

Hazard Vulnerability Assessment (HVA)

STEP ONE

Hazard Vulnerability Analysis



DEFINITION OF CRITICAL PROCESSES

HAZARD

- a source of danger
- a chance or chance event
- a risk
- an accident

VULNERABILITY

- capable of being physically or emotionally wounded
- open to attack or damage



VARIABLE BASED ON FACTORS

- Hazard effects are variable and severity can be affected by such factors as location, occurrence time, population, impact area, intensity, duration, response capacities and capabilities and mitigation efforts taken before the occurrence.



FEMA INFORMATION

- The Federal Emergency Management Agency (FEMA) classifies¹ the causes of hazards as **natural**, **technological** (human caused) and **national security** incidents (terrorist acts, warfare, or civil disturbance).



1. There are a variety of debates on classifying hazard types so for simplicity this document will utilize the definition about and sources here:

<https://training.fema.gov/hiedu/docs/hazrm/fema%20module%202-3.doc>



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FEMA INFORMATION (cont)

- **Natural** hazards can include, earthquakes, floods, severe weather, fires, contagious disease outbreaks, and others.
- **Technological** hazards include unplanned hazardous materials releases, large scale transportation accidents, utility failures, and others.
- **National Security** hazards include armed attack on the country by armed military forces, terrorist attacks, sabotage and civil insurrection.



FEMA INFORMATION (cont)

- Some hazards can either originate naturally or be human-made by design or error.
- Examples of these are fires started by human or lightning, catastrophic dam failures caused by terrorist action or by an earthquake as well as acts of bio-terrorism or naturally occurring events such as epidemics and pandemics.



FLAVORS OF EMERGENCY

Natural/Nature

- High winds, hurricane, tornado
- Thunder, electrical storm
- Winter / ice storm
- Earthquake, tsunami
- Temperature extremes, drought
- Flood
- Fire
- Landslide
- Dam failure
- Volcanic
- Pandemic, epidemic

Technological

- Valves
- Meters
- Electrical, generator
- Transportation
- Fuel or supply shortage
- Water / sewer
- Steam
- Fire Systems
- IT, security system
- Structural damage

Human

- Accidental or intentional
- Food, water contamination
- Human error
- Riot, labor strike
- VIP situation
- Armed intruder, hostage, civil disturbance
- Vandalism
- Sabotage
- Chemical, biological, radiological
- Nuclear
- Mail System



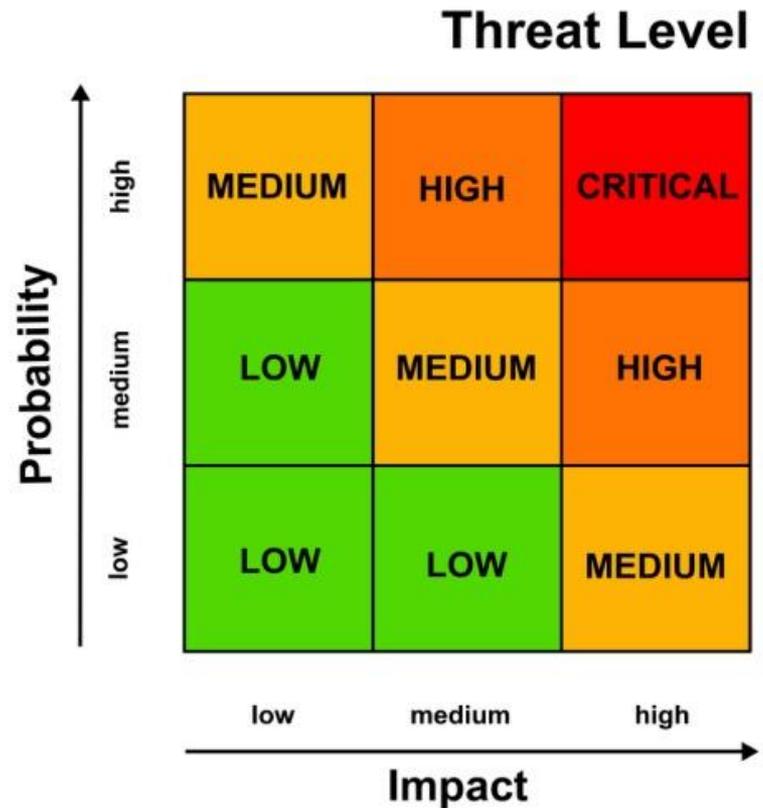
PURPOSE OF THE HVA

- Hazard Vulnerability Analysis (HVA) attempts to identify and classify hazards and vulnerabilities that are potentially harmful to the community or facility.
- While based on history, prior experiences and current assumptions, this analysis allows one to establish probability, risk, and preparedness elements to address.



Qualitative Criteria Used for Ranking

- **HISTORY** – the number of times the event has occurred in prior years (typically set by a time period, i.e., 20 years, 50 years, 100 years)
- **VULNERABILITY** – the percentage of the population or property likely to be affected
- **MAXIMUM THREAT (SEVERITY)** – the percentage of the population or property that could be impacted
- **PROBABILITY** – the likelihood of an occurrence within a specified period of time



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Risk Elements to Consider

- Threat to life safety and/or health
- Disruption of services
- Damage/failure possibilities (property/utilities)
- Loss of communication capabilities
- Loss of available emergency service response
- Loss of access (transportation)
- Loss of community trust
- Ecological degradation or loss of stability
- Financial impact (economic impact)
- Legal issues



Preparedness Elements to Consider

- Status of current emergency and continuity plans
- Training and Exercise status
- Insurance Coverage
- Availability of back-up systems
- Availability of community resources
- Availability of augmentation resources and associated timelines



EMERGENCY MANAGEMENT MODEL

example

WEIGHT FACTOR	2 Points	5 Points	10 Points	7 Points	TOTAL
HAZARD	HISTORY	VULNERABILITY	MAXIMUM THREAT (Severity)	PROBABILITY	
Intensity	Events in last 100 years in which citizens affected	Percent of property or population affected	Percent of property or population affected in worse-case event	Likelihood of an occurrence within specified time period	
High	4 or more events (7-10 Points)	More than 10% (7-10 Points)	More than 25% (7-10 Points)	1 incident in the next 10 years (7-10 Points)	
Moderate	2-3 events (4-6 Points)	From 1 to 10% (4-6 Points)	From 5% to 25% (4-6 Points)	1 incident in the next 50 years (7-10 Points)	
Low	1 or no event (1-3 Points)	Less than 1% (1-3 Points)	Less than 5% (1-3 Points)	1 incident in the next 100 years (7-10 Points)	
Pandemic Influenza	6 = 12	10 = 50	10 = 100	10 = 70	232
Weather Emergencies	10 = 20	10 = 50	9 = 90	10 = 70	230
Earthquake	5 = 10	9 = 45	10 = 100	9 = 63	223
Flood	10 = 20	10 = 50	8 = 80	10 = 70	220
Hazardous Materials	10 = 20	10 = 50	7 = 70	10 = 70	210
Power Failure	10 = 20	8 = 40	8 = 80	10 = 70	210
Terror Attack - WMD	2 = 4	10 = 50	10 = 100	8 = 56	210
Wildland Fire	10 = 20	6 = 30	8 = 80	10 = 70	200
Pipe Line Disruption	5 = 10	10 = 50	10 = 100	5 = 35	195
Volcano/Fallout	3 = 6	10 = 50	8 = 80	8 = 56	192
Dam Failure	2 = 4	10 = 50	10 = 100	4 = 28	182
Landfills/Leachate Flow	10 = 20	1 = 5	2 = 20	10 = 70	115



HEALTHCARE MODEL example

Event	Probability	Impact - Pick ONE ONLY					Preparation-2 points for every one that is true					Relative Risk
		Life Threatening	Health Threatening	High Disruption	Moderate Disruption	Low Disruption	Plan	Exercises	Physical Assets	MOU/MOA	Training	
Adapted from Kaiser, American Society for Healthcare Engineering, and Region 1 list Scoring Criteria (ASHE: When in doubt, grade more severely, base on healthcare, not emergency management)	ASHE standards Occurred in region or has high potential to do so, (5) annually, (4) last 2-5 yrs, (3) last 5-10 yrs, (2) last 10-25 yrs, (1) > 25 yrs	Significant risk or loss of life to over 5 people (8 points)	Significant risk of health and well being to > .5% of population (6 points)	Most businesses and/or public services disrupted for > 12 hours (3 points)	Some businesses and/or public services disrupted for 6-12 hours (2 points)	A few businesses and/or public services disrupted for < 6 hours (1 point)	Have a regional plan	Have regionally exercised plan	Have stockpile or identified extra supplies or equipment	Have an MOU or MOA that crosses at least one county line	Have held training within last 3 years	Probability (Impact-Prep) Highest Number is Greatest Risk
Widespread Electrical Failure	2	8	6		2	1			2	2	2	22
Natural Gas Emergency	1					1						1
Water Contamination	2					1						2
Communication Failure (phones)	2				2		2	2	2	2	2	-16
Supply Shortage (for whatever reason)	4	8	6		2				2	2		40
Elevator Failure	1					1						1
Tornado/High winds	4		6			1			2	2		12
Severe Thunderstorm	4					1			2	2		-12
Winter Storm	5	8	6	3					2	2		65
Earthquake	3	8	6	3					2	2	2	33
Tidal Wave	1	8	6	3					2	2		13
Temperature Extremes	3					1			2	2		-9
Flood	4	8	6	3					2	2		52
Wild Fire	2					1			2	2		-6
Landslide	2					1			2	2		-6
Dam Failure	1			3					2	2		-1
Volcano	1					1			2	2		-3
Novel Virus	5	8	6	3					2	2	2	55
Massive Urban Fire	1					1			2	2	2	-5
Mass Casualty Incident (trauma - less than 10 critical patients)	5	8				1			2	2	2	15
Massive Mass Casualty Incident	2				2				2	2	2	-8
Mass Casualty Incident (medical/infectious)	5	8			2				2	2	2	20
Mass Casualty Hazmat Incident	4					1			2	2	2	-20
Terrorism, Biological release	1					1			2	2		-3
Terrorism, Chemical release	1					1			2	2	2	-5
VIP Situation	5					1			2	2		-5
Significant Disruption of Operations	2					1			2	2		-2
Significant Event Risk of Evacuation	1					1			2	2		-1
	1					1			2	2		-1
												0
												0



COMBINED MODEL example

HC-EMI HAZARD AND VULNERABILITY ASSESSMENT TOOL NATURALLY OCCURRING EVENTS

INCIDENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)						RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	Possibility of death or injury	Physical losses and damages	Interruption of services	Preplanning	Time, effectiveness, resources	Community/ Mutual Aid staff and supplies	Relative threat*
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 - 100%
High Winds	3	2	3	3	1	2	2	72%
Thunder/Electrical Storm	1	1	2	2	3	2	2	22%
Winter Storm	3	1	3	3	2	2	2	72%
Earthquake/Tsunami	2	3	3	3	3	3	3	67%
Temperature Extremes	2	1	1	2	3	2	2	41%
Drought	1	1	1	2	3	2	2	20%
Flood, External	2	2	3	3	3	2	2	56%
Wild Fire	1	1	2	3	3	2	2	24%
Landslide	2	1	2	2	3	2	2	44%
Dam Inundation/Failure	1	2	3	3	1	3	3	28%
Volcano	1	1	1	1	3	3	3	22%
Disease Outbreak	2	3	2	2	2	2	3	52%
AVERAGE SCORE	1.31	1.19	1.63	1.81	1.88	1.69	1.75	24%

*Threat increases with percentage.

RISK = PROBABILITY * SEVERITY		
0.24	0.44	0.55



Building your program using HVA

- Annual cycle of capabilities based planning should lead to three to five year roadmap
- Based on HVA – reviewed annually
- Select Target Capabilities to implement for coming year.
- Develop Plans, Training and Exercises to achieve desired results of strengthening programmatic elements.
- Measure, refine, review, revise as necessary to ensure continuous cycle of improvement.



Hazard Vulnerability Assessment

To Learn More
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