members.
Type II: Non-Combustible	Typically used in strip shopping center malls. Roofs are constructed out of steel rafters.
Type III: Ordinary Construction	Brick and mortar walls, wood frame floors. City row houses are where this type of construction is most often found.
Type IV: Heavy Timber	Often used in churches or other community-based buildings.
Type V: Wood Frame	Typically used in recent construction of single-family dwellings, townhouses, garden apartments with four floors or less.

PROFILE OF STRUCTURAL FIRES IN MIAMI-DADE

The structural failure of a building can be slow or sudden and usually always without warning. Excessive stresses and strains of critical supports can deteriorate the integrity of the structure. The facility that fails can range from simply a bridge to a massive high-rise. Structural failures are usually the result of other hazards. The largest known occurrences of structural failure are those attributed to terrorism; however, there have been structural failures as a result of human error attributed to design or construction error. According to the National Fire Protection Association, apartment high rises represent the greatest number of fires in the United States with 7,000 fires annually and millions of dollars in damage.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	50%	Score	0%	Score	25%	Score	12.5%	Score	83%	Score	82%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	45%		Score	30%		Score	35%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	24%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	55%		Score	49%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	54%
						Insured Risk Exposure ▶	Impact Rating	
							Score	40%
						Special Properties ▶	Impact Rating	
							Score	44%
						Faith-Based ▶	Impact Rating	
							Score	38%

TRANSPORTATION INCIDENT (I.E. HIGHWAY AND/OR RAIL INCIDENT)

OVERVIEW OF TRANSPORTATION INCIDENT

The transportation infrastructure is the backbone to an urban area's success. As in any large urban areas, disruption of highway systems, mass transit, or commercial and industrial modes of transporting can strangle traffic and can affect the productivity of an urban area'. Inter-dependencies exist between transportation and nearly every other sector of the economy. A failure to the transportation infrastructure is defined as a shutdown of a segment of the transportation sector. Most significant transportation incidents are the affects of natural or technological hazards. Operator error or equipment malfunction is typically an isolated event; however, these isolated events can result in mass casualties and a have a significant cascading impact on the short-term efficiency of an area. Urban areas are dependent on a maintained and functioning transportation system in order for it to carry out daily activities.

The transportation sector can be broken down into three main sub-sectors:

Aviation

Most incidents are attributed to pilot error and are usually nonfatal. Most incidents occur prior to takeoff or after landing. A NOAA/NWS study determined trends that suggest that weather is contributing factor to about 30% of aircraft accidents and about 35% of aircraft fatalities. This weather would include low ceiling, thunderstorms, fog, rain, icing, updrafts/downdrafts, snow, turbulence, and tailwind/crosswind.

Highway

Urban areas are dependent on a fully functioning highway system to transport goods, services, and commuters. Highway traffic varies between commercial and industrial purposes and is therefore a fundamental component of every resident's daily lives. “Motor vehicles injuries constitute 99% of non-fatal transportation injuries and 94% of transportation deaths. Human error contributes to most automobile accidents. This contributing factor can come in many forms such as driver impairment, driver inexperience, driver distraction, etc. The NHTSA highlights future trends will have a great affect on national road safety.

Public Mass Transit

Public Mass Transit includes buses, trains and other modes of public transportation. The Federal Railroad Administration (FRA) determined for train accidents, “human factor” caused 38.4% of total accidents, the largest category of train accident causes. This human factor is unique, in the way that more people are involved in the operation of the rail lines besides the operator. Because the operations of rail transit depend on a larger number of people, the potential for human error is increased. Equipment malfunctions related to Weather are a significant concern for mass transit. Extreme weather can lower equipment or transit fatigue limits. For example, extreme heat has been known to bend rails, causing train derailment. Transit systems should be regularly inspected for evidence of fatigue failure, but certain fatigues can be naked to the human eye.

PROFILE OF TRANSPORTATION INCIDENT VULNERABILITY IN MIAMI-DADE

Refer to the following sections in the Vulnerability Index and Assessment:

- Airports
- Freight Rail
- Mass Transit
- Transportation (Highway)

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	75%	Score	0%	Score	50%	Score	12.5%	Score	83%	Score	86%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	23%		Score	31%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	41%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

WATER / WASTEWATER INCIDENT

OVERVIEW OR WATER / WASTEWATER INCIDENT

The water and wastewater infrastructure is a critical element to developed areas. Residents depend daily on the ability of local government to provide clean potable water as well as dispose of sanitary water. The arrangement of water and wastewater systems is dictated by the source of water or wastewater, topography of the distribution or service area, and variations in water consumption or use. Each water system is unique and is influenced by local conditions.

Wastewater Systems: Domestic or sanitary wastewater refers to liquid discharged from residences, business buildings, and institutions. Industrial wastewater is typically treated to regulated levels of contamination, before discharged to the sanitary wastewater system. Municipal wastewater is the general term applied to collecting and treating stormwater. Typically, municipal wastewater systems are independent from sanitary and industrial wastewater systems.

Water Systems: They objective of municipal water treatment is to provide a potable supply – one that is chemically and microbiologically safe - for human consumption. For domestic uses, treated water must be aesthetically acceptable – free of turbidity, color, odor, objectionable taste, and safe for consumption. Water distribution systems are typically dictated by the surrounding environment and water source. For example, if water is supplied at only one point in a pipe network in remote areas, elevated storage or ground-level storage with booster pumping is required in order to maintain pressures. The primary engineering objectives of a water distribution system are to provide a stable hydraulic gradient pattern for maintaining adequate pressure throughout the service area and sufficient pumping and storage capacities to meet fire demands and emergencies such as main breaks and power failures.

PROFILE OF WATER / WASTEWATER INCIDENT VULNERABILITY IN MIAMI-DADE

- Refer to the following sections in the Vulnerability Index and Assessment:
  Water / Wastewater Treatment

- Also refer to Public Health Hazard Assessment & Consequence Analysis for references to Contaminated Water Incident

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	18.8%	Score	0%	Score	12.5%	Score	0%	Score	81%	Score	68%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	37%		Score	23%		Score	34%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	56%		Score	41%		Score	26%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ►	Impact Rating		Building Stock ►	Impact Rating		Environmental Conditions ►	Impact Rating	
	Score	30%		Score	24%		Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating	
							Score	73%
						Insured Risk Exposure ►	Impact Rating	
							Score	16%
						Special Properties ►	Impact Rating	
							Score	20%
						Faith-Based ►	Impact Rating	
							Score	38%

CRIME/TERRORISM HAZARDS

The world has witnessed a growing number of politically or criminally motivated incidents (hazards) that have had a significant impact on the global social environment. These hazards constitute deliberate acts (violent or non-violent) that have a direct relation to political motives and/or events. These acts have a significant effect on the community's safety, social environment, and economy.

In the past decade, terrorism has had a significant influence on the daily lives of Americans. The consistent attacks abroad and intermittent attacks within the United States have made all communities more conscious of the growing risks and vulnerabilities in a free environment. The advancement of technologies has made our communities more vulnerable to the impacts from these hazards. It should be noted that the impact of a terrorist attack can extend beyond the immediate targeted facility. The effects of terrorism include:

- Direct Result: Injury, illness, or death.
- Psychological Reactions: fear, anxiety, stress, shock, revulsion, long-term emotional effects, post traumatic stress.
- Economic, Political, and Social Impacts.

Crime/Terrorism hazards will damage or impair the County's infrastructure, disrupt commerce, and possibly result in large-scale health emergencies, disease outbreaks, and/or epidemics. Although the total volume of terrorist incidences worldwide has declined in the 1990s, the percentage of terrorist events resulting in fatalities has grown. As a large U.S. city and a key economic component of the United States, Miami-Dade could be a possible target for terrorist activities. Federal and public buildings, large market sectors, critical infrastructure, tourist attractions, and large-scale events are all prime targets for terrorist organizations. Additional vulnerabilities include:

- Transportation Systems – highways, railways, waterways, and airports are vital to the transportation of materials, goods, services and people.
- Population – an attack on a large population is attractive to gain large media attention.
- Industry – large manufacturers and companies house hazardous materials. Disruption of these facilities can have an economic impact and cause physical damages to property and loss of lives due to the large volume of hazardous materials housed.
- Utilities – there is a large dependency on telecommunications, power, water, wastewater, and pipeline services for daily activities and operations.
- Government Buildings – an attack on government buildings is attractive in order to deliver a political statement.
- Entertainment/Recreation – anywhere that attracts large populations is an attractive target.

The following hazards were assessed in this category:

- Terrorism
- Bomb Threat Incident
- Civil Disobedience/Civil Unrest
- Cyber-Security Incident

CIVIL DISOBEDIENCE/CIVIL UNREST

OVERVIEW OF CIVIL DISOBEDIENCE / CIVIL UNREST

Civil unrest is the result of groups or individuals within the population feeling, rightly or wrongly, that their needs or rights are not being met, either by the society at large, a segment thereof, or the current overriding political system. When this results in community disruption of a nature where intervention is required to maintain public safety it has become a civil disturbance. Civil disturbances can also occur in reaction to political movements or special events that attract large crowds. Celebrations of professional or collegiate sporting events such as the Super Bowl, NBA Finals or the NCAA's Bowl Championship Series championship game can turn violent resulting in civilian deaths, property damages and numerous arrests. When groups or individuals disrupt the community to the point where intervention is required to maintain public safety, the event has become a civil disturbance.

Civil disturbance spans a wide variety of actions and includes, but is not limited to labor unrest; strikes; civil disobedience; demonstrations; riots; prison riots or rebellion leading to revolution. Triggers could include racial tension; religious conflict; unemployment; a decrease in normally accepted services or goods, such as extreme water, food, or gasoline rationing; or unpopular political actions. The most common type of civil disturbance is riots. Riots can cause extensive social disruption, loss of jobs, death, and property damage. The loss and damages may result from those involved in the action or initiated by authorities in response to the perception of a potential threat.

CIVIL DISOBEDIENCE / CIVIL UNREST THREAT TO MIAMI-DADE

Miami-Dade County has a multi-ethnic population originating from countries with widely divergent political systems, religious beliefs, and educational backgrounds. As with any large metropolitan area with diverse cultures, civil disturbances must be anticipated and expected. The Miami-Dade Police Department has the primary responsibility for gathering intelligence and maintaining law and order within this arena and maintains the SOP that outlines the coordination and handling of responses to civil disturbances. DEM & HS's Change in Caribbean Government Plan also addresses the possibilities of local civil disturbance related to any instability or change in Caribbean government.

The Greater Miami Area has hosted the Super Bowl nine times and over NCAA Orange Bowl Championship. In 2006, the Miami Heat won the NBA championship. These special events attract large crowds, celebrities, and dignitaries throughout the Miami-Dade area. Post-game celebrations of professional or collegiate sporting events can turn violent and result in deaths and property destruction. In addition, Florida's large immigration population can react negatively to U.S. immigration policies. Reactions to court cases that deal with racial issues or immigration can spark civil unrest. Miami-Dade can be impacted by an influx of refugees from Caribbean nations entering the nation legally or illegally. The consequences of a mass arrival of illegal entrants include the threat of health, safety and welfare if they are detained in mass for an extended length of time.

Since the 1960's, the State of Florida has consistently experienced some form of civil disturbance that has prompted a public safety and emergency services response. The potential always exists for individuals or groups to turn their grievances into violent acts resulting in deaths and property destruction. Consequently, civil disturbances can result in significant business interruptions. Usually local businesses are targeted during riots resulting in short-term financial losses and long-term recovery costs.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	25%	Score	0%	Score	6.3%	Score	6.3%	Score	75%	Score	65%

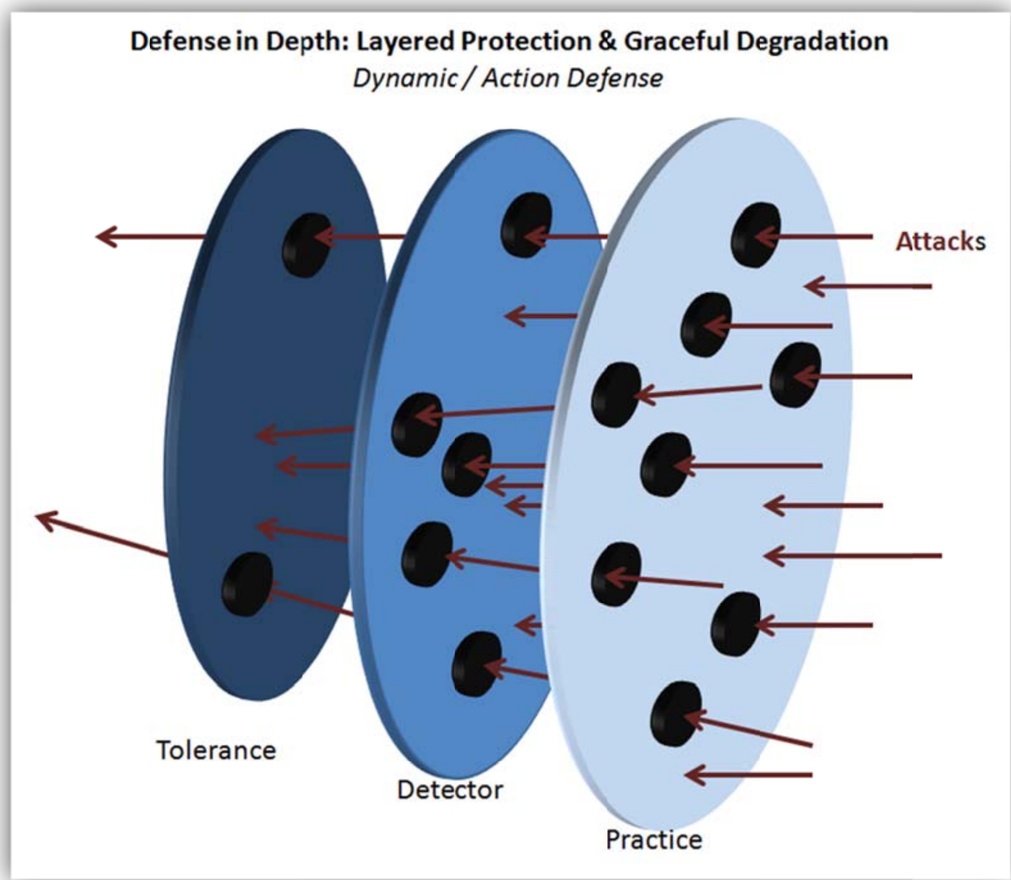
HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	37%		Score	21%		Score	43%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	31%		Score	17%		Score	51%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	
	Score	50%		Score	24%		Score	61%
Socio-Economic Conditions ►	Impact Rating		Building Stock ►	Impact Rating		Environmental Conditions ►	Impact Rating	
	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating	
							Score	81%
						Insured Risk Exposure ►	Impact Rating	
							Score	40%
						Special Properties ►	Impact Rating	
							Score	20%
						Faith-Based ►	Impact Rating	
							Score	38%

CYBER-SECURITY INCIDENT

OVERVIEW OF CYBER-SECURITY INCIDENT

The advancements in technology have increased the productivity of our nation and made daily operations and markets reliant on cyber systems. As a result, the United States has become, and will continue to become, increasing vulnerable to non-traditional attack including information warfare and operations. Studies performed by the Government Accounting Office and the Computer Security Institute found that the number of cyber security threats to both public and private sectors are on the rise. In 2000 there was over 20,000 cyber attacks to commercial institutions and 30,000 cyber attacks to federal agencies. The threat ranges from attacks by nation-states to attacks by unorganized groups or individuals. Cyberspace is the nervous system for all critical infrastructures and is composed of hundreds of thousands of interconnected computers, servers, routers, switches, and fiber optic cables that allow our critical infrastructures to work.



The attacks on computer systems can come in the form of viruses, Trojans, worms, spoofs, or hoaxes from virtually anywhere including other innocent victims. Sometimes harmful and sometimes only annoying, computer viruses are sent out daily by organizations and individual hackers, and intermittently by people who fail to protect their computer software. There are many changes taking place in the computer security arena, including.

- Unauthorized use of computer systems is on the decline, as is the reported dollar amount of annual financial losses resulting from security breaches.
- In a shift from previous years, virus attacks and denial of service outpaced theft of proprietary information.

The initial attack may go undetected for a long time, hibernating until it is launched years after initially installed. A slow attack that is not reported for an extended period-of-time, allows for logic bombs, trap doors, Trojan horses, and viruses to be inserted periodically over time and in a place of the intruder's choosing.

Many of the information defense systems today take a 'Defense in Depth' approach to securing information technology systems. Defense in Depth takes a layered approach with multiple firewalls, intrusion detection devices, and network security. This enables authorities to detect intrusions, stop intruders from causing further damage, denied further access, tracked for future legal action, or counterattacked. There is a tolerance for those attacks that cannot be avoided. Back-up systems, redundancy, heightened awareness, integrity restoration, and recovery will provide means to adequately, manage the consequence of an attack.

Many of the cyber attacks are unsuccessful. Even more are simple hackers with a heightened level of curiosity. However, some of these attacks are malicious and can result in catastrophic damages to the nervous system of a community's cyber infrastructure.

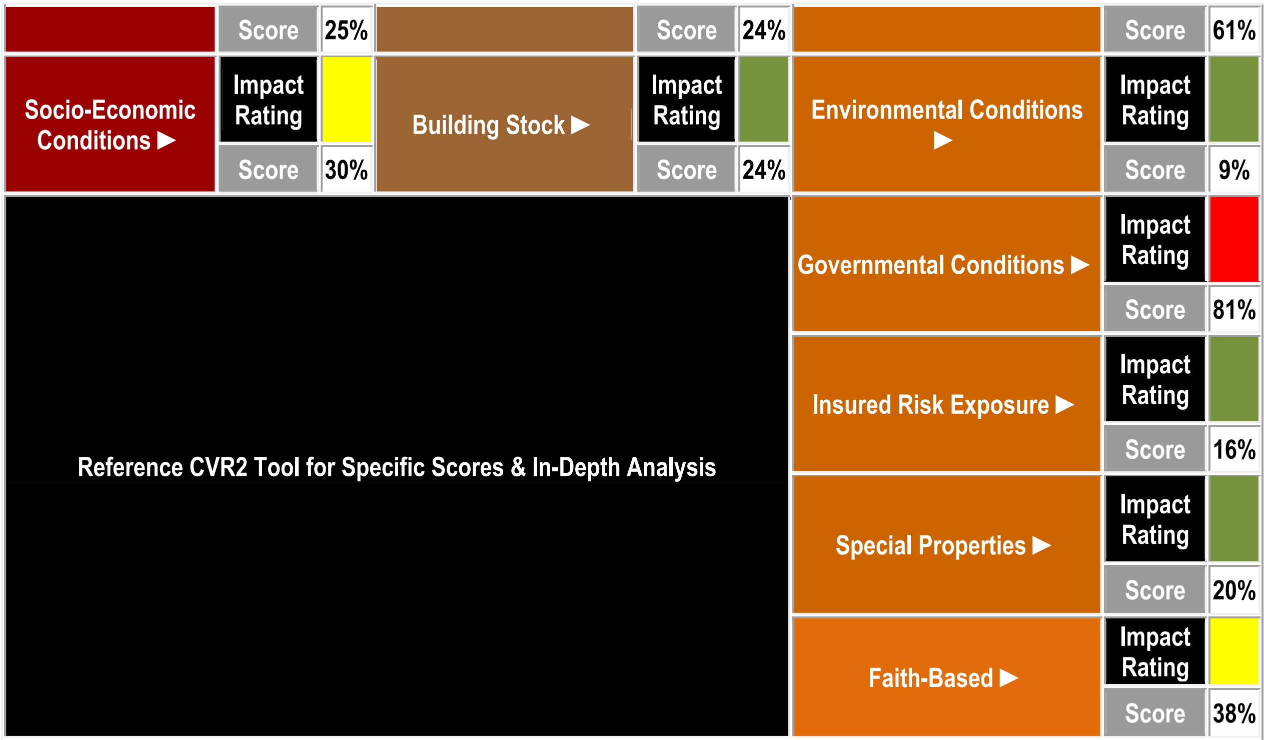
HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	37.5%	Score	5%	Score	0%	Score	0%	Score	75%	Score	68%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	29%		Score	30%		Score	39%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	31%		Score	41%		Score	51%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	


Score
25%
Score
24%
Score
61%
Socio-Economic Conditions ▶
Impact Rating
Building Stock ▶
Impact Rating
Environmental Conditions ▶
Impact Rating
Score
30%
Score
24%
Score
9%
Governmental Conditions ▶
Impact Rating
Score
81%
Insured Risk Exposure ▶
Impact Rating
Score
16%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis
Special Properties ▶
Impact Rating
Score
20%
Faith-Based ▶
Impact Rating
Score
38%

TERRORISM

OVERVIEW OF TERRORISM

In the past decade, terrorism has had a significant influence on the daily lives of Americans. The consistent attacks abroad and intermittent attacks within the United States have made all communities more conscious of the growing risks and vulnerabilities in a free environment. The advancement of technologies has made our communities more vulnerable to and the impacts greater from a political hazard. The impact of a terrorist attack can extend beyond the immediate targeted facility. The effects of terrorism include:

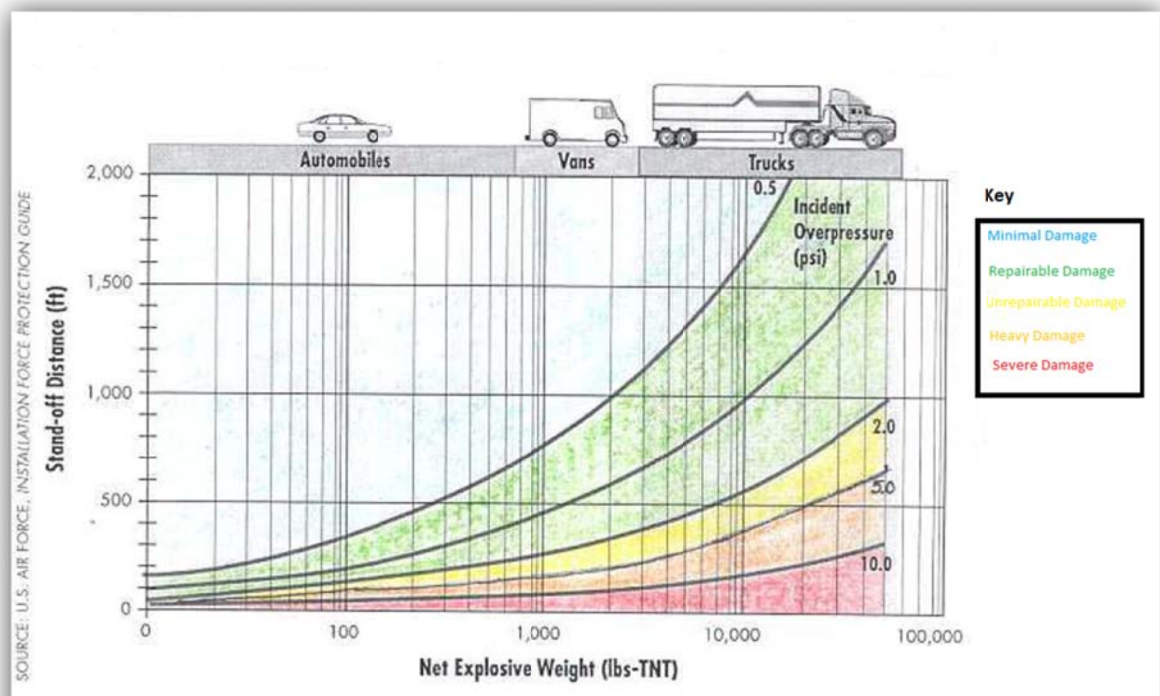
- Direct Result: Injury, illness, or death
- Psychological Reactions: fear, anxiety, stress, shock, revulsion, long term emotional effects, post traumatic stress.
- Economic, Political, and Social Impacts.

Improvised Explosive Device

Munitions are the most common weapon used in acts of terrorism typically consists of the detonation of an explosive device delivered via person, vehicle, or projectile on or near a target. The duration of the hazard is instantaneous and consists of a rapid release of energy in the form of light, heat, sound, and shock waves. Additional devices can be utilized in order to increase the complexity, impact, and/or the duration of the hazard. Bombings are categorized as low-order and high-order munitions.

High-order munitions consist of materials that detonate using all of the filler material at a burning rate greater than of the speed of sound. High-order munitions destroy the target by shattering structural materials. Examples of high-order munitions include Trinitrotoluene, Tertytol, Amatol, Nitroglycerin, Cyclonite, and Dynamite. The pressure wave of high-order munitions range from 50,000 - 4,000,000 psi. Low-order munitions consist of materials that deflagrate at a burning rate less than that of the speed of sound. Low-order munitions do not consume completely leaving shock sensitive material. Examples of low-order munitions include Black Powder, Ammonium nitrate, Hypergolic chemicals, gasoline, and propane. The pressure wave of low-order munitions reaches 50,000 psi. A munitions' blast is caused by a dynamic over-pressures generated by the detonation of the explosive. As the shock wave expands, there is a rapid decrease in pressure.

Complete detonation of high-order explosives can generate pressures up to 700 tons per square inch and temperatures exceeding 3,000° F at the point source of the blast. Half of the energy is expended in the compression of air surrounding the bomb, resulting in the 'blast effect', which results in the most significant damage. The energy from the blast decreases logarithmically as a function of distance from the blast. Terrain, forestation, and structures can absorb or deflect the energy released from an explosive device. The incident overpressure, or blast pressure, that is emitted is a function of the net explosive weight of the munitions and the distance from the blast source. The extent of damages and injuries of a munitions explosion are dependent on numerous factors. The Department of Defense provided general indications of the overall damage and injuries expected by a munitions explosion based on size of and distance from the explosion and typical construction practices. In order to identify the potential damage impact of a munitions blast, a relation is required between the weapons yield (net explosive weight) of the munitions, the distance from the blast source, and the amount of damage that is expected. The Department of Defense identifies the following levels of potential damage from a blast:



Incident overpressure measured in pounds per square inch, as a function of stand-off

Damage Type	Incident Overpressure	Description
Severe Damage	10 PSI	Total destruction of most buildings
Heavy Damage	5-10 PSI	Over 50% of major structural and secondary
Unrepairable Damage	2.0 to 5.0 PSI	Sections of structure may collapse or lose structural capacity
Repairable Damage	0.5 – 2.0 PSI	Minor to major structural and non-structural deformation
Minimal Damage	0.0 to 0.5 PSI	No permanent deformation, minor damage

Radiological

The use of radioactive material as a weapon dates back to World War II. Today these technological advances are in use in many industries including energy production, medicine, industrial and manufacturing operations, agriculture, scientific research, consumer products and services. Radioactive material, whether naturally occurring or manmade, is unstable and is constantly seeking a stable, atomic configuration through a process called radioactive decay. As radioactive material decays to stable, non-radioactive material, or to other types of radioactive material, ionizing radiation is emitted. Radiation exposure is dependent on the magnitude and duration of the dose; the area of the body exposed to it; and a person's sex, age, and physical condition. Ionizing radiation can cause important changes in our cells, quickly destroying our cells or altering its growth or function. A very large dose of radiation can result in death. Exposure to large doses of radiation can increase the risk of developing cancer. There are three scenario types for radiological attack:

Radiological Dispersal Device (RDD or "Dirty Bomb"): A RDD is a high-order munitions device used to spread radioactive material. A small conventional bomb would be adequate to disperse material in a significant geographic area. The extent and area of contamination is dependent on the type of radioactive material and the munitions range. Currently, over 2,000 metric tons of high-level radioactive waste and 12 million cubic feet of low-level radioactive waste produced annually by the 103 operating reactors in the United States (Nuclear Energy Institute, 2004). In the United States, it is estimated that of roughly 2 million small-but-valuable radioactive contraptions used annually in industries ranging from construction to healthcare to scientific research. Hundreds of these devices have been lost, stolen, or even abandoned and 30,000 devices are unaccounted (Nuclear Energy Institute, 2004). Approximately 2 kilograms of highly enriched uranium were stolen from poorly protected nuclear facilities in the former Soviet Republic of Georgia during the last decade (Honour, 2003).

Nuclear Facility Attack: Since September 11, 2001, the NRC has performed state-of-the-art structural and fire analyses to predict the consequences of terrorist acts on a nuclear power plant. These studies confirm that, given robust plant designs and the additional enhancements to safety, security, and emergency preparedness and response, it is unlikely that significant radiological consequences would result from a wide range of terrorist attacks, including one from a large commercial aircraft.

Delivery of Radioactive Materials: Of almost 400 million packages of hazardous material shipped each year in the United States, radioactive materials account for less than 1 percent with the vast majority of these shipments low-level radioactive material used in medical applications (NEI, 2004). The transportation of nuclear and radioactive material is highly regulated by the NRC and the Department of Transportation. About 250,000 packages per year contain radioactive materials resulting from nuclear power plants (NEI, 2004). Transportation of spent nuclear fuel and other high activity shipments require physical protection including:

- Use of NRC-certified, structurally rugged, shipment over packs and canisters.
- Advance planning and coordination with local law enforcement along routes.
- Protection of information about schedules.
- Regular communication between transports and control centers.
- Armed escorts within heavily populated areas.
- Vehicle immobility measures to protect against movement of a hijacked shipment before response forces arrive.

Biological

Biological agents are living organisms, or the materials derived from them, that cause disease in, or harm to humans, animals, or plants, or cause deterioration of material. Biological agents may be found as liquid droplets, aerosols, or dry powders. A biological agent can be adapted and used as a terrorist weapon, i.e., anthrax, tularemia, cholera, encephalitis, plague and botulism. There are three different types of biological agents: bacteria, viruses, and toxins. There are estimated to be over 1,200 effective biological agents, however there are only several biological agent considered to have both a high potential for adverse public health impact and that also have a serious potential for large-scale dissemination. The biological agents that pose the most serious threat are readily accessible in nature, have the potential to spread rapidly and have the ability to cause mass casualties. The CDC has placed biological agent into one of three priority categories for initial public health preparedness: A, B, and C. Category A agents have the greatest potential for adverse public health impact with mass casualties, and require broad-based public health preparedness efforts. Category A agents also have a moderate to high potential for large-scale dissemination or a heightened general public awareness that could cause mass public fear and civil disruption (Rotz et al, 2002)

Category "A" Agents	
Biological Agent(s)	Disease
Variola minor	Smallpox
Bacillus anthracis	Anthrax
Yersinia pestis	Plague
Clostridium botulinun	Botulism
Francisella tularensis	Tularemia
Filovisuses and Areanviruses	Viral hemmohagic fevers (Ebola, Lassa virus)

There is a long history of the use of biological agents during armed conflict. In 1346, the bodies of soldiers who died of the bubonic plague were catapulted over the walls of the besieged city of Kaffa. This event is hypothesized by some medical historians that the action resulted in the infamous pandemic that spread over the entire continent of Europe, via the Mediterranean ports. Organized research by Nation states first gained momentum during World War II and carried into the Cold War. The former Soviet Union and the United States had large biological warfare programs to develop weapons-grade biological agents. Although many of the most threatening biological agents are military-grade weapons, many can be cultivated and introduced with the intention of inflicting harm. Only a handful of biological agents have the ability to paralyze a large city or region of the country and cause high numbers of deaths, wide-scale panic and massive disruption of commerce.

Biological agents are not difficult to cultivate and the technology to weaponize most mediums does exist. The successful dispersion of biological agents is contingent on the agent, the munitions, the delivery, and meteorological conditions. Most dispersion takes place in a closed environment (e.g., buildings, HVAC systems, etc). Most biological agents have the ability to disperse as an aerosol. Agro-terrorism is a subset of bioterrorism, and defined as the deliberate introduction of an animal or plant disease with the goal of generating fear, causing economic losses, and/or undermining stability. The results of an agro-terrorist attack may include major economic crises in the agricultural and food industries, loss of confidence in government, and possibly human casualties. Humans could be at risk in terms of food safety or public health, especially if the chosen disease is transmissible to humans (zoonotic).

Chemical

Historical uses of chemical agents have been limited to acts of war; however, they have been several reported instances where chemical agents were utilized by terrorists in civilian settings. There are two objectives of using chemical agents: incapacitate and kill. Most chemical agents are in liquid form and disseminated by using heat to evaporate the agent, exploding munitions, or a mechanical spray device. Weaponizing chemical agents is not difficult but does require several steps to stabilize degradation, increase the viscosity and persistency, and applying methods to improve the dispersion of the agent. The successful dispersion of chemical agents is contingent on the characteristics of the agent, the munitions, the delivery, and meteorological conditions. Air temperatures, humidity, precipitation, and wind speed can all have mitigating or exacerbating effects on the chemical agent's impact. Chemical agents may persist longer in an urban environment because building materials are porous and can absorb agents, which slowly releases over time (Sidell, 2002). Chemical agents are classified based on their effects on the victim(s). Chemical agents are broken into neurotoxins (nerve agents), blister irritants (military blister agents), chemical asphyxiates (blood agents), and respiratory irritants (choking agents).

The use of chemical agents in a covert attack has been limited to a few international instances where terrorists or extremists targeted a mass population. The Tokyo Subway sarin gas attack of 1995 was the first successful use of a chemical agent in a covert attack and increased the awareness of the possibility of an attack by a terrorist organization or individuals. Some chemicals, such as Sarin and hydrogen cyanide, are used in commercial manufacturing and would require little sophistication to obtain or use, but would require technical expertise to produce and deliver. The production of chemical nerve agents requires sophisticated laboratory equipment and generates corrosive and dangerous by-products. Successful delivery of a chemical agent would need to be in vapor state, or aerosolized. To serve as a weapon, chemical agents require high toxicity and volatility, further complicating the process of production, storage, and release. Whether the chemical agent is released indoors or outdoors will be a significant factor of the success of deployment. The outdoor delivery of chemical agents proves to be difficult due to meteorological and environmental conditions. Sun, rain, humidity, temperature, and wind can increase or decrease the effectiveness of the chemical agent. An aerosolized cloud gradually dissipates over time; however, the time it takes to dissipate is dependent on atmospheric conditions such as exposure to oxygen, pollutants, and ultraviolet rays. Indoor dissemination of a chemical agent can be more effective because meteorological and environmental conditions are controlled.

Although chemical agents are readily available throughout commercial manufacturing and industry, the 1993 Chemical Weapons Convention makes it difficult to obtain enough of the chemicals needed in the synthesis of nerve agents. Law enforcement activities have reduced the threat by cracking down on terrorist activities and funding in Chicago and the nation. Increased security measures at a high profile; densely populated events have further reduced the probability of a successful chemical agent attack. However, the arrest of a Chicago man who obtained cyanide and other chemicals and stored them in an underground storage room of the Chicago "L" makes it apparent that loopholes in securing chemical agents do exist.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	18.8%	Score	40%	Score	56.3%	Score	25%	Score	54%	Score	55%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating Score	 53%	Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating Score	 47%	Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating Score	 58%
Special Populations ▶	Impact Rating Score	 56%	Critical Infrastructure ▶	Impact Rating Score	 55%	Economic Conditions ▶	Impact Rating Score	 71%
Cultural Conditions ▶	Impact Rating Score	 50%	Key Resources ▶	Impact Rating Score	 39%	Social Conditions ▶	Impact Rating Score	 61%
Socio-Economic Conditions ▶	Impact Rating Score	 55%	Building Stock ▶	Impact Rating Score	 49%	Environmental Conditions ▶	Impact Rating Score	 30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating Score	 86%
						Insured Risk Exposure ▶	Impact Rating Score	 54%
						Special Properties ▶	Impact Rating Score	 44%
						Faith-Based ▶	Impact Rating Score	 62%

PUBLIC HEALTH HAZARDS

Disasters, almost by definition, involve health risks. Current discussions of disasters tend to center on terrorist attacks and health risks. It is important to remember that disasters are a multi-faceted challenge and include the public health consequences of geophysical hazards, industrial/technological accidents, terrorist events, and biological disasters, such as SARS outbreaks and E. coli contamination.

This assessment includes the following public health hazards:

- Animal and Plant Disease Outbreak
- Food Borne Illness Incident
- Meningitis
- Plague
- Anthrax
- Pandemic/Epidemic
- Water Contamination

ANTHRAX

OVERVIEW/INTRODUCTION

Biological agents have been used in conflicts to intimidate, kill and injure dating back centuries. Biological agents are not difficult to cultivate and the technology to weaponize most mediums exists. The successful dispersion of biological agents is contingent on the agent, the munitions, the delivery, and meteorological conditions. Most dispersion takes place in a closed environment (e.g., buildings, HVAC systems, etc). Most biological agents have the ability to disperse as an aerosol. Many of the most threatening biological agents have already been processed into military-grade weapons and many others can be cultivated and introduced with the intention of inflicting harm. A handful of biological agents have the ability to threaten a community and result in high numbers of casualties, wide-scale panic, and disruption of essential service and operations. These agents have the highest potential impact to public health and have been given the highest priority by the CDC. Anthrax has been identified as one of these agents.

Anthrax has been classified as a Category A agent by the CDC. Category A agents have the greatest potential for adverse public health impact with mass casualties and require broad-based public health preparedness efforts. The CDC defines a Category A agent as a high-priority agent that poses a risk to national security because it:

- Can be easily disseminated or transmitted from person to person
- Results in high mortality rates and has the potential for major public health impact
- Might cause public panic and social disruption
- Requires special action for public health preparedness

For a biological agent to cause illness, it must gain entry into the body and begin to promulgate. There are four routes of entry into the body: absorption through the skin, inhalation into the respiratory system, ingestion into the gastrointestinal system and injection into the body or circulatory system. These routes of transmission have varying severities depending on the agent in question, but for anthrax, inhalation is the most problematic form of transmission.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal.

- **Cutaneous**: Exposure occurs when anthrax spores enter the body through an open wound or small break in the skin. About 1 to 2 days after exposure, a small blister will develop that resembles an insect bite. This blister will contain a black lesion in the middle. As anthrax is present in the environment, it is possible to contract cutaneous anthrax from handling contaminated animal hides, wool, and hair (especially goat hair). If treated with antibiotics quickly, cutaneous anthrax is almost 100% curable. If untreated, the survival rate will drop to 80%.
- **Inhalation**: Inhalational anthrax is the most deadly form of the disease. Inhalational anthrax occurs when spores are aerosolized and breathed into the respiratory system. After exposure, symptoms can occur anywhere within one to sixty days, although it is more common to see symptoms manifest within three to seven days. Initial symptoms include fever, chills, a non-productive cough, shortness of breath, fatigue, and other general flu like symptoms. As the disease progresses, breathing becomes extremely difficult and can lead to shock or death. If treated with antibiotics the survival rate is only 25%; if left untreated the survival rate is 10%.

- **Gastrointestinal**: Gastrointestinal anthrax exposure occurs when anthrax is ingested in the gastrointestinal system, usually through meat from anthrax-infected animals. This occurs through the consumption of tainted food, most commonly meat. Symptoms manifest themselves within 2–5 days of exposure and are characterized by an acute inflammation of the intestinal tract. Initial symptoms include nausea and loss of appetite and progress to bloody diarrhea, fever, and severe stomach pain. Symptoms of gastrointestinal anthrax are similar to those of the stomach flu, food poisoning, and appendicitis. Gastrointestinal anthrax has a survival rate between 75% and 40 % if it is not treated with antibiotics. Data on the survival rate of gastrointestinal anthrax with antibiotic treatment is not well developed at this time.

In order for a biologic agent to infiltrate the body, the agent must first be present in the environment and in a form that is conducive to one of these routes of transmission. Anthrax is caused by the bacterium Bacillus anthracis, a gram-positive sporulating bacterium. It is pervasive in the environment and can be easily obtained. Anthrax, along with other types of bacteria, can form spores. Bacteria in spore form are more resistant to cold, drying, chemicals, and heat than the vegetative form. Spores are the dormant form of the bacterium, and like seeds, they can "germinate" or transform into the vegetative form of the bacterium when conditions are favorable. The bacterium can be cultivated in ordinary nutrient medium under aerobic or anaerobic conditions. The spores from B. anthracis are usually the infective form. Anthrax is primarily a zoonotic disease of herbivores.

The primary concern for this bacterium is intentional infection. Anthrax is an effective agent because it is highly lethal if inhaled. It can be weaponized for low cost and is extremely stable as a powder as the spores can survive for decades in water and soil and are able to survive UV light, high heat, and desiccation. Initial symptoms of the disease are easily confused with the common cold.

A biological attack using anthrax as the biological agent contains complicating factors for response agencies. Anthrax can have an unusually long latency period. After exposure to the disease, it can remain dormant in the system for up to 60 days. Laboratory tests required for confirmation of the presence of the disease can take up 72 hours, although in large concentrations of the disease, this timeline may be shortened. Anthrax is difficult to detect, and unless announced or obvious, an attack could last for a period of time without being discovered.

Unlike concerns regarding pandemic outbreaks, anthrax cannot be transmitted directly from person to person. However, spread of disease may occur if a person comes in contact with spores on an exposed person's body or clothes. Effective decontamination of exposed individuals can be achieved using antimicrobial soap and water. Use of chlorine bleach, boiling water, or formaldehyde can be effective in decontaminating articles, such as clothing. Once decontaminated, it may not be necessary to isolate previously exposed individuals.

Treatment of anthrax illness requires administration of antibiotics such as ciprofloxacin, erythromycin, doxycycline, penicillin, or other antibiotics either orally or intravenously. Treatment must occur timely as any delay can significantly impair the survival potential of individuals exhibiting symptoms of anthrax illness. Even a few days of delay can have detrimental impacts; therefore, provision of antibiotics should begin immediately upon suspicion of exposure even if the individual does not exhibit any overt signs of anthrax illness. A vaccine currently exists for anthrax but is available only for military personnel and certain at-risk individuals such as laboratory workers. Due to the controversy surrounding the safety and efficacy of the anthrax vaccine, it is currently not recommended for the general public.

AT-RISK POPULATIONS

While anthrax exposure can threaten the health of all individuals, certain populations are more vulnerable to the harmful effects of the bacteria. These groups include the immunocompromised individuals, elderly, and young children. Due to various reasons such as a weak immune system, individuals from the immunocompromised and elderly populations may develop the symptoms associated with inhalation anthrax more rapidly and/or suffer them to a greater degree than the general population, thus they require priority during mass prophylaxis and treatment. Young children are more susceptible to the side effects associated with the antibiotics currently available for the disease; therefore, careful attention should be paid when dispensing medication to young children during mass prophylaxis.

- *Immunocompromised*- is defined as individuals that suffer from immune deficiency in which the immune system's ability to combat infectious disease is either reduced or entirely absent. The condition can be primary (individuals are born with it) or secondary (the immune system becomes impaired due to a disease or certain medical treatment). Immunocompromised individuals are not only susceptible to infections that could affect anyone, but they are also vulnerable to opportunistic infections. Immunocomprised individuals include the elderly, individuals suffering from malnutrition, individuals undergoing certain medical treatments or taking particular drugs (e.g. chemotherapy, disease-modifying antirheumatic drugs, immunosuppressive drugs after organ transplants, glucocorticoids, etc.), and individuals suffering from diseases such as cancer (particularly those of the bone marrow and blood cells such as lymphoma, leukemia, and multiple myeloma), chronic infections, and AIDS.

  Anthrax exposure will induce the same symptoms in immunocompromised individuals as healthy individuals. However, the severity of the symptoms may be greater in the immunocompromised individuals. Moreover, the progression of the symptoms may also be more rapid among this vulnerable population. Although the dosage of medication for the immunocompromised individuals is the same as normal individuals (ciprofloxacin 500 mg po BID for 60 days; doxycycline 100 mg po BID or amoxicillin 500 mg po TID, either antibiotic for 60 days), these individuals must be given priority during prophylaxis to evade the potential rapid progression of symptoms of inhalation anthrax. The prognosis of inhalation anthrax once the symptoms begin to evolve is poor. Even with antibiotic treatment, 90% of cases are fatal in the second stage of the disease due to buildup of toxins. For immunocompromised individuals, this progression into the second stage of inhalation anthrax may occur within hours. Therefore, it is imperative that such individuals are promptly identified and provided with appropriate medications.

- *Elderly*- as a natural part of the aging process, an individual's immune system declines. Therefore, elderly individuals generally have a reduced immune response to infectious diseases. The initial, first stage, symptoms of inhalation anthrax are virtually the same for all individuals. However, similar to immunocompromised individuals, the elderly may experience these symptoms to a more severe degree and develop a faster progression of symptoms after exposure leading to complications such as shock, hemorrhagic meningitis, mediastinitis, and ARDS (adult respiratory distress syndrome). Once these complications develop, treatment becomes very difficult and ineffective since a 90% fatality rate is observed for patients suffering from second stage inhalation anthrax.

Prophylaxis for the elderly is the same as that for adults in general (ciprofloxacin 500 mg po BID for 60 days; doxycycline 100 mg po BID or amoxicillin 500 mg po TID, either antibiotic for 60 days). However, these antibiotics must be dispensed to the elderly population within a short frame of time after the agent has been confirmed to avoid the progression of the disease into the second stage where inhalation anthrax becomes fatal. Therefore, priority must be given to the elderly during mass prophylaxis.

- *Children*- the signs and symptoms of anthrax exposure in children older than 2 months resemble those in adults. While the illness affects children and adults in a similar way, children are more prone to suffer from the side effects of the antibiotics used to treat or prevent the disease. If exposed, children take the same antibiotics recommended for adults; however, they are recommended to take them in smaller doses: Ciprofloxacin 15 mg/kg po q 12 hrs but not to exceed 500 mg/dose for 60 days; weight > 20 kg, amoxicillin 500 mg po TID for 60 days; weight < 20 kg amoxicillin 80 mg/kg po TID for 60 days. A complicating factor in the prophylaxis of children is that the antibiotics should not be dispensed unless public health or medical authorities have determined that they have had contact with the bacteria that causes the disease.

  Providing children with antibiotics if there is no need can do more harm than good. The side effects of antibiotics in children can be very serious. In addition, usage without need can also lead to the development of drug-resistant bacteria. In such a case, the same antibiotic will be ineffective should a child require it for sinus, ear, or other infections later on. Once this happens, treatment for these common ailments becomes more difficult and prolonged. Early detection and treatment of inhalation anthrax in children is imperative; however, the need for an antibiotic treatment must be inspected prior to dispensing it to avoid unnecessary complications among this vulnerable population.

TIME/SEASON

Although anthrax is present in the natural environment, natural outbreaks are very rare. Most likely, an anthrax outbreak will be caused by an intentional release. Therefore, there is no time or season where anthrax incident is more likely to occur.

DURATION & SPEED OF ONSET

An intentional anthrax exposure can occur rapidly and does not require a prolonged exposure. Attacks that are more sophisticated may release multiple attacks during a prolonged period of time. Symptoms occurring from anthrax exposure can manifest in as little as 24 to 36 hours and on rare occasions take as long as 60 days. Spores can persist in the environment for decades.

FREQUENCY & MAGNITUDE

Anthrax is listed by the CDC as a Category A agent capable of causing mass causalities and impacting public health. The magnitude of an anthrax incident is dependent on the scenario and scope of the attack. It is capable of causing mass causalities and rendering facilities contaminated for long periods of time.

The Department of Defense has stated the likelihood of a terrorist attack on the nation at 100 percent in the future. They have also identified anthrax as the number one biological threat facing the nation.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	18.8%	Score	5%	Score	25%	Score	0%	Score	50%	Score	61%

2001 Anthrax Attacks – New York City, Washington D.C. and Boca Raton, FL: Anthrax-bearing letters were opened in an office at the Hart Senate Office Building and several media outlets. Exposure to other letters in the mail system resulted in cross-contamination of the media. The Capitol Hill complex was contaminated with less than one gram of weaponized anthrax spores. Bio-weapons experts were unable to determine the chemical composition of the anthrax media. Seven of the twenty-six federal buildings from which samples taken were found to have traces of anthrax. The Environmental Protection Agency spent $27 million over three months to decontaminate the one million-square foot Capitol Hill offices and examining 10,000 samples from 26 buildings. Thousands of people were treated with antibiotics as a precaution. Twenty-two people around the country died.

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	29%		Score	21%		Score	42%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	31%		Score	17%		Score	51%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	
	Score	25%		Score	24%		Score	61%
Socio-Economic Conditions ►	Impact Rating		Building Stock ►	Impact Rating		Environmental Conditions ►	Impact Rating	
	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating	
							Score	73%

[redacted]	Insured Risk Exposure ▶	Impact Rating	
		Score	40%
	Special Properties ▶	Impact Rating	
		Score	20%
	Faith-Based ▶	Impact Rating	
		Score	38%

ANIMAL AND PLANT DISEASE OUTBREAK

OVERVIEW/INTRODUCTION

Plant Diseases with Major Impact on Humans

There are many examples of plant diseases that have made a major impact on society and have even changed human history More than 70% of all major crop diseases are caused by fungi Late blight of potato was responsible for the loss of 25% of the population of Ireland; during the 1840s, more than 1 million people died from starvation or famine-related diseases, and more than 1.5 million emigrated from Ireland A more recent epidemic that resulted in large-scale famine was caused by a fungus responsible for brown spot of rice; 2 million people died of starvation during the great Bengal famine of 1942 A related fungus, which attacks corn and causes southern leaf blight, resulted in a widespread epidemic in the U.S. in 1970; ca. 15 % of the total corn crop was lost, with yields in some states reduced 50%.

Animal Disease with Major Impact on Humans

Animal health has broad implications, ranging from the health of individual animals and the well-being of human communities to issues of global security. Many people would be surprised by the assertion that our nation's highest priorities must include animal health, yet we must recognize and act on this reality to ensure a safe and healthy future. Among other things, animal diseases critically affect the adequacy of the food supply for a growing world population, and they have huge implications for global trade and commerce. Moreover, many animal disease agents are zoonotic—meaning that they are transmittable to humans—so they have dramatic implications for human health and safety, and for animal disease prevention. Animal disease prevention and control is crucial to improving public health on a global scale. In addition, in an era of growing concern about the threat of terrorism, the potential impact of the intentional use of animal disease agents to cause morbidity and mortality, as well as economic damage, is enormous.

The U.S. animal health framework includes many federal, state, and local agencies that generally have differing mandates of law and numerous other public and private entities and international organizations, each with its own goals and objectives, each responsible for maintaining animal health. In the past, this framework has been reasonably effective in responding to a range of demands and challenges. In recent years, however, animal health has been challenged in a manner not previously experienced.

Today animal health is at a crossroads. The risk of disease is coming from many directions, including the globalization of commerce, the restructuring and consolidation of global food and agriculture productions into larger commercial units, the interactions of humans and companion animals, human incursions into wildlife habitats, and the threat of bioterrorism. The impacts of these sources of risk are evident in recent disease events.

- In 2003, severe acute respiratory syndrome (SARS) sent a global shock wave, affecting countries with even few cases, such as the United States. Although SARS infected only 8,000 people globally, the disease spread to 30 countries and its effect on the global economy totaled $8 billion.
- The United Kingdom's economy has not yet recovered from a foot-and-mouth disease (FMD) outbreak in 2001, which also reverberated around the world, affecting both agricultural and nonagricultural interests (such as rural businesses and tourism/recreational use of the countryside).

- A single case of mad cow disease (bovine spongiform encephalopathy or BSE) in Washington State on December 23, 2003, had an immediate market impact and severe, sustained economic losses due to trade restrictions on U.S. cattle and their products. The infected animal was discovered as part of the government's policy to routinely test downer cattle for BSE, which has been linked to a new variant of Creutzfeldt-Jakob disease, a fatal neurological illness in humans. In June 2005, a second case of BSE was confirmed in the United States.
- In 2004, a new strain of highly pathogenic avian influenza (AI) spread through Southeast Asia, resulting in loss of more than 100 million birds through mortality and control measures and dozens of human cases, high-lighting the unpredictable and potentially catastrophic nature of an emerging zoonotic disease. This new influenza strain was transmitted from birds to people, raising concern that it might be capable of evolving into the next pandemic influenza strain.
- In 1999, West Nile virus (WNV), an arbovirus similar to St. Louis encephalitis virus, emerged for the first time in the Western Hemisphere in New York from an unknown source. Over the next five years it swept across the continental United States, Canada, Mexico, Central America, and several Caribbean islands, carried by mosquito vectors infecting wild birds. In the United States in 2004, the virus was detected in approximately 2,250 humans (40 states), 1,250 horses (36 states), nearly 7,000 wild birds, mostly corvids (45 states), and in much smaller numbers in a few other animal species. While these numbers are substantially below those that occurred in the first wave of infection, WNV bodes to become endemic in wild birds and an ongoing source of infection transmitted to other species by mosquito vectors.

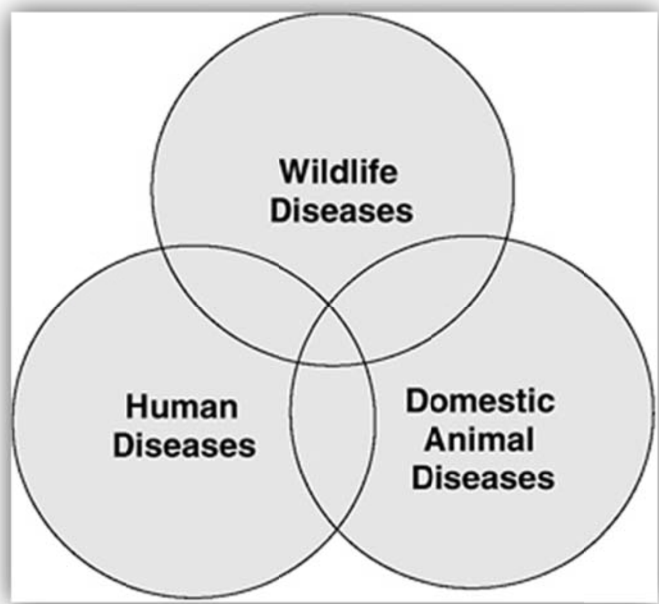


FIGURE. Interactions of emerging infectious diseases (EIDs) with a continuum that includes wildlife, domestic animal, and human populations. Few diseases affect exclusively one group, and the complex relations among host populations set the scene for disease emergence. Examples of EIDs that overlap these categories include Lyme disease (wildlife to domestic animals and humans); bovine tuberculosis (between domestic animals and wildlife); Escherichia coli O157:H7 (between domestic animals and humans); and Nipah virus and rabies (all three categories). Companion animals are categorized in the domestic animal section of the continuum.

Diseases found in humans have always been intensely affected by human-animal interactions. In fact, it is accepted that many infections of humans have origins in common with animals. Although there are some diseases that are transmitted between humans only (for example, syphilis), a large number of domestic animal diseases are shared with humans—60 percent of the 1,415 diseases found in humans are zoonotic, and most are "multispecies" for domestic animal diseases.

With the development of agriculture approximately 10,000 years ago and the domestication of dogs and later livestock, animals became a more prominent part of our lives. Although there is good evidence to suggest that the advent of agriculture brought with it the phenomenon of zoonotic diseases, a new era of emerging and reemerging zoonotic diseases appeared to begin several decades ago. Since the mid-1970s, approximately 75 percent of new emerging infectious diseases of humans have been caused by zoonotic pathogens. Similar to the time of animal domestication, which triggered the first zoonoses era a number of millennia ago, a group of factors and driving forces have created a special environment responsible for the dramatic upsurge of zoonoses today.

The transmission of animal diseases to humans most often occurs via food through poor hygiene or improper handling of animal products. Organisms that cause zoonoses (such as bacteria, viruses, parasites, and protozoa) can also be transmitted via air, water, and vectors such as mosquitoes. In the field of emerging diseases, vector-borne and rodent-borne diseases are especially notable since they remain major causes of morbidity and mortality in humans in the tropical world and include a large proportion of the newly emerged diseases. The spectrum of vector-borne diseases are from animal-to-animal (bluetongue), animal-to-human (WNV), or human-to-human (dengue). It has been estimated that one tick-borne disease has emerged in the United States every decade for the past 100 years.

Some scientists argue that, of the more than 30 emerging diseases recognized since 1970, none are truly "new" but instead only newly spread to the human population.

PROFILE OF ANIMAL AND PLANT DISEASE OUTBREAK IN MIAMI-DADE

Reportable animal diseases range from those that are subject to program control measures such as Pseudorabies and Equine Infectious Anemia to diseases or pests that have been eradicated from Florida such as Bovine Brucellosis and Screwworm infestation. It also includes animal diseases never reported before in Florida or the United States such as Rinderpest and African Swine Fever. In addition, any animal disease with an unusually high morbidity or mortality that may be a foreign or emerging disease that could seriously impact the health of our animals, economy, or public health is reportable.

Each of the following pests or diseases is declared to be a dangerous, transmissible pest or disease of animals and to constitute an animal and/or public health risk in the State of Florida:

1. African Horse Sickness.
2. African Swine Fever.
3. Anthrax.
4. Avian Influenza.
5. Bont Tick Fever (Amblyomma).
6. Bovine Piroplasmosis (Cattle Tick Fever).
7. Bovine Spongiform Encephalopathy.
8. Brucellosis (B. abortus, B. suis).
9. Southern Cattle Tick Infestation (Boophilus).

10. Chlamydiosis (Psittacosis, Ornithosis).
11. Classical Swine Fever.
12. Chronic Wasting Disease.
13. Contagious Bovine or Caprine Pleuropneumonia.
14. Contagious Equine Metritis.
15. Dourine.
16. Equine Encephalitis (Eastern, Western, Venezuelan, or West Nile Virus).
17. Equine Herpes Virus (Neurological Disease)
18. Equine Infectious Anemia.
19. Equine Piroplasmosis (Horse Tick Fever).
20. Equine Viral Arteritis.
21. Exotic Newcastle Disease.
22. Foot and Mouth Disease.
23. Glanders.
24. Heartwater.
25. Infectious Bronchitis.
26. Infectious Laryngotracheitis.
27. Lumpy Skin Disease.
28. Mycoplasmosis (poultry).
29. Peste des Petits Ruminants.
30. Pseudorabies (Aujeszky's Disease).
31. Pullorum Disease.
32. Rabies.
33. Rift Valley Fever.
34. Rinderpest.
35. Salmonella Enteritidis.
36. Scabies (sheep or cattle).
37. Scrapie (sheep or goats).
38. Screwworm Infestation.
39. Sheep and Goat Pox.
40. Spring Viremia of Carp.
41. Strangles (Equine).
42. Swine Vesicular Disease.
43. Tropical Horse Tick Infestation (Dermacentor nitens).
44. Tuberculosis.
45. Vesicular Exanthema.
46. Vesicular Stomatitis.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)		
	Index Rating	**Score**
Frequency/Probability Assessment		12.5%
Magnitude/Scale Assessment		0%
Casualty & Fatality Assessment		6.3%
Damage Assessment		0%
Hazard-Specific Mitigation Assessment		N/A
Hazard-Specific Capability Assessment		71%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Physical Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Community Conditions Vulnerability Consequence & Impact Analysis	Impact Rating	Score
Social Vulnerability Hazard Impact Analysis ▶		29%	Physical Vulnerability Hazard Impact Analysis ▶		21%	Community Conditions Vulnerability Hazard Impact Analysis ▶		35%
Special Populations ▶		31%	Critical Infrastructure ▶		17%	Economic Conditions ▶		51%
Cultural Conditions ▶		25%	Key Resources ▶		24%	Social Conditions ▶		37%
Socio-Economic Conditions ▶		30%	Building Stock ▶		24%	Environmental Conditions ▶		9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶		73%
						Insured Risk Exposure ▶		16%
						Special Properties ▶		20%
						Faith-Based ▶		38%

FOOD BORNE ILLNESS INCIDENT

OVERVIEW/INTRODUCTION

Food borne illness can be spread due to several factors including the consumption of spoiled food, improper food handling and hygiene, vector based, and intentional contamination. There are many types of food-borne illness, the following describes three food borne illness of particular interest to jurisdictions due to their severity, their ability to be used as a weapon, and their overall ubiquitous nature in the environment.

Shigella

Shigella is a microscopic germ from a family of diarrhea causing bacteria in humans. There are several different kinds of Shigella bacteria: Shigella sonnei, also known as "Group D" Shigella, accounts for over two-thirds of shigellosis in the United States. Shigella flexneri, or "group B" Shigella, accounts for almost all the rest. Other types of Shigella are rare in this country, though they continue to be important causes of disease in the developing world. One type found in the developing world, Shigella dysenteriae type 1, can cause deadly epidemics. Each year, about 14,000 cases are reported in the United States. Shigellosis is particularly common and causes recurrent problems in settings where hygiene is poor.

Symptoms of Shigella exposure include stomach cramps (within 1-2 days of exposure to Shigella), fever, and bloody diarrhea. Persons with diarrhea usually recover completely, although it may be several months before their bowel habits are entirely normal. Hospitalization is rarely required as the disease resolves itself within 5-7 days. However, in children under the age of two, infection with a fever can cause seizures. Moreover, about two percent of persons who are infected with one type of Shigella, Shigella flexneri, later develop pains in their joints, irritation of the eyes, and painful urination. This is called post-infectious arthritis. It can last for months or years, and can lead to chronic arthritis. Post-infectious arthritis is caused by a reaction to Shigella infection that happens only in people who are genetically predisposed to it.

Shigella are present in the diarrheal stools of infected persons while they are sick and for up to a week or two afterwards. Most Shigella infections are the result of the bacterium passing from stools or soiled fingers of one person to the mouth of another person. This happens when basic hygiene and hand washing habits are inadequate and can happen during certain types of sexual activity. It is particularly likely to occur among toddlers who are not fully toilet-trained. Family members and playmates of such children are at high risk of becoming infected. Some people who have been exposed to Shigella can be asymptomatic but still infect others. Once an individual has had shigellosis, they are not likely to be infected with that specific type again for at least several years. However, they can still be infected with other types of Shigella.

Shigella infections may be acquired from eating contaminated food. Contaminated food usually looks and smells normal. Food may become contaminated by infected food handlers who forget to wash their hands with soap after using the bathroom. Vegetables can become contaminated if they are harvested from a field with sewage in it. Flies can breed in infected feces and then contaminate food. Water may become contaminated with Shigella bacteria if sewage runs into it or if someone with shigellosis swims in or plays with it (especially in splash tables, untreated wading pools, or shallow play fountains used by daycare centers). Shigella infections can then be acquired by drinking, swimming in, or playing with the contaminated water. Outbreaks of shigellosis have also occurred among men who have sex with men.

Salmonella

Salmonella serotype Enteritidis (SE) is one of the most common types of reported Salmonella in the world. Most types of Salmonella live in the intestinal tracts of animals and birds and are transmitted to humans when feces from animals directly or indirectly contaminate foods that humans eat. It can also be passed from infected animals in the food supply. For example, the Salmonella epidemic that started in the 1980s and continues to cause illnesses today is due to SE being inside of intact grade A eggs with clean shells. The reason is that SE can silently infect the ovaries of healthy appearing hens and contaminate the inside of eggs before the shells are formed. SE infection is present in hens in most areas in the United States. An estimated one in 20,000 eggs is internally contaminated. Only a small number of hens might be infected at any given time, and an infected hen can lay many normal eggs while only occasionally laying eggs contaminated with SE.

Salmonella outbreaks throughout the United States increased steadily from the east to west coasts from the 1980s to the 1990s. The most common food sources are contaminated eggs that are eaten raw or lightly cooked (runny egg yolks and whites). Additional sources of contamination are raw almonds, sprouts, beef, pork, raw milk, and chicken. Individuals that keep reptiles as pets can be exposed to SE through contact with the reptiles as well.

Symptoms of Salmonella exposure usually develop 12–72 hours after infection and include diarrhea, fever, and abdominal cramps. Although unpleasant, symptoms are not life threatening and most people recover in four to seven days without requiring hospitalization, although it may be a few months before their bowel movements return to normal. However, certain populations are at higher risk for Salmonella infection. The elderly, infants, and those with compromised immune systems can suffer serious health complications due to salmonella exposure. In rare cases, Salmonella can progress from the digestive track and enter the bloodstream. When this occurs, the disease can cause serious illness or even death and requires treatment with antibiotics. A small number of persons with Salmonella can develop pain in their joints, irritation of the eyes, and painful urination. This is called Reiter's syndrome. It can last for months or years, and can lead to chronic arthritis, which is difficult to treat. Antibiotic treatment does not make a difference in whether or not the person develops arthritis.

Simple food handling and hygienic practices will reduce the likelihood of Salmonella exposure. These include ensuring food is thoroughly cooked prior to consumption, washing produce prior to eating, and keeping counters, plates, hands, and food utensils clean and free from contaminants.

E. Coli

Escherichia coli (E. coli) are a large and varied group of bacteria. Exposure to E. coli can cause illness including vomiting, severe stomach cramps, and bloody diarrhea. These symptoms are sometimes accompanied by a low fever (101° F or lower). Symptoms generally present themselves three to five days after exposure but can occur in as little as one day or as long as 10 days.

Most E. coli exposures cause minor illness with recovery ranging from a day or two to a week. However, certain strains have the potential to cause serious to life threatening illness. These strains produce the toxin, Shinga toxin, and are referred to as “Shinga toxin producing E. coli” or STEC. The E. coli strain 0157:87 is the most common of these strains and has the potential to be especially problematic in at-risk populations such as the elderly and children under five years of age. Although most exposures to E. coli 0157:97 result in mild illness and are resolved in five to ten days without treatment, rare cases can progress to serious health complications such as kidney failure. About five to ten percent of those who are diagnosed with STEC infection develop a potentially life-threatening complication known as hemolytic uremic syndrome (HUS). Clues that a person is developing HUS include decreased frequency of urination, feeling very tired, and losing pink color in cheeks and inside the lower eyelids. Persons with HUS should be hospitalized because their kidneys may stop working and they may develop other serious problems. Most persons with HUS recover within a few weeks, but some suffer permanent damage or die. Individuals that develop HUS may require blood transfusions and dialysis.

E.coli lives in the intestines of animals such as elk, deer, sheep, pigs, birds, goats, and cattle. While these animals are infected, the bacteria only adversely affect humans. The infection begins when a person ingests microscopic amounts of human or animal feces through contact with contaminated feces, consumption of unpasteurized milk or apple cider or soft cheeses made from raw milk, or consumption of contaminated food. Infections can be spread by unhygienic food handling, contact with animal exhibits or petting zoo environments, or swallowing lake water while swimming.

Norovirus

Noroviruses refer to the group of single-stranded RNA viruses that cause acute gastroenteritis in humans. Other names used to refer to this type of infection include food poisoning, stomach flu, and viral gastroenteritis. The result of the infection is an inflammation of the intestines and stomach (acute gastroenteritis). It is highly contagious due to ease of transmission and can lead to diarrhea, vomiting, and dehydration. Infection can result from improper hand washing procedures before eating/preparing food or after changing diapers or using the bathroom. It is also the result of person-to-person contact with an infected person (caring for the infected, sharing food/eating utensils, being present while vomiting), touching contaminated surfaces then one’s mouth, eyes, or nose, and eating food/drinking liquid contaminated by the norovirus.

Historically, noroviruses cause over 23 million cases of gastroenteritis per year in the United States. According to the CDC, from 2006-2007, about half of all reported foodborne outbreaks were caused by the norovirus. Contamination occurred in a variety of locations including during preparation, handling, shipping, and growing. Foods associated with these outbreaks included shellfish, fruits, and leafy vegetables.

VULNERABILITIES OR AT-RISK POPULATIONS

While food borne bacteria exposure can threaten the health of all individuals, certain populations are more vulnerable to the harmful effects of the bacteria. These groups include the immunocompromised individuals, elderly, and young children. Due to various reasons such as a weak immune system, individuals from the immunocompromised and elderly populations may develop the symptoms associated with bacteria exposure more rapidly and/or suffer them to a greater degree than the general population, thus they require priority during mass prophylaxis and treatment. Young children are more susceptible to the side effects associated with the antibiotics currently available for the disease; therefore, careful attention should be paid when dispensing medication to young children during mass prophylaxis.

TIME/SEASON

- Summer (Shigellosis)
- Year round (Salmonella)
- Year round (E. coli)
- Year round (Norovirus)

DURATION & SPEED OF ONSET

- Shigellosis
    - Symptoms present themselves within 1-2 days of exposure to Shigella
    - Mild infections resolve themselves in 5-7 days without hospitalization or antibiotics
    - Severe cases require lab testing and an antibiotic
- Salmonella
    - Fever, diarrhea, and abdominal cramps within 12 to 72 hours after consumption of the contaminated beverage or food.
    - Most people recover in 4 to 7 days without hospitalization. In severe cases, hospitalization is required.
- E.Coli
    - Symptoms usually display within 3-4 days of exposure, but can begin as early as 1 day or as long as 10 days
    - Symptoms develop slowly with non-bloody diarrhea and stomach pain that increase in severity over several days
    - Hemolytic uremic syndrome (HUS) can occur after 7 days as diarrhea decreases
- Norovirus
    - The speed of onset associated with norovirus is immediate.
    - The illness lasts for a period of one to two dayso but infected individuals can be contagious for up to two weeks.
    - Vomitting is more common among children than adults.
    - The most common symptoms include stomach pain, vomiting, and diarrhea.
    - The least common symptoms include tiredness, nausea, muscle aches, headache, chills, and low-grade fever.

FREQUENCY & MAGNITUDE

- *Shigella*- Each year, about 14,000 cases are reported in the United States. Shigellosis is particularly common and causes recurrent problems in settings where hygiene is poor and can sometimes sweep through entire communities. Children, especially toddlers aged 2 to 4, are the most likely to get shigellosis. Many cases are related to the spread of illness in child-care settings, and many are the result of the spread of the illness in families with small children. In the developing world, shigellosis is far more common and is present in most communities most of the time.

- *Salmonella*- Annually, there are about 40,000 cases of Salmonella reported in the U.S. resulting in about 400 deaths from acute salmonellosis. About one in 20,000 eggs is contaminated with SE (based upon data estimates from the 1990s). The U.S. produces about 65 billion eggs annually with about 30% that are pasteurized. This leaves about 2.2 million eggs contaminated with Salmonella in general circulation. Since dishes in institutional/commercial kitchens and restaurants are made with pooled eggs, one contaminated egg can infect an entire batch of eggs thus

potentially infecting everyone who eats eggs from the batch. If the eggs are cooked thoroughly (firm egg whites and yolks), Salmonella will be destroyed and cannot infect anyone.
In 2007, the USDA estimated that one in 250 chickens is contaminated with Salmonella. The likelihood of infection is increased when unsafe food handling practices increase in the home and in commercial/institutional kitchens. These include not separating raw eggs or chicken from other foods during food preparation, eating at restaurants, and a lack of hand washing.

- *E. Coli*- Researchers estimate that there are about 70,000 infections caused by E. coli O157 per year in the U.S. This is only an estimate as there are many who are infected who do not see a medical professional, provide a sample, and have a lab test. As a result, there is little research/data on the frequency and magnitude of E. coli.

- *Norovirus*-The norovirus can be found on infected surfaces touched by symptomatic individuals and in the vomit or stool of infected individuals. Outbreaks occur most frequently where people are in close proximity in small areas such as cruise ships, catered events, restaurants, and nursing homes. There are three reasons why the norovirus is closely associated with cruise ships:
  - Health officials track the frequency of illnesses on ships. As a result, outbreaks are found and reported quickly aboard ships when compared to land-based outbreaks.
  - New passengers bring the virus with them exposing the virus to the crew and passengers
  - Living in close quarters increases the amount of group contact

In the United States, norovirus is the most common cause of acute gastroenteritis. Any individual can become infected with the possibility of infection multiple times during one's lifetime.

Outbreak-associated Foodborne Illness by Cause, U.S., 2006-2007	
Foodborne Illness	Number of cases (annual percentage)
Norovirus	22,777 (46%)
Bacteria	14,356 (22%)
Unknown Cause	9,452 (19%)
Multiple/Other Causes	1,604 (3%)
Chemicals	477 (1%)
Parasites	212 (1%)

HAZARD ASSESSMENT
(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	37.5%	Score	0%	Score	12.5%	Score	0%	Score	63%	Score	33%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Physical Vulnerability Consequence & Impact Analysis	Impact Rating	Score	Community Conditions Vulnerability Consequence & Impact Analysis	Impact Rating	Score
Social Vulnerability Hazard Impact Analysis ►		37%	Physical Vulnerability Hazard Impact Analysis ►		15%	Community Conditions Vulnerability Hazard Impact Analysis ►		29%
Special Populations ►		56%	Critical Infrastructure ►		17%	Economic Conditions ►		26%
Cultural Conditions ►		25%	Key Resources ►		6%	Social Conditions ►		37%
Socio-Economic Conditions ►		30%	Building Stock ►		24%	Environmental Conditions ►		9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►		54%
						Insured Risk Exposure ►		16%
						Special Properties ►		20%
						Faith-Based ►		38%

MENINGITIS

INTRODUCTION/OVERVIEW

Meningitis is an inflammation of the membranes that cover the spinal cord and the brain as a result of an infection. Meningitis traditionally occurs by infection from two sources: viruses and bacteria. The meninges are membranes that surround and protect the central nervous system. There are three types of meninges: the pia mater, the arachnoid, and the dura mater. The pia mater (subarachnoid space) is the innermost membrane that adheres to the brain. It is a fibrous, delicate layer that houses the blood vessels that feed the spinal cord and the brain. The arachnoid is the lacy, weblike middle membrane. The dura mater is the tough, outer membrane that adheres to the inside of the skull.

Viral Meningitis

Viral meningitis is a communicable disease that is passed when a virus infiltrates the meninges. It is the most common form of meningitis and usually resolves itself without treatment in two weeks. The incubation period for viral meningitis is approximately three to seven days. Many individuals are exposed to the viruses that cause viral meningitis, but few healthy adults become symptomatic. Individuals with lower immune systems such as infants may be more susceptible to developing symptoms. Symptoms may differ in infants and adults. Common symptoms in infants include fever, irritability, diminished eating, and sleepiness. Symptoms in adults include fever, headache, stiff neck, sensitivity to light, loss of appetite, sleepiness, and nausea.

Viral meningitis is spread by coming in contact with bodily fluids or feces from an infected person. Many viruses cause meningitis. Non-polio enterovirus is most common meningitis causing virus, although the disease can occur from other viruses such as measles, mumps, and chickenpox. Viral meningitis can also be transmitted by vectors such as mosquitoes and other biting insects.

Viral meningitis can be prevented by following public health hygienic practices such as hand washing, covering your cough, cleaning contaminated or dirty surfaces, and avoiding reusing dirty utensils, lipstick, chapstick, or drinking glasses of infected individuals.

Bacterial Meningitis

Bacterial meningitis is a serious disease caused when bacteria infiltrate the meninges. The disease is transmitted through close contact with infected individuals such as the exchange of respiratory secretions. If an individual is suspected of having bacterial meningitis or has been exposed to someone with bacterial meningitis, immediate medical attention should be sought.

Bacterial meningitis most commonly caused by the Haemophilus influenza type b (Hib), streptococcus pneumonia, neisseria meningitides, and listeria monocytogenes bacteria. While these bacteria are known to be contagious, they are not passed through casual contact. Positive strides have been made in recent years in reducing the incidence of bacterial meningitis. A vaccine was developed for Hib that has greatly reduced its occurrence. Currently, streptococcus pneumonia and neisseria meningitides are the most common contributors to bacterial meningitis.

Symptoms of bacterial meningitis infection include fever, headache, stiff neck, sensitivity to light, sleepiness and nausea. As the disease progresses, symptoms can lead to brain damage, coma, and death. Bacterial meningitis can also cause long-term health complications such as hearing loss, mental retardation, paralysis, and seizures.

Bacterial meningitis is particularly hard to diagnose in infants because their inability to communicate symptoms. Symptoms of neonatal bacterial meningitis are nonspecific and include the following:

- Diminished feeding
- Sleepiness
- Listlessness
- Fever
- Seizures
- Jaundice
- Bulging fontanelle (soft spot on head)
- Convolutions
- Seizures

Symptoms typically develop over the course of a few hours or can take up to one to two days.

Once identified, bacterial meningitis must be aggressively treated with antibiotics. The length and type of treatment varies depending on the kind of meningitis being treated, but immediate, aggressive treatment with ampicillin, cephalosporins, gentamicin, vancomycin, or trimethoprim-sulfamethoxazole can be effective. Prophylaxis is recommended for suspected exposures. Preventative measures include vaccination against some of the bacteria that can lead to meningitis.

Untreated cases of bacterial meningitis have case fatality rates that range from 10-30% depending on the type of bacterial infection. Even with treatment, case fatality rates are approximately 15%.

AT-RISK POPULATIONS

- Viral Meningitis
    - Newborns and children - Those who are 5 years and under
    - Immunosuppressed - This includes renal/adrenal insufficiency, HIV patients, etc.
    - Health care employees - This is specific to those who have been exposed to patients with the virus
    - Day care employees - This is specific to those who interact with children age 5 and under
    - Elderly - Those who are 60 years of age or older
    - Exposure to an individual with a recent viral infection - This is due to the infectious nature of the disease
- Bacterial Meningitis
    - Travelers - This is specific to those who travel to countries where the bacterium is epidemic or hyperendemic (high or continued incidence). This is particularly true if the travelers will be among the local population for an extended period of time.
    - College Freshman and military recruits - These individuals have a higher risk of infection than others their age due to living in residence halls and barracks.
    - Pre-teens and Adolescents - Vaccinations received during childhood wear off as a child approaches adolescence. This makes them more susceptible to infection.

- o Smokers - These individuals can develop mucosal lesions making them susceptible upon exposure to the bacteria providing a direct path to the bloodstream.
- o Homosexuall men - These individuals engage in close, direct contact with other men in social settings where the exchange of bodily fluids allows for the transmission of bacteria.

TIME/SEASON

- *Viral*- Incidence is highest in summer and fall due to high mosquito populations which increase the risk of transmission
- *Bacterial*- This type occurs year round due to the variety of ways in which one can be exposed to the bacteria

DURATION & SPEED OF ONSET

Meningitis symptoms mimic those of the flu and can develop in as few as 1-2 days. Viral meningitis (also called aseptic meningitis) is mild and usually lasts a week or two. It is an inflammation of the leptomeninges and affects the central nervous system. Treatment includes medication for fever and pain along with added fluids and rest at home. Those who are infected can be contagious from the 3rd through the 10th day of being symptomatic (symptom appearance is dependent on the type of virus).

In comparison, bacterial meningitis is more dangerous and can be categorized into three groups. Subacute (1-7 days) and chronic (>7 days) can be caused by a variety of noninfectious and infectious organisms. Subacute patients account for about 75% of bacterial meningitis cases. These patients present with symptoms and will require emergency care to prevent death. Chronic meningitis is caused with CSF pleocytosis and can last for about 4 weeks. Acute meningitis (<1 day) is usually caused by one infectious organism. Acute bacterial meningitis patients can decompensate quickly so it is recommended that they see emergency care where they can receive antimicrobial therapy.

Hospital staff will observe the individual for the development of serious problems such as brain damage, seizures, and hearing loss. Additionally, a person can remain contagious as long as the bacteria exists in the secretions of the nose and mouth. A person is no longer contagious within 24-48 hours of beginning the antibiotic treatment.

Meningitis (either type) can develop over the course of several hours or one to two days. On average, about 10%- 30% of those who are infected with bacterial meningitis die from it. When the outcome for the patient is not death, adverse outcomes include deafness, loss of limb, and brain damage.

FREQUENCY & MAGNITUDE

According to the CDC in 2004, there were between 1,400 and 2,800 cases of meningitis in the U.S. (about 0.5-1.1 per 100,000). Vaccinations against some of the agents that can lead to meningitis have caused a decrease in meningitis within the past two decades. Since the introduction of the conjugate pneumococcal vaccine in 2000, the rate of pneumococcal meningitis has declined 59%. Hib vaccine has been successful in greatly reducing instances of this strain. Isolated outbreaks of bacterial meningitis occasionally still occur. These outbreaks are met with aggressive medical countermeasure campaigns.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Meningitis Outbreak, South Florida, Spring 2009 - A rare strain of bacterial meningitis (W135) caused an outbreak in south Florida that infected a dozen people, killing four of them. The W135 strain of bacterial meningitis is known to have mortality rates of approximately 20 percent. As a prophylactic measure, the Miami-Dade Health Department provided free vaccinations for children between the ages of 2 and 18.

Hazard Assessment
(Refer to CVR2 Tool)

Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	43.8%	Score	0%	Score	25%	Score	0%	Score	63%	Score	77%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	37%		Score	21.5%		Score	35%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	17%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	24%		Score	61%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	30%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

PANDEMIC/EPIDEMIC

OVERVIEW/INTRODUCTION

Influenza is a virus that occurs on seasonal basis and presents itself in one of many different genetic combinations. Influenza has been classified into three types of viruses: A, B and C. The A and B viruses are responsible for seasonal epidemic spikes and cause illness in 5 to 20 percent of the population. The C virus is less virulent and causes only mild respiratory illness. Once the influenza is introduced to a host, it has the ability to replicate itself billions of times resulting in illness. Due to its persistence in the population and its seasonal nature, humans have developed a natural resistance to many of the genetic variations of the influenza virus. However, when a novel genetic variation presents itself in a population, humans will be absent their natural resistance to the virus. This will allow the virus to spread rapidly from host to host causing larger than normal morbidity and mortality rates. This occurrence is classified as pandemic influenza.

Typically, influenza A circulates within human and animal populations such as birds and pigs. Due to its diverse population of hosts, influenza A has the proclivity to acquire genetic material and mutate into different strains. This process is called virus reassortment. Virus reassortment can occur in two ways. The first is when a virus acquires genetic material and mutates within the animal host and the second is when the virus mutates within human populations. Depending on the level of mutation, either of these methods can contribute to making a virus either more genetically novel or allow for easier transmission between hosts.

Two proteins, hemagglutinin and neuraminidase, compose part of the influenza virus. In influenza A there are 11 combinations of hemagglutinin and nine combinations of neuraminidase that compose a particular strain of the virus. During the reassortment process, one of these two proteins will change resulting in a slightly different genetic strain. Since only one protein changed, the body will still have a partial immunity to the strain. It will likely cause illness but the immune system typically mitigates the effect. This process is referred to as antigen drift. However, in certain instances, both proteins will change resulting in a completely novel strain. This is what occurs during a pandemic. The body will not have immunity to the new strain; consequently, the result will be increased transmission and possible higher degree of virulence.

Therefore, when influenza A strain is introduced to animal populations such as birds or pigs, genetic reassortment leads to antigen drift which increases the likelihood of novel strains. This is why certain pandemics originate in birds and pigs. An example of this is seen in the current H5N1 “avian influenza” strain and the recent H1N1 “swine influenza” strain. While the virulence of these strains differ dramatically, both are considered highly transmittable due to the novel nature of the strain and the lack of human immunity. Although there is no way to predict where a pandemic will originate, they are thought to occur in areas where there is a higher degree of interaction between animal and human hosts.

Pandemics typically occur in waves lasting anywhere from six to eight weeks. As immunity is developed within a population, the virus will recede for a period of 8-12 weeks. The virus will then reemerge slightly mutated for another wave lasting six to eight weeks. This process repeats during a pandemic two to three times.

Symptoms of pandemic influenza vary depending on the virulence of the strain but mirror typical seasonal symptoms including, fever, coughing, sore throat, congestion headaches, soreness in the muscles and joints, chills and fatigue. During a pandemic, these symptoms can be severe resulting in hospitalizations and death.

The severity of pandemic influenza has varied in the past, but estimates range from an infection rate of 30 to 40 percent. Mortality rates will depend on the virulence of the strain. The 1918 strain has an estimated mortality rate of three percent of infected persons.

Special populations to consider are those with weakened immunity such as infants and the elderly, those with autoimmune disease, and individuals with respiratory complications. However, pandemics in the past have also affected those with healthy immunity such as young adults because of the massive immune response certain strains have generated.

The most effective strategy to combating pandemic influenza is vaccination. However, since a pandemic is caused by a novel strain, it is likely vaccine will not be available for the first wave and sometimes not until the middle of the second wave. Alternate strategies for mitigation include the use of antiviral medication, antibiotics for bacterial pneumonia often associated with influenza, social distancing, and public health hygienic practices.

AT-RISK POPULATIONS

- Children younger than 2 years old*
- Adults 65 years and older
- Pregnant women and women up to 2 weeks from end of pregnancy
- People with certain chronic medical conditions (such as asthma, heart failure, chronic lung disease) and people with a weak immune system (due to illnesses such as diabetes and HIV)
- People younger than 19 years of age who are receiving long-term aspirin therapy

*Children who are 2 years through 4 years of age also have a higher rate of complications compared to older children, although the risk for these children is lower than the risk for children younger than 2 years.

TIME/SEASON

In contrast to seasonal influenza when it occurs during the late fall and early winter months, a pandemic influenza can occur during any month or season.

DURATION & SPEED OF ONSET

Pandemic Influenza generally occurs in multiple waves (2 to 3) that last a period of six to eight weeks each. Generally, each wave will occur approximately 12 weeks apart. Once a novel strain of influenza can achieve human to human transmission, the pandemic is expected to spread rapidly and across geographic barriers.

FREQUENCY & MAGNITUDE

Although the likelihood of pandemic is a certainty, their frequency is difficult to predict. In the 20th century, there were three influenza pandemics. In the 21st century, there has been one to date. A pandemic influenza is characterized based on its ability to spread, not its virulence. Pandemics in the past have ranged from severe to mild.

HAZARD ASSESSMENT
(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Three pandemics occurred in the 20th century and one occurred in the 21st century: 1918, 1957, 1968, and 2009.

- **1918 (Spanish Flu)**-The influenza pandemic of 1918-1919 was one of the deadliest epidemics in history, causing influenza-related symptoms in more than 20 percent of the world's population and claiming more than 21 million lives worldwide. It spread along trade routes and shipping lines. Outbreaks swept through North America, Europe, Asia, Africa, Brazil and the South Pacific. The Great War (i.e. World War I), with its mass movements of men in armies and aboard ships, probably aided in its rapid diffusion and attack. The origins of the deadly flu disease were unknown but widely speculated upon. Some of the allies thought of the epidemic as a biological warfare tool of the Germans. Many thought it was a result of the trench warfare, the use of mustard gases and the generated "smoke and fumes" of the war. A national campaign began using the ready rhetoric of war to fight the new enemy of microscopic proportions. A study attempted to reason why the disease had been so devastating in certain localized regions, looking at the climate, the weather and the racial composition of cities. They found humidity to be linked with more severe epidemics.
- **1957 (Asian Pandemic Flu-H2N2)**-The 1957 Asian Flu Pandemic was much milder than that of the 1918 occurrence. The global death toll was estimated to be around 2 million. In 1957, the Asian flu pandemic resulted in about 70,000 deaths in the United States. Immunity to this strain was rare in people less than 65 years of age, and a pandemic was predicted. In preparation, vaccine production began in late May 1957, and health officials increased surveillance for flu outbreaks. The 1957 pandemic is instructive in that the first US cases occurred in June but no community outbreaks occurred until August and the first wave of illness peaked in October. The 1957 pandemic was associated with the emergence and spread of the H2N2 virus (this virus subtype stopped circulating in 1968). Vaccine was available in limited supply by August 1957.
- **1968 (Hong Kong Flu-H3N2**)-The 1968 pandemic was milder than that of 1957, and spread more slowly than previous pandemics, apart from in the Unites States, where it was introduced by troops returning home from Vietnam. There the disease spread from California to the rest of America in just three months, affecting mostly the very old and those with underlying medical conditions. But in Europe symptoms were relatively mild, and the death count not as high as in previous epidemics. Between one and four million people are estimated to have died worldwide, and around 30,000 people were killed in England and Wales. Some experts believe the 1968 pandemic may have been milder than the previous two because those exposed to the 1957 strain may have built up a partial protection against the virus.
- **2009 (Swine Flu-H1N1)-H1N1** was first detected in the United States in April 2009. This virus was a unique combination of influenza virus genes never previously identified in either animals or people. The virus genes were a combination of genes most closely related to North American swine-lineage H1N1 and Eurasian lineage swine-origin H1N1 influenza viruses. Because of this, initial reports referred to the virus as a swine origin influenza virus. However, investigations of initial human cases did not identify exposures to pigs and quickly it became apparent that this new virus was circulating among humans and not among U.S. pig herds.The CDC estimates about 55 million people were infected, 246,000 H1N1-related hospitalizations, and 11,160 H1N1-related deaths in 2009.

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	6.3%	Score	55%	Score	25%	Score	0%	Score	75%	Score	55%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	68%		Score	30%		Score	43%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	75%		Score	41%		Score	71%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	63%		Score	24%		Score	61%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	67%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	86%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

PLAGUE

OVERVIEW/INTRODUCTION

Yersinia pestis (Y. pestis) is the bacterium that causes plague in humans and animals. Plague is a highly lethal disease that manifests itself in three forms: bubonic, pneumonic and septicemic. These three forms differ on how they are transmitted to the human body.

Bubonic plague is the most common form of transmission. It is a vector borne disease that is transmitted when a plague infected flea, most likely the Xenopsylla cheopis species, bites a human being. A flea infected with Y. pestis will bite its living host to feed and pass the infection to the host. The Xenopsylla cheopis flea is usually carried into an area by rodents such as rats, mice, and squirrels. When the flea loses its original host, it will look for the next closest source of food. An indicator of possible bubonic plague presence is large amount of dead rats or rodents, as rodents that are infected by Yersinia pestis usually die quickly. Once its living host is dead, the flea will find a new living host such as a household pet or human. If a human being is exposed to a flea in search of a host, the flea will feed off the human host and pass the bacteria that causes plague.

After exposure to an infected flea, bubonic plague symptoms appear suddenly, usually after 2 - 8 days. Symptoms include chills, high fever, muscle pain, severe headache, and seizures. Another typical symptom of bubonic plague is an extremely painful swelling in the lymph node called a bubo. The bubo most commonly develops in the groin, armpits, or neck and is often so painful that it prevents patients from moving the affected area of the body. If left untreated, bubonic plague will progress into the blood stream (secondary septicemia) and into the lungs (secondary pneumonic plague). The fatality rate of untreated bubonic plague is approximately fifty percent. When identified and treated in the early stages with antibiotics, the mortality rate for bubonic plague decreases to approximately fifteen percent.

Pneumonic plague is another form of transmission that occurs when an individual inhales aerosolized plague particles. This form of transmission is rare, occurring in only two percent of cases in the United States; however, it is highly lethal. Untreated cases of pneumonic plague are almost one hundred percent fatal. Even if treated with antibiotics, the mortality rate is still approximately fifty percent.

A complicating factor of pneumonic plague is that it is communicable from one infected host to another. Naturally occurring instances of pneumonic plague have been known to occur when an individual has been in close contact (within approximately 6ft) to an infected animal or another human infected with pneumonic plague. This can also occur when working closely with animal hides such as rabbit fur. The disease is most commonly passed from one infected person to another by the inhalation of aerosolized droplets released by coughing or sneezing. Once the bacteria infect the lungs, the disease progresses quickly with symptoms surfacing two to four days post exposure. Initial symptoms include high fever, cough, and chills, similar to the flu. Later symptoms include pneumonia and bloody sputum (coughing up blood).

Although primary pneumonic plague is rare, secondary pneumonic plague occurs in approximately twelve percent of cases in the United States. Secondary pneumonic plague occurs when plague enters the body from a different mode of transmission, moves into the bloodstream, and infiltrates the lungs. Symptoms of secondary pneumonic plague are the same as primary pneumonic plague and include severe bronchopneumonia, chest pain, dyspnea, cough, and hemoptysis.

Pneumonic plague is of concern to emergency planners due to its ability to be aerosolized and made into a weapon. Although difficult to produce, the bioweapons program of the Soviet Union was thought to have produced plague in a weaponzied, aerosol form. In 1970, the World Health Organization (WHO) reported that a worst case scenario plague release could infect up to 150,000 people in a city of five million. Of the infected, an estimated 36,000 would be fatalities. The plague bacilli can remain viable as an aerosol for one hour and travel a distance of up to 10 kilometers.

The third type of plague transmission is **septicemic plague**. Septicemic plague occurs when plague enters the bloodstream through an open wound or cut. This form of transmission is extremely rare but has a close to one hundred percent fatality rate if left untreated. A more common form of septicemic plague is secondary septicemic plague. This occurs when bubonic plague progress to a point where it enters the bloodstream. Septicemic plague is characterized by nausea, vomiting, fever, chills, abdominal pain, necrosis of small vessels, internal bleeding, and shock. Due to damage of the circulatory system, septicemic plague also causes gangrene. The dark dead tissue that is a result of gangrene with septicemic plague is what gave rise to the name “black death”, which was synonymous for plague outbreaks in the middle ages. Even when treated with antibiotics, septicemic plague is still approximately fifty percent fatal.

Large scale plague outbreaks are very rare in the United States. In fact, there has not been a large incident in over 80 years. Moreover, naturally occurring pneumonic plague is even rarer. If a large number of plague cases are diagnosed within a short time frame, it would be reasonable to suspect an insidious outbreak. A terrorist incident of plague would most likely occur due to an aerosolized release. In this case, prompt prophylaxis of suspected exposures is key to increasing survival rates. Social distancing measures and isolation of exposed individuals may also be considered to decrease the chances of communicability. If an insidious bubonic release is suspected, prompt prophylaxis is still paramount but aggressive vector and rodent control measures are also appropriate.

AT-RISK POPULATIONS

Plague has largely been eliminated as a naturally occurring threat in the developing world. However, isolated cases of the disease still exist in the United States. Due to its infrequent nature, it is difficult to identify populations at risk of contracting the disease. Individuals that live in housing with poor sanitation (infected rats and rat fleas), hunters, farmers, and veterinarians, those who live/work/travel to rural areas (in southwestern US) and come in contact with wild animals (such as infected rabbits or rodents), and those who engage in outdoor recreational activities (camping, hunting, hiking, etc.) may have slightly increased risk of contracting the disease. However, if large numbers of individuals are infected with plague, due to a terrorist or any kind of incident, at-risk populations will be those who have weakened immune systems such as the chronically ill, infants, and the elderly. In addition, individuals that come in close contact with plague victims or vectors responsible for spreading plague such as healthcare workers and sanitation workers, respectively, will be at-risk.

TIME/SEASON

Plague can occur at any time

DURATION & SPEED OF ONSET

A person infected by Yersinia pestis will become symptomatic within two to six days of exposure. For those who develop plague pneumonia, the incubation period is one to three days. Symptoms are identical to plague, but with a death rate higher than 50%.

FREQUENCY & MAGNITUDE

In the US, there is an average of 10 to 20 cases of plague annually. About 1 in 7 cases in the US result in death. These cases are usually confined to rural areas. The primary causes in these instances of plague are infected rats and rat fleas that are in the home or wild rodents. The most frequent human cases are found in Nevada, Oregon, California, New Mexico, Colorado and Arizona. Among animals, cases are located from Mexico to southwestern Canada and the Great Plains to the Pacific Coast.

HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

- **The Black Death (also known as 'Bubonic Plague'), 1328-**1351: This is one of the largest epidemics in world history because it killed a quarter of the world's population in 8 years (1348-1356). It arrived in Europe in 1328 and peaked in China (also in 1328) where it cut the population from 125 million to 90 million in about 50 years. It is most commonly associated with England from 1348-1350. Europe lost about 200 million or about one-third of its population. It was able to spread across Europe and Asia along trade routes and killed about 7,500 people per day.

  This epidemic was aptly named because its symptoms caused the skin around the buboes (swelling of the skin) to turn red, then purple, and finally black. Infected persons who sought medical treatment were the victims of blood-letting. Their blood was characterized as thick, black, and having a vile odor.

- **Hong Kong outbreak of 'Oriental Plague', 1859-1923**: The plague traveled along the Pacific trade route and arrived in Hong Kong in 1859 killing millions over the course of 80 years. Researchers believe that the 1855 bubonic plague in China contributed to the outbreak in Hong Kong in Canton, but was largely ignored as a result of the Taiping rebellion that occurred concurrently (1851-1864). Since Hong Kong was a colony of Great Britain, the British government sent a number of doctors, the Colonial Surgeon, and the Inspector of Hospitals to assist in research and containment of plague. The Sanitary Board was brought in to dispose of infected corpses, disinfect infected homes, and complete house-to-house investigations for plague cases.

  At the height of the plague (1884), about 1,000 people fled Hong Kong per day. Economically, this had a significant impact on the manufacturing and construction industries, which suffered labor shortages and eventually came to a standstill. The price of food and other essential items in Hong Kong increased by nearly 50%.

  Alexandre Yersin was the first to provide evidence of the connection between humans and rats by isolating the bacillus in each case type. As a result of research, he developed an antiserum. Among those provided the serum, the mortality rate was cut in half (about 50%).

- **Bubonic Plague in India, 1896-1906**: This outbreak is particularly concerning because the cause is an antibiotic-resistant Y. pestis that killed over 1 million people. The earliest recorded incidence of plague occurred in the 1300s (around the time of the 'Black Plague) and killed nearly half of India's population. Plague spread quickly through the rural and semi-rural areas of India as family members were in close contact and care for the infected. The result for those who were infected was almost always fatal.

- **The Urban Plague Epidemic of Los Angeles, October 1924-1925:** This event began on October 19, 1924 when a woman died of pneumonic plague. Over the next few days, her husband and nurse died. By October 28th, an additional 18 people (all family and friends of the first victim) developed symptoms and died within four days. By November 1st, the Los Angeles City Health Department quarantined the neighborhoods where plague cases originated, providing guards and food with limited contact to residents. A laboratory conducted a bacteriological examination of rats that were trapped in these areas. Rodents were tagged, examined, and dated and locations were recorded for epidemiological purposes.

  Additionally, to prevent further spread of plague, the following protocols were implemented:
  - Garbage disposal policies were changed,
  - Buildings were rat-proofed
  - Trapping increased throughout Los Angeles
  - Established labs exclusively for human plague and rodents
  - All corpses examined by doctors
  - Hospitalization of identified cases in quarantined areas
  - Daily house-to-house inspections

- **Japanese Army Unit 731 Plague, 1940-1942:** The Japanese army Unit 731 dropped plague-infected fleas over Manchuria and China during World War II. They dropped ceramic containers filled with plague-infected fleas along with grains to attract rats, increase their population, and spread the disease in the center of large Chinese cities. Within five days, 37 deaths were recorded and the area was quarantined to prevent the spread of the epidemic. Over 100 people died as a result of this attack.

  This attack was considered a failure for two reasons. First, the Japanese army had exaggerated the expected results of a biological attack. Second, the infectious nature of the disease alerted the public health community based on the number of cases. This allowed them to quickly step in and establish a quarantine thus preventing a wide spread epidemic.

- **Plague Outbreak in India, 1994:** In September 1994, plague struck Surat, a city in the western part of India. Bubonic plague cases were first identified by Indian health officials in the Beed District of Maharashtra State in late August. By September 24, more than 300 unconfirmed cases of pneumonic plague and 36 deaths had been reported from the city of Surat, Gujurat State, approximately 300 km. west of the Beed District. After these reports, hundreds of thousands of Surat's two million residents fled, some to the major cities of Bombay, Calcutta, and New Delhi. Unconfirmed pneumonic plague cases and plague-related deaths were subsequently reported from several areas throughout India.

  The conditions of these slums in August, 1994 were typical of shanty towns all over India: open sewers, tightly clustered shelters made of cement or plastic sheets, rotting animal carcasses, heaps of garbage, and pools of stagnant water fill the alleys. Floods in early August heightened the horror as the human waste and refuse mixed with slush and mud that were washed up and left on the riverbank creating ideal conditions for the spread of infection. Cows, dogs and pigs stood on top of high piles of garbage while people sold vegetables from rickety wooden carts alongside allowing rats to thrive. As a result of living in crowded conditions without medical care, or money to pay for it, untreated bubonic plague infections progressed systemically to plague pneumonia. Inevitably, the rapid person-to-person spread of pneumonic plague commenced.

Physicians and pharmacists escaping the city brought large amounts of treatment drugs away with them for their families and friends. Preventive dosing with the essential antibiotic made locating medication for treatment of suspected cases difficult. Supplies were being rushed to Surat from other parts of the country on an emergency basis. Officials raided pharmacies where antibiotics were being hoarded for black-market prices due to scarcity, and turned the antibiotics over to health officials. Insufficient supply persisted because those with adequate resources to buy purchased and hoarded medication, worsening the chances of the poor to have medication available if they became ill.

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	6.3%	Score	10%	Score	18.8%	Score	0%	Score	75%	Score	65%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ►	Impact Rating		Physical Vulnerability Hazard Impact Analysis ►	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ►	Impact Rating	
	Score	68%		Score	23%		Score	41%
Special Populations ►	Impact Rating		Critical Infrastructure ►	Impact Rating		Economic Conditions ►	Impact Rating	
	Score	75%		Score	41%		Score	64%
Cultural Conditions ►	Impact Rating		Key Resources ►	Impact Rating		Social Conditions ►	Impact Rating	
	Score	63%		Score	6%		Score	61%
Socio-Economic Conditions ►	Impact Rating		Building Stock ►	Impact Rating		Environmental Conditions ►	Impact Rating	
	Score	67%		Score	24%		Score	9%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ►	Impact Rating	
							Score	81%

[redacted]	Insured Risk Exposure ▶	Impact Rating	
		Score	16%
	Special Properties ▶	Impact Rating	
		Score	20%
	Faith-Based ▶	Impact Rating	
		Score	38%

WATER CONTAMINATION

OVERVIEW/INTRODUCTION

Contamination of a drinking water system can cause illness, disease, or even death. A water system can be contaminated, damaged or disrupted through intentional terrorist or criminal actions or by an accident. Intentional contamination poses one of the most serious threats to a water system because of the intent to harm human health or cause damage.

There are two kinds of water contamination problems:

- *Contamination threats*: A contamination threat is a suggestion or an indication that water has been or will be contaminated, but no conclusive proof has been collected yet to confirm that contamination has actually occurred. A threat may be written, verbal, or based on observations or other evidence.
- *Actual contamination incidents*: A drinking water contamination incident occurs when the presence of a harmful contaminant has been confirmed.

Contamination threats and contamination incidents could impact the public in the following ways:

- Cause harm to public health (illness, disease, or death);
- Cause fear or loss of public confidence;
- Disrupt the water system or cause long-term shortage of clean, safe water to customers or prevent use of the water supply for fire fighting;
- Disrupt businesses and services that depend on a safe water supply;
- Cause damage to the water system infrastructure (e.g., water plant, pumps, pipes, wells, treatment system, distribution system, electrical system or computer network) resulting in contamination or interference with treatment or delivery;
- Create a need to remediate and replace portions of the water system to make it safe, which could in turn create water shortages or outages;
- Result in significant costs for remediation or replacement; and
- Impact other critical infrastructures that rely on safe water, due to interdependencies (e.g., food processing and refineries, among others).

Security experts have warned that terrorist organizations may be considering water systems as possible targets for weapons of mass destruction, known as WMD. WMD include some chemical, biological and radiological contaminants whose purpose is to cause harm. It has always been possible to intentionally contaminate a water system, but 9/11 and other recent events have suggested that the likelihood that an intentional contamination incident will happen has increased.

There are many ways in which water can be intentionally contaminated, just as there are many different contaminants. Each contaminant has different effects on humans, animals and the environment, depending on its concentration (level) and toxicity (harmfulness).

Examples of Possible Contaminants:

- **Pathogens** are harmful microorganisms that can impact human health, such as E. coli, Cryptosporidium, polio virus, Hanta virus, smallpox virus, and the microorganisms responsible for anthrax, bubonic plague, cholera and other illnesses;
- **Toxic metals** such as arsenic, cadmium, mercury, osmium, and others;
- **Toxic organic compounds** such as biotoxins (Ricin), pesticides, chlorinated compounds such as dioxin, or volatile organic compounds such as mustard gas; and
- **Radioactive materials** such as radioactive isotopes used in hospitals, research labs, universities and nuclear reactor fuels.

A few contaminants are so dangerous that very small amounts could sicken or kill many humans or animals. These include certain pathogenic bacteria and viruses, some biotoxins, and some highly toxic chemicals that can persist in water for a long time before they break down into less harmful chemicals. Other contaminants could cause death or illness in people who are especially at risk, such as children, the elderly, those who are already ill due to other causes or others who are particularly sensitive. There are hundreds of contaminants that could disrupt normal operations and cause the public to lose confidence in the water system, but which would not cause illness or death.

PROFILE OF WATER CONTAMINATION IN FLORIDA AND MIAMI-DADE COUNTY

Cattle Dipping Vats

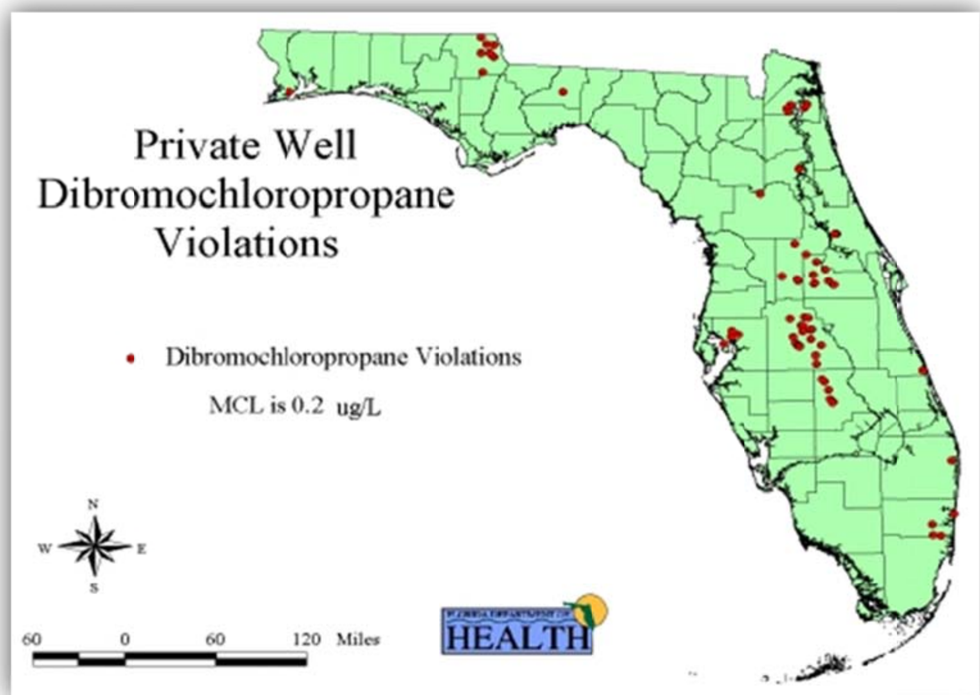
From the 1910's through the 1950's, these vats were filled with an arsenic solution for the control and eradication of the cattle fever tick. Other pesticides such as DDT where also widely used. By State law, all cattle, horses, mules, goats, and other susceptible animals were required to be dipped every 14 days. Under certain circumstances, the arsenic and other pesticides remaining at the site may present an environmental or public health hazard, specifically water contamination.

This is a list of the number of known cattle-dipping vats in Miami-Dade County that have been accounted for thus far. There are likely many more that have not been located.

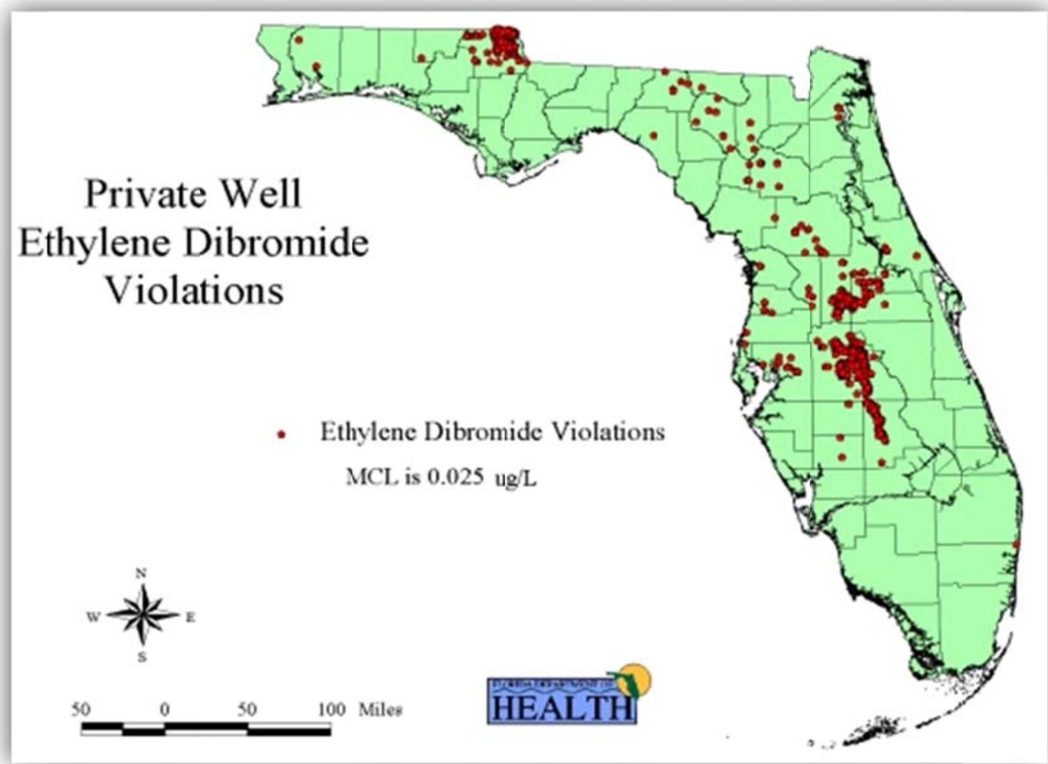
- **County**: Miami-Dade
- **Vats**: 1

Areas with Well Contamination

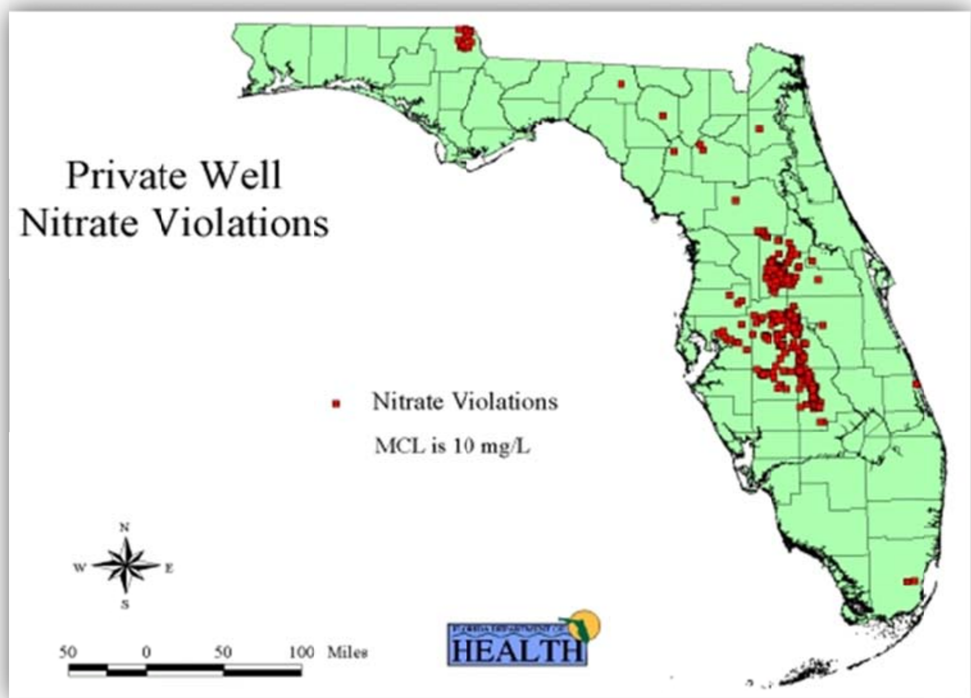
Dibromochloropropane



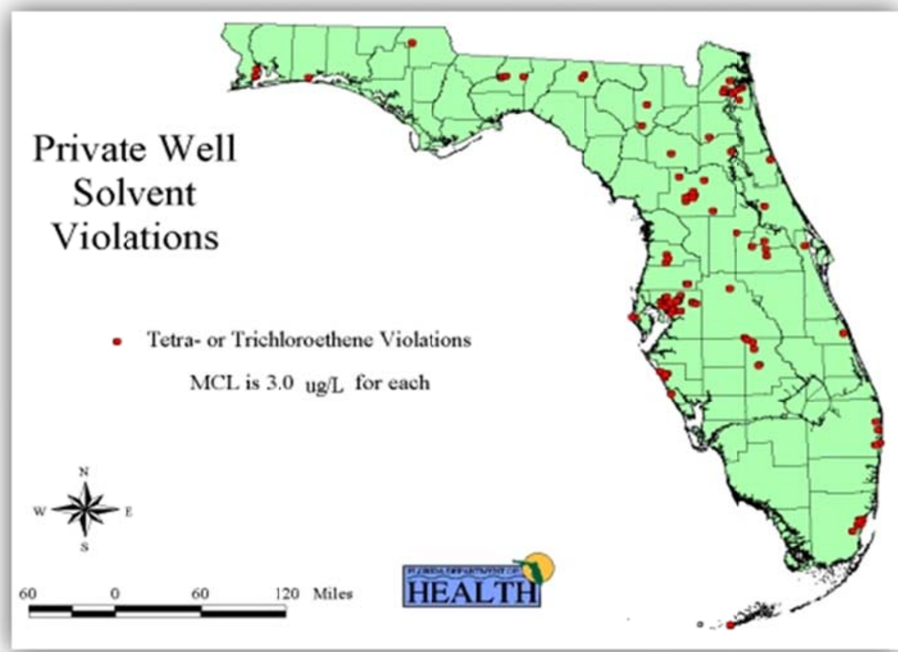
Ethylene Dibromide



Nitrate



Tetrachloroethylene (PERC)/Trichloroethylene (TCE)



HAZARD ASSESSMENT

(Probability, Frequency, and Magnitude of Past Events in Miami-Dade)

Hazard Assessment (Refer to CVR2 Tool)											
Frequency/Probability Assessment		Magnitude/Scale Assessment		Casualty & Fatality Assessment		Damage Assessment		Hazard-Specific Mitigation Assessment		Hazard-Specific Capability Assessment	
Index Rating		Index Rating		Index Rating		Index Rating		Index Rating		Index Rating	
Score	25%	Score	10%	Score	12.5%	Score	0%	Score	67%	Score	73%

HAZARD IMPACT ANALYSIS

Social Vulnerability Consequence & Impact Analysis			Physical Vulnerability Consequence & Impact Analysis			Community Conditions Vulnerability Consequence & Impact Analysis		
Social Vulnerability Hazard Impact Analysis ▶	Impact Rating		Physical Vulnerability Hazard Impact Analysis ▶	Impact Rating		Community Conditions Vulnerability Hazard Impact Analysis ▶	Impact Rating	
	Score	45%		Score	23%		Score	34%
Special Populations ▶	Impact Rating		Critical Infrastructure ▶	Impact Rating		Economic Conditions ▶	Impact Rating	
	Score	56%		Score	41%		Score	26%
Cultural Conditions ▶	Impact Rating		Key Resources ▶	Impact Rating		Social Conditions ▶	Impact Rating	
	Score	25%		Score	6%		Score	37%
Socio-Economic Conditions ▶	Impact Rating		Building Stock ▶	Impact Rating		Environmental Conditions ▶	Impact Rating	
	Score	55%		Score	24%		Score	30%
Reference CVR2 Tool for Specific Scores & In-Depth Analysis						Governmental Conditions ▶	Impact Rating	
							Score	73%
						Insured Risk Exposure ▶	Impact Rating	
							Score	16%
						Special Properties ▶	Impact Rating	
							Score	20%
						Faith-Based ▶	Impact Rating	
							Score	38%

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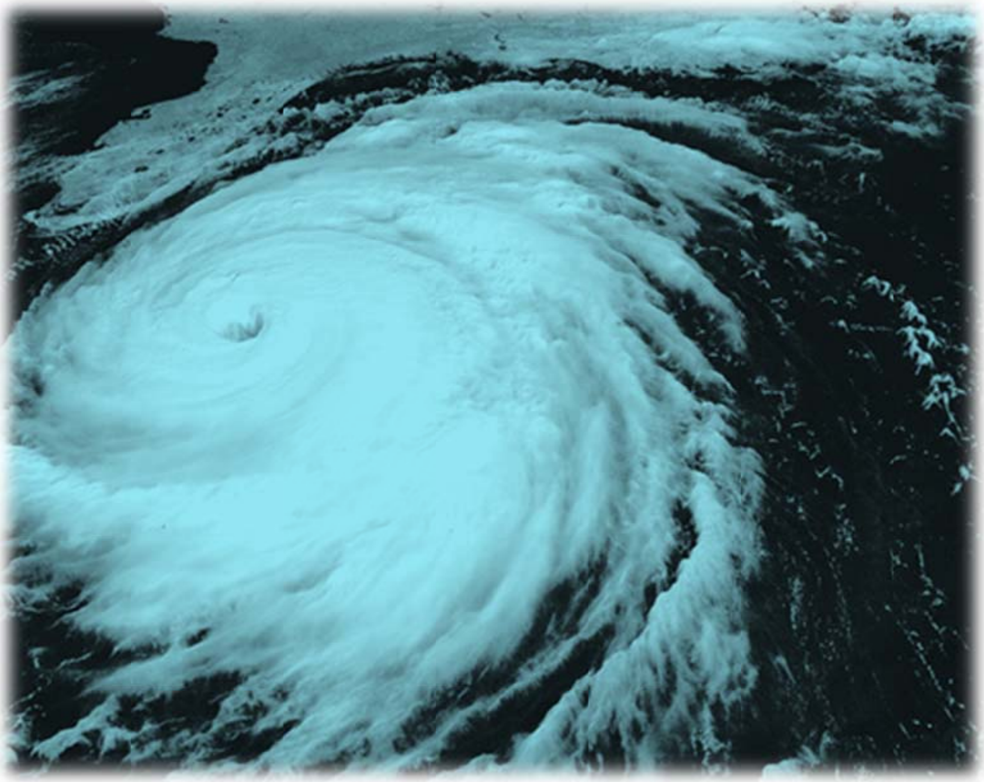
VII. RISK ASSESSMENT SUMMARY



VII. RISK ASSESSMENT SUMMARY

At the most fundamental level, both DHS and FEMA recognize that risk is equal to Frequency/Probability X Consequence ($R = F \times C$). More specifically, risk is based on the premise that in order to have a certain level of risk, there must be a probability or likelihood for that event to occur. Likewise, if the event does occur but there is no impact or consequence, the level of risk is negated or substantially reduced.

Whereas measuring frequency/probability of a hazard is straightforward, defining and measuring "consequence" is more complex. At the most basic level, "consequence" is an assessment of the potential impact(s) if the attack or hazard event actually does occur. As the methodology section states (see THIRA Methodology), the consequence of an event (or the impact) will be interdependent on the following factors: vulnerabilities (i.e. social, physical, and community conditions), capabilities and capacities, mitigation, and the characteristics (i.e. magnitude, scale, etc.) of the hazard event or attack itself. Again, the frequency/probability of the hazard is not included in assessing the “consequence” because without the event, there is no consequence or impact.

This section is simply a summary of the County’s risks and the factors that contributed to the overall risk score for each hazard based on the above framework. Each of the previous sections contributed to the total scores for each category. See assessment summaries below:

NATURAL HAZARDS

Probability		Consequence							OVERALL RISK SCORE
			Impact Analysis						
Hazards	Frequency & Probability	Potential Magnitude & Scale	Social Vulnerabilities Hazard Impact Rating	Physical Vulnerabilities Hazard Impact Rating	Community Conditions Impact Rating	Capabilities & Capacity	Mitigation	Hazard Consequence & Impact Score	
Natural Hazards									
Droughts	38%	38%	29%	15%	39%	82%	70%	40%	39%
Extreme Cold	17%	11%	29%	15%	34%	82%	67%	32%	23%
Extreme Heat	75%	16%	41%	15%	34%	82%	58%	36%	52%
Flooding	50%	27%	53%	38%	52%	68%	96%	53%	51%
Hailstorms	69%	18%	29%	24%	51%	82%	50%	41%	53%
Heavy Rain	50%	9%	29%	32%	32%	68%	96%	36%	42%
Hurricanes & Tropical Storms	69%	64%	66%	58%	64%	63%	58%	75%	72%
Lightning	75%	18%	29%	15%	29%	82%	96%	32%	49%
Winter Weather / Ice	5%	16%	37%	15%	35%	82%	75%	35%	13%
Sinkholes / Erosion	50%	13%	29%	38%	41%	82%	50%	41%	45%
Space	1%	7%	29%	23%	29%	68%	N/A	29%	5%
Tornadoes	44%	20%	53%	42%	53%	68%	75%	53%	48%
Tsunami	13%	24%	37%	24%	36%	68%	25%	45%	24%
Volcano (Ash)	1%	4%	37%	15%	32%	85%	N/A	28%	5%

Probability		Consequence							OVERALL RISK SCORE
			Impact Analysis						
Hazards	Frequency & Probability	Potential Magnitude & Scale	Social Vulnerabilities Hazard Impact Rating	Physical Vulnerabilities Hazard Impact Rating	Community Conditions Impact Rating	Capabilities & Capacity	Mitigation	Hazard Consequence & Impact Score	
Natural Hazards									
Windstorm	50%	18%	37%	42%	45%	82%	75%	45%	47%
Wildfires	38%	13%	57%	42%	51%	68%	63%	53%	44%
Earthquakes	5%	4%	29%	24%	29%	68%	N/A	29%	12%

KEY:

Frequency	Consequence	Capability/Mitigation	Overall Risk
Not Probable/Frequent	Minimal Impact	Very Capable/Adequate	Low Risk
Somewhat Probable/Frequent	Moderately Low Impact	Capable/Adequate	Moderately Low Risk
Probable/Frequent	Moderately High Impact	Somewhat Capable/ Adequate	Moderately High Risk
Very Probable/Frequent	High Impact	Not Capable or Adequate	High Risk

TECHNOLOGICAL HAZARDS

Probability		Consequence							OVERALL RISK SCORE
			Impact Analysis						
Hazards	Frequency & Probability	Potential Magnitude & Scale	Social Vulnerabilities Hazard Impact Rating	Physical Vulnerabilities Hazard Impact Rating	Community Conditions Impact Rating	Capabilities & Capacity	Mitigation	Hazard Consequence & Impact Score	
Technological Hazards									
Dam/Levee Failure	6%	16%	29%	15%	40%	63%	46%	38%	15%
Electric Utility Failure	75%	13%	29%	23%	35%	65%	67%	37%	53%
Hazardous Materials Release	50%	13%	53%	24%	40%	55%	50%	47%	48%
Mass Migration	25%	0%	37%	15%	35%	55%	38%	37%	30%
Nuclear Power Plant Incident	19%	17%	53%	38%	58%	54%	81%	55%	32%
Structural Fires	50%	17%	45%	30%	35%	82%	83%	41%	45%
Transportation Incident	75%	28%	29%	23%	31%	86%	83%	37%	52%
Water/Wastewater Incident	19%	6%	37%	23%	34%	68%	81%	36%	26%

KEY:

Frequency	Consequence	Capability/Mitigation	Overall Risk
Not Probable/Frequent	Minimal Impact	Very Capable/Adequate	Low Risk
Somewhat Probable/Frequent	Moderately Low Impact	Capable/Adequate	Moderately Low Risk
Probable/Frequent	Moderately High Impact	Somewhat Capable/ Adequate	Moderately High Risk
Very Probable/Frequent	High Impact	Not Capable or Adequate	High Risk

CRIMINAL/TERRORISM HAZARDS

Probability		Consequence							
Hazards	Frequency & Probability	Potential Magnitude & Scale	Impact Analysis: Social Vulnerabilities Hazard Impact Rating	Impact Analysis: Physical Vulnerabilities Hazard Impact Rating	Impact Analysis: Community Conditions Impact Rating	Capabilities & Capacity	Mitigation	Hazard Consequence & Impact Score	OVERALL RISK SCORE
Criminal/Terrorism Hazards									
Civil Unrest	25%	6%	37%	21%	43%	65%	75%	38%	31%
Cyber Security Incident	38%	2%	29%	30%	39%	68%	75%	36%	37%
Terrorism	19%	46%	53%	47%	58%	55%	54%	65%	35%
Bomb Threat	56%	0%	29%	30%	32%	78%	63%	33%	43%

KEY:

Frequency	Consequence	Capability/Mitigation	Overall Risk
Not Probable/Frequent	Minimal Impact	Very Capable/Adequate	Low Risk
Somewhat Probable/Frequent	Moderately Low Impact	Capable/Adequate	Moderately Low Risk
Probable/Frequent	Moderately High Impact	Somewhat Capable/ Adequate	Moderately High Risk
Very Probable/Frequent	High Impact	Not Capable or Adequate	High Risk

PUBLIC HEALTH HAZARDS

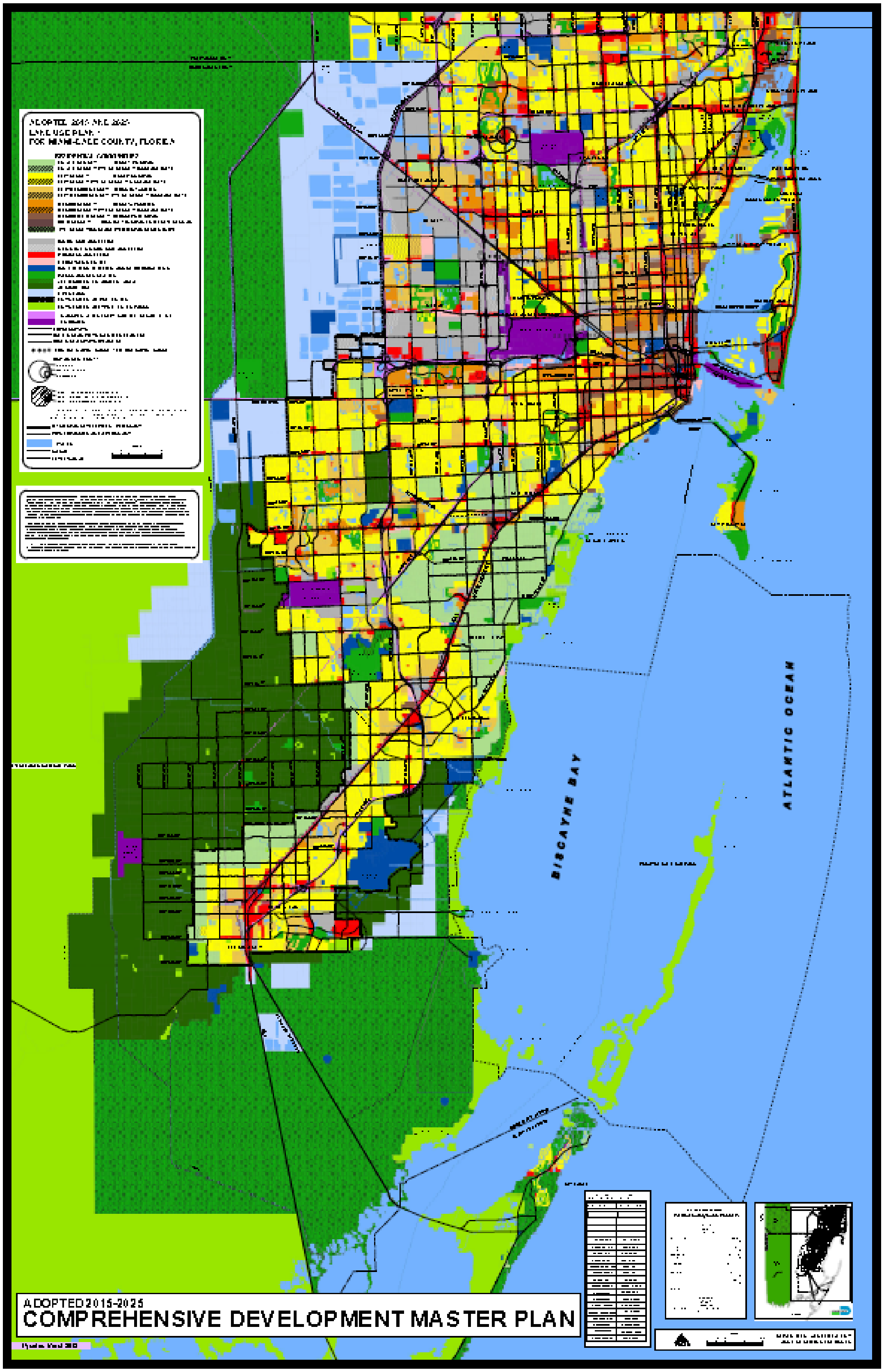
Probability		Consequence							
Hazards	Frequency & Probability	Potential Magnitude & Scale	Impact Analysis: Social Vulnerabilities Hazard Impact Rating	Impact Analysis: Physical Vulnerabilities Hazard Impact Rating	Impact Analysis: Community Conditions Impact Rating	Capabilities & Capacity	Mitigation	Hazard Consequence & Impact Score	OVERALL RISK SCORE
Public Health Hazards									
Anthrax	19%	13%	29%	21%	42%	61%	50%	39%	27%
Animal / Plant Disease Outbreak	13%	3%	29%	21%	35%	71%	N/A	29%	19%
Food Borne Illness	38%	6%	37%	15%	29%	72%	63%	33%	35%
Meningitis	44%	0%	37%	21%	35%	77%	63%	34%	38%
Pandemic / Epidemic	6%	36%	68%	30%	43%	55%	75%	57%	19%
Plague	6%	13%	68%	23%	41%	65%	75%	48%	17%
Water Contamination	25%	10%	45%	23%	34%	73%	67%	39%	31%

KEY:

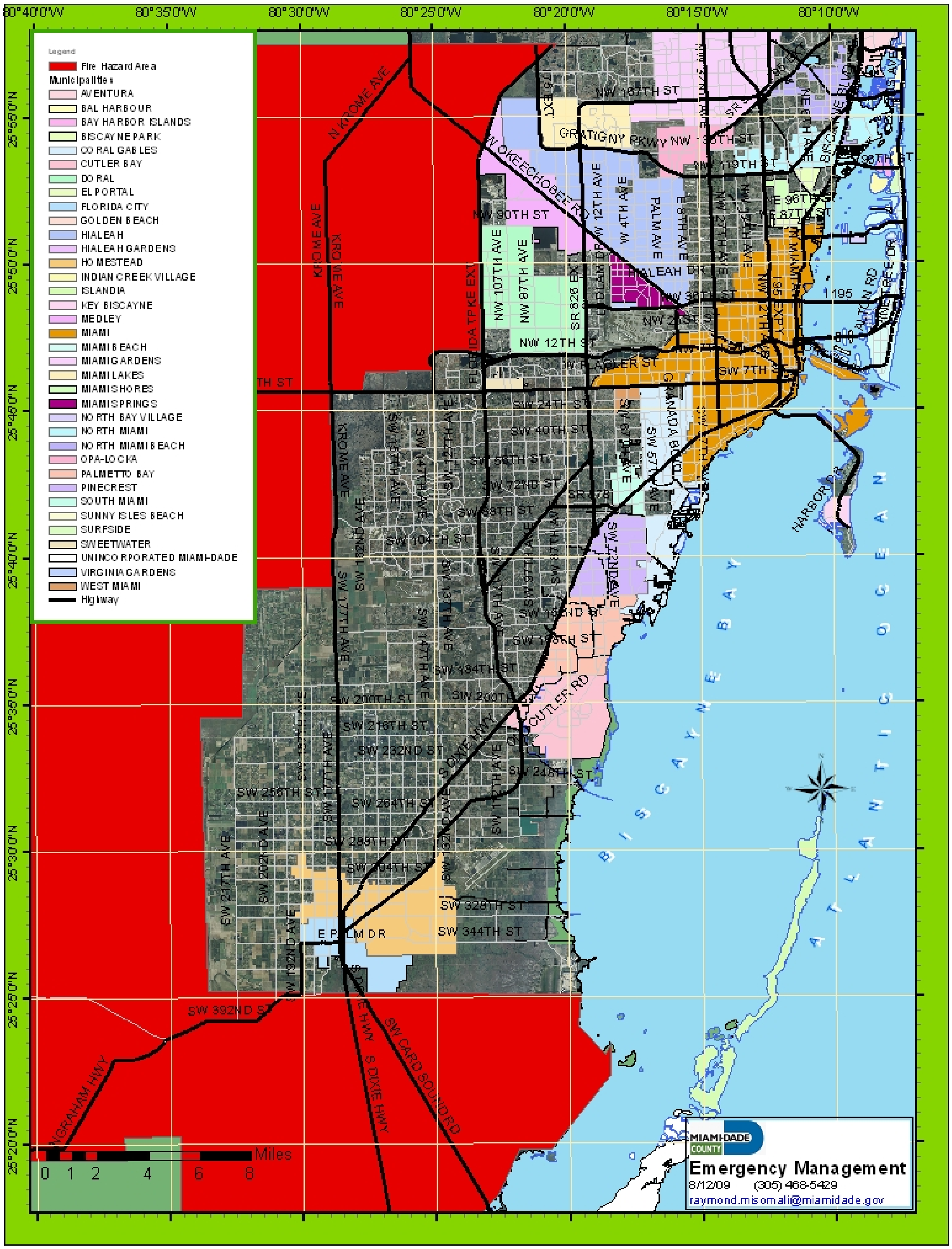
Frequency	Consequence	Capability/Mitigation	Overall Risk
Not Probable/Frequent	Minimal Impact	Very Capable/Adequate	Low Risk
Somewhat Probable/Frequent	Moderately Low Impact	Capable/Adequate	Moderately Low Risk
Probable/Frequent	Moderately High Impact	Somewhat Capable/ Adequate	Moderately High Risk
Very Probable/Frequent	High Impact	Not Capable or Adequate	High Risk

Appendix F: Maps

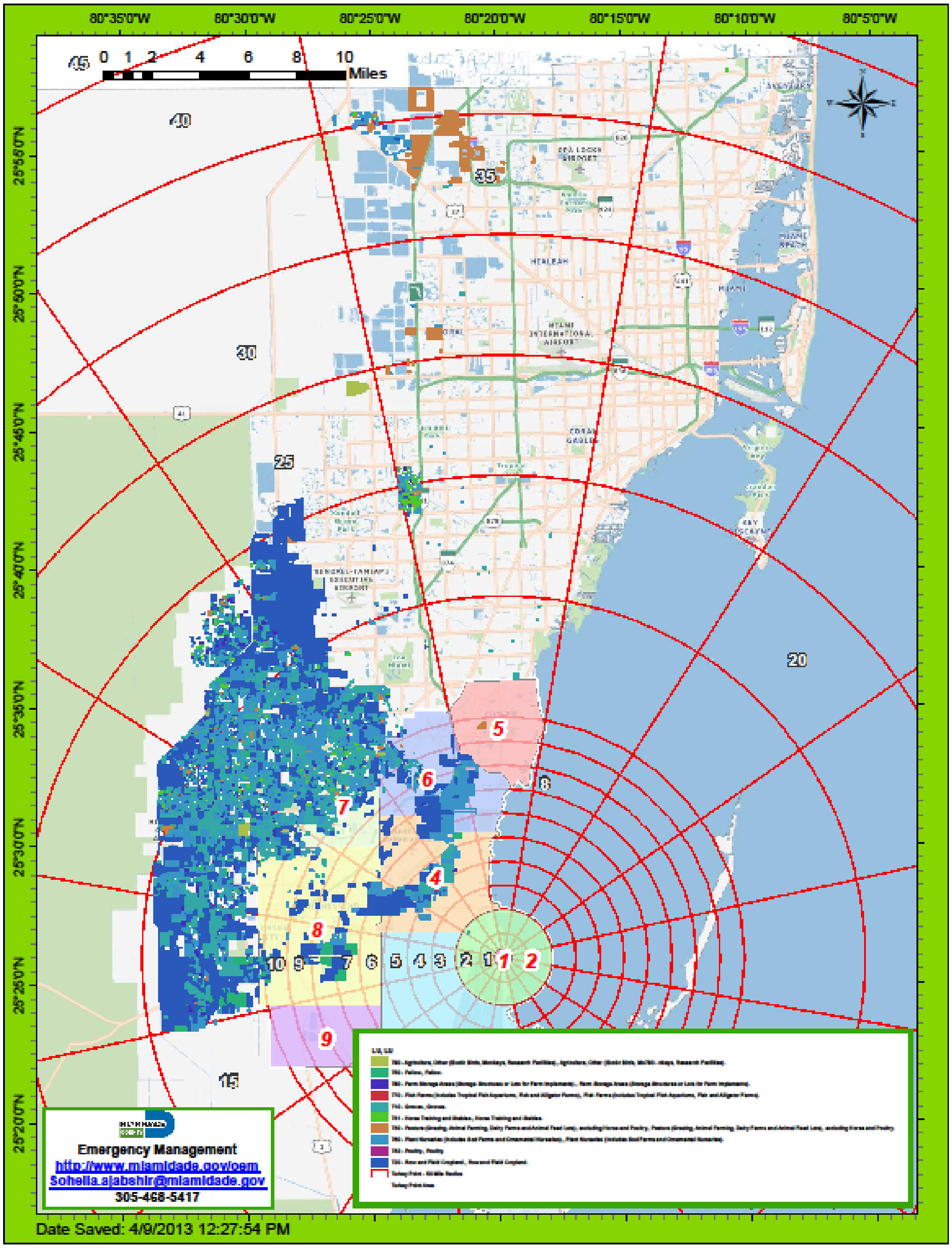
Miami-Dade Comprehensive Land Use


BISCAYNE BAY
ATLANTIC OCEAN
ADOPTED 2015-2025
COMPREHENSIVE DEVELOPMENT MASTER PLAN

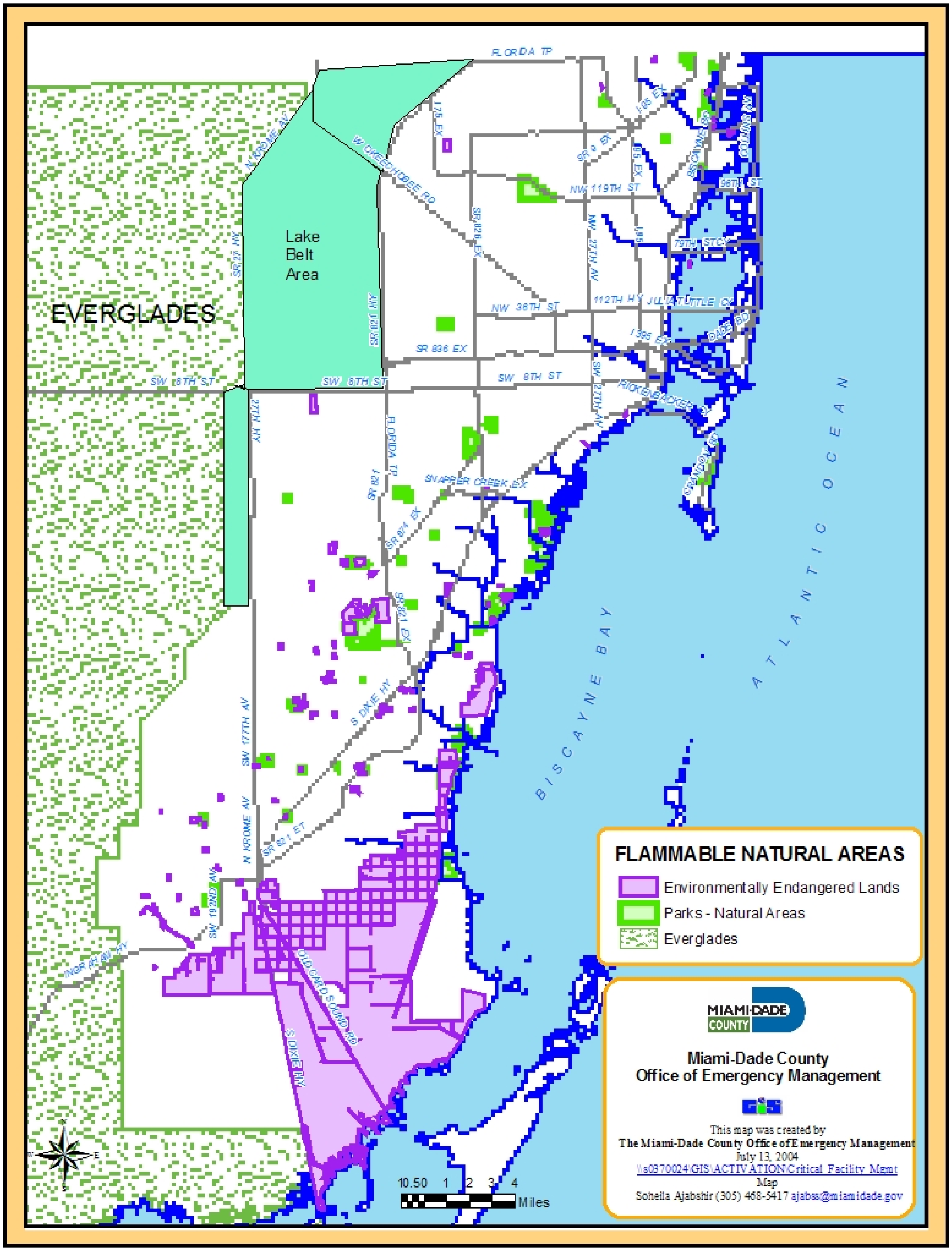
Fire-Hazard Area in Miami-Dade County



Land Use within Turkey Point Nuclear Power Plant 50-Ingestion Pathway



Map of Miami-Dade Flammable Natural Areas



Appendix G: LMS Benefit Cost Review

Initiative Being Scored:					
Name of Applicant:					
Project Cost:					
Parameter		**Weighting Factor**	**Scoring Criteria**	**Score**	**Points**
Suitability		**30%**			
1	Appropriateness of the Measure	35%	**5 - High:** Reduces vulnerability and is consistent with Local Mitigation Strategy (LMS) goals and plans for future growth. **3 - Medium:** Needed, but does not tie to identified vulnerability. 0 **- Low:** Inconsistent with LMS goals or plans.		
2	Vulnerability to Hazards	15%	**5 - High:** Project adresses 2 or more hazards, includes consideration for sea level rise impacts. **3 - Medium:** Project addresses at least 2 hazards. **1 - Low:** Project addresses one hazard.		
3	Lifespan of mitigation measure and consideration of future risk	15%	**5 - High:** Expected to last\address hazards for 40 or more years. **3 - Medium:** Expected to last\address hazards for 20-39 years. **1 - Low:** Expected to last\address hazards less than 20 years		
4	Environmental Impact	10%	**5 - Positive effect** on the environment. **3 - No effect -** environmentally neutral. **0 - Adverse effect** on the environment.		
5	Consistent with Existing Legislation and/or Policies	10%	**5 - High:** Consistent with existing laws and policies. **3 - Medium:** New legislation or policy changes needed, but no conflicts identified. **1 - Low:** Conflicts with existing laws, regulations and/or policies, requires waivers.		
6	Consistent with Existing Plans and Priorities	15%	**5 - High -** Consistent with existing plans and priorities. **3 - Medium -** Somewhat consistent with current plans and priorities. **1 - Low -** Conflicts with existing plans and priorities. Does not fit in with identified initiatives.		
	Parameter Subtotal	100%	**sum of parameter scores; max =**		

Suitability subtotal			(sum of parameter scores) / (maximum possible score)	100%	
Parameter		**Weighting Factor**	**Scoring Criteria**	**Score**	**Points**
Risk Reduction		**55%**			
1	Scope of Benefits	15%	**5 - High:** Benefits multiple jurisdictions. **3 - Medium:** Benefits more than half but not all of the municipalities and/or the unincorporated area. **1 - Low:** Benefits less than half of the municipalities and/or the unincorporated area.		
2	Potential to Protect or Save Human Lives	30%	**5 - High:** More than 1,000 lives. **3 - Medium:** Up to 1,000 lives. **1 - Low:** No lifesaving potential.		
3	Supports Protection of Critical Infrastructure or Continuity of Essential Services	20%	**5 - High:** Project will ensure continuity of operations for critical infrastructure or essential services for disaster response. **3 - Medium:** Project will support critical infrastructure or essential services with loss/damage history. **1 - Low:** Project will support infrastructure or services without loss/damage history. **0- Neutral -** Project has no impact on community infrastructure or services.		
4	Repetitive Damages Corrected	10%	**5 - High:** Alleviates repetitive loss. Property must have been damaged in the past by a disaster event. **3 - Medium:** Repetitive loss may have occurred but was not documented. **1 - Low:** No effect on repetitive loss.		
5	Economic Effect or Loss During Lifespan of the Project	10%	**5 - Minimal** economic loss (project improves resiliency of the community, does not increase risk of other adjacent areas/buildings.) **3 - Moderate** economic loss (project may help minimize disruption and economic losses). **1 - Significant** economic loss (project not likely to minimize economic impact of the community).		
6	Number of People to Benefit	15%	**5 - High: M**ore than 100,000 people. **3 - Medium:** 10,000 to 100,000 people. **1 - Low: F**ewer than 10,000 people.		
	Parameter Subtotal	100%	**sum of parameter scores; max =**		
Risk Reduction Subtotal			(sum of parameter scores) / (maximum possible score)		100%

Parameter		Weighting Factor	Scoring Criteria	Score	Points
Cost and Time		**15%**			
1	Estimated Costs*	30%	*(This score combines a weighted factor of Initial and Maintenance/Operating Costs)		
	i. Initial Cost (including design, project management, research…)	*75%*	**5 - Low:** $0 to $100,000. **3 - Moderate:** $100,001 to $1 million. **1 - High:** More than $1 million.		
	ii. Maintenance/Operating (Annual/Deployment) Costs	*25%*	**5 - Lower costs:** Less than 5% per annum of the intial cost. **3 - Moderate costs:** 5-10% per annum of the intial cost. **1 - Higher costs:** More than 10% annum of the intial cost.		
2	Affordability	30%	**5 - Good:** Project is easily affordable. Has been budgeted or a grant for this project is available and the likelihood of success is high. (If a match is needed, it is available.) **3 - Moderate:** Project is somewhat affordable. Grants for this project are available and the likelihood of success is moderate. (If a match is needed, high confidence that it could be obtained.) **1 - Poor:** Project is very costly for the agency. Grants for this project are limited. (If a match is needed, there may be difficulty in obtaining a match.)		
3	Complexity of Implementation	20%	**5 - Low:** This project is feasible, acceptable to most in the community, and does not require a public vote or hearing that may delay implementation. (Or has already been approved and accepted.) **3 - Moderate:** This project is feasible, may have some opposition from the community and may require specialized permitting or a public hearing or vote that may delay implementation. **1 - High:** This project is feasible, may have some opposition from the community, and will require either specialized permitting, or a public hearing or vote that will delay implementation.		

4	Completion Timeframe	20%	**5 - High:** 6 months or less from time of funding**.** **3 - Medium:** 6 months to 1 year from time of funding. **1 - Low:** more than 1 year from time of funding.		
	Parameter Subtotal	100%	**sum of parameter scores: max =**		
Cost Subtotal			(sum of parameter scores) / (maximum possible score)		100%
* Estimated costs are comprised of two secondary parameters: initial and maintenance/operating costs					
SUITABILITY		**30%**		100%	
RISK REDUCTION		**55%**		100%	
COST		**15%**		100%	
TOTAL		**100%**			

For a working Microsoft Excel worksheet of the LMS Prioritization Matrix send an e-mail request to: **mdlms@miamidade.gov**.

Appendix H: LMS Working Group and Subcommittee Members 2013

Chairman/Coordinator: Cathie Perkins
Vice Chairman/Coordinator: Mike Gambino

Colleges and Universities

Florida International University
St. Thomas University
University of Miami
Miami Dade College
International Hurricane Research Center
University of Florida IFAS Extension

Miami-Dade County Departments

Miami-Dade Finance
Miami Dade Fire Rescue
   Office of Emergency Management
Miami-Dade-Internal Services (GSA, HR, Procurement, A&E of CIP)
   General Services Administration
Miami Dade-Library
Miami-Dade - Management and Budget
   Office of Grants Coordination
   Office of Capital Improvements
Miami-Dade Parks, Recreation and Open Spaces
Miami-Dade Police Department
Miami- Dade Public Housing and Community Development
Miami –Dade Public Works and Waste Management
Miami-Dade Port of Miami
MD-Regulatory and Economic Resources
   Permitting (P&Z)
   Planning (P&Z)
   Agriculture Extension
   Environmental Resources Management
Miami-Dade Transit
Miami-Dade Water and Sewer Department
Vizcaya Museum and Gardens
Miami Dade County Public Schools

State Agencies

South Florida Water Management District

Federal Agencies

National Oceanic and Atmospheric Administration

Hospitals and Health Care

Citrus Health
Jackson Health Systems
Miami Children's Hospital
Mount Sinai Medical Center

Municipalities

Aventura
Biscayne Park
Coral Gables
Cutler Bay
Doral
El Portal
Florida City
Golden Beach
Hialeah
Homestead
Key Biscayne
Medley
Miami
Miami Beach
Miami Gardens
Miami Lakes
Miami Shores
Miami Springs
North Bay Village
North Miami
North Miami Beach
Opa Locka
Palmetto Bay
Pinecrest
South Miami
Sweetwater
Virginia Gardens

Regional

Private Non-Profit

American Red Cross
Camillus House

Private Sector/Businesses

AMEC
Grove Isle Marina
Hurricane Protection Industries
Kolisch Marine Insurance
Miami River Commission
Miami River Marine Group
Mitigat
Strategic Initiative Planning and Advocacy
URS Corporation

Other

Private Citizens

Appendix I: LMS Committees

Local Mitigation Strategy Steering Committee: 2013

Ricardo Alvarez, Mitigat
Dallas Brown, City of Coral Gables
Ken Capezzuto, University of Miami
Steve Detwiler, Business Recovery Program
Mike Gambino, City of Miami Gardens
Hugh Gladwin, Florida International University
Theresa Grandal, Miami Dade College
Nichole Hefty – Miami Dade Office of Sustainability
Stacy Kilroy, Mount Sinai Medical Center
Michael Nardone, AMEC
Robert Page, American Red Cross of Greater Miami and the Keys
Cathie Perkins, Miami-Dade Emergency Management
Don Pybas, Private Citizen
Robert Molleda, National Weather Service
Jeff Robinson, Hurricane Protection Inc.
Erik Salna, International Hurricane Research Center
Armando Villaboy, South Florida Water Management District

LMS Sub- Committees

Agriculture and Landscaping
Education and Outreach
Extreme Weather Events
Financial and Grants
Flooding and CRS
Marine Interests
Structural

Appendix J: List of LMS Changes

Section	Name	Date	Change Made	Purpose
Global	--	11/25/2013	Added section numbers to make tracking easier	Formatting
Introduction			Added notation about plan undergoing major revision in 2014 for 2015 adoption.	Inform readers of upcoming changes
Part 1			Formatting changes	Formatting
Part 2	Projects	1/17/2014	Updated list as reflected in new WebEOC board tracking system	New system implemented December 2013
Part 3	Funding		No Changes	Remain as published December 2012
Part 4 Appendices	All			
	F - Maps	1/13/2014	Updated Land Use Map within 50 Mile Ingestion Pathway for Turkey Point Nuclear Power Plant	Updated map 4/09/2013
	F – Maps*	1/13/2014	Moved and Updated FEMA Flood Zone Map to Part 7	Updated map 8/28/2013
	F - Maps	1/13/2014	Comprehensive Land Use Map	Adopted for 2015-2025 Comprehensive Development Master Plan
	F – Maps*	01/13/2014	Moved and updated Storm Surge Planning Zones to Part 7	Updated map 4/03/2013 as determined by Miami-Dade in 2013 replaces Evacuation Zone Map
	F – Maps*	01/13/2014	Updated and move Surge maps for MOMs for Cat 5 Hurricane to Part 7	Updated maps as incorporated by Miami-Dade in 2013
	G *	01/13/2014	Updated and moved Map of 1979-2013 RL and SRL claims to Part 7	Updated map 10/08/2013
	H Changed to G	11/12/2013	Change of LMS Prioritization Matrix to Benefit Cost Review to give preliminary prioritization to entire project list	Update process and incorporate additional considerations
	I changed to I	01/13/2014	Update of Working Group and Subcommittee members based on 2013 meeting attendance	Update
	K – changed to J		Updated to reflect changes	
Part 5	Meeting Minutes	1/17/2014	Updated Section with all minutes from 2013 meetings	

Section	Name	Date	Change Made	Purpose
Part 6	Completed Projects	1/17/2014	List of Projects reported as completed in 2013 – and Archived	For 2015 update a comprehensive list of projects over the life of the LMS will be incorporated.
Part 7	Flooding: NFIP and CRS	1/13/2014	This previously was the County update for Activity 510 Items identified in the chart with an * were moved to Part 7	This section will be expanded to incorporate additional information for flooding and to assist CRS communities with credit.

Part 2 –The Projects is to be updated by each participant of the LMS Working Group twice a year for inclusion in the June 30th and December 31st publications of the LMS document. Consequently, each member is responsible for monitoring their project lists for appropriate changes and updating. Due to the change in how the LMS is tracking projects there was no publication in June of 2013. All projects were shifted to a spreadsheet format starting in June 2013 and in December 2013 imported into an internet based tracking system, WebEOC.

Miami-Dade will be working during 2014 to update the plan for submittal for review by the State and FEMA for the 2015 approval and adoption process.