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Implementation of Predetermined Protective Action Plans for EAL-based Initial Response:

Results and Lessons Learned

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Situation

- Hazardous Material Operational Emergencies
- Need to:
  - Assess potential impacts
  - Identify affected populations
  - Implement protective actions
    - Reduce injury
    - Save lives
- Problem:
  - Within very short time windows
  - In high stress, low information environment
  - Many potential scenarios and many facilities

Solution

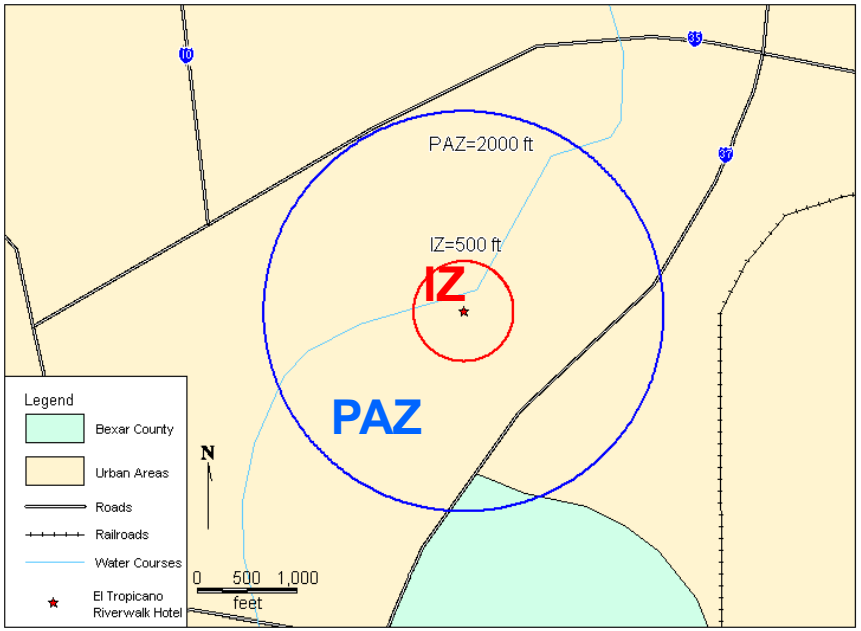
- SNL/NM has extended EAL-linked PAs
- Integrated decision support tools
  - For initial decision-makers
  - Graded approach
  - Applicable for all potential emergency events
    - Emergency Action Levels (EALs)
    - (Predetermined) Protective Action Plans
    - Shelter/Evacuation Decision Support Tool

Graded Approach Using Zones

- Two protective action regions implement a graded approach
- Define areas in which urgent protective actions are needed to avoid potential:
  - Life-threatening health effects (death)
    - **Isolation Zone**
  - Serious and irreversible health effects (injury)
    - **Protective Action Zone**

The Zone Concept

- Circular (impact might occur in any direction)
- Usually centered on emergency location
- Concentric
  - **–Isolation Zone (IZ)** in center
  - **–Protective Action Zone (PAZ)** surrounds Isolation Zone



DOE Protective Action Criteria Define the Zones

- Threshold of Early Lethality (TEL) defines the **Isolation Zone**
  - Distance to which 100 rem TEDE (radiological) or AEGL60-3/ERPG-3/ TEEL-3 (chemical) may be exceeded
- Protective Action Criterion (PAC) defines the **Protective Action Zone**
  - Distance to which 1 rem TEDE (radiological) or AEGL60-2/ERPG-2/ TEEL-2 (chemical) may be exceeded

Integrated Decision Support Tools

- Emergency Action Levels
  - Initial decisions
  - Conservative
  - Consistent identification of:
    - Type of event
    - Severity of event
    - Protective action plan
- Protective Action Plans
  - Key decisions and actions
  - Identify zones and populations
- Sheltering/evacuation Work Aid
  - For potentially affected zones/populations

Emergency Action Levels (EALs)

- Link easily identified event indicators or observations to:
  - Pre-analyzed model-projected consequences
  - Appropriate consequence-based decisions
  - Identification number

Area:	Property Area
Facility:	PELICAN
Hazardous Material Zone:	Hazardous Gas Storage
Distance To Site Boundary (ft):	1312

Event: Release

Events that involve all hazardous substances in the facility.

Inventory-specific EALs

	Hazardous Material	Container Type	MAR per Container (lb)	Source Term (lb)	Protective Action Plan	Event Class	Distance from Source (ft) to		EAL #
							Protective Action Zone	Isolation Zone	
1	Arsine	Arsine 100.0 lb	100	100	4	GE	3,330	3,330	PELICAN-0118-007
2	Chlorine	Chlorine 150.0 lb	150	150	3	GE	1,670	0	PELICAN-0118-008
3	Nitrogen dioxide	Fertilizer Accelerant (Nitrogen dioxide) 300.0 lb	300	300	None	None	280	180	PELICAN-0118-009

Protective Action Plans

- Geographically based around facility
  - Potential incident command post locations
  - Traffic control points
  - Potentially impacted populations and key receptors
  - Map depicting Protective Action Zones
- Building occupancy
- Messages to send (tar, pager, etc.)
- Building ventilation control capability

PA Work Form

- Key receptors listed by distance and direction
- Draw vertical line for Protective Action and Isolation Zones
- Fill in evacuation instructions
- Onsite and offsite forms

Emergency Response Protective Action Plan

Building 110			PA Plan 3	GE
El Tropicano Riverwalk Hotel			Page 3 of 4	

ONSITE PROTECTIVE ACTIONS

Note: SHELTER IN PLACE initiated for entire Protective Action Zone via TAR and pager notification.

Isolation Zone / Protective Action Zone	Distance (ft) from ###	Direction	Facility	Remote vent control	Downwind	Occupancy	Shelter	Evacuation	Evacuation Instructions Dist (ft) / Dir
	57	N	Armadillo Florists	Y		8			/
	78	E	Bubba's BBQ	N		53			/
	125	NE	Horton Haberdashers	N		12			/
	489	SW	Bucks Coffee	N		24			/
	523	W	Mickey D's Lounge	Y		112			/
	574	NE	Silver Spur Tack	N		31			/
	608	S	Burger Queen	Y		27			/
	655	NW	Five Seasons	N		97			/
	673	E	Rooster Cogburn's	Y		74			/
	698	SE	Silverado Saloon	Y		157			/
	753	W	Riverwalk Riviera			212			/
	802	SE	Dogwalk Cafe			47			/
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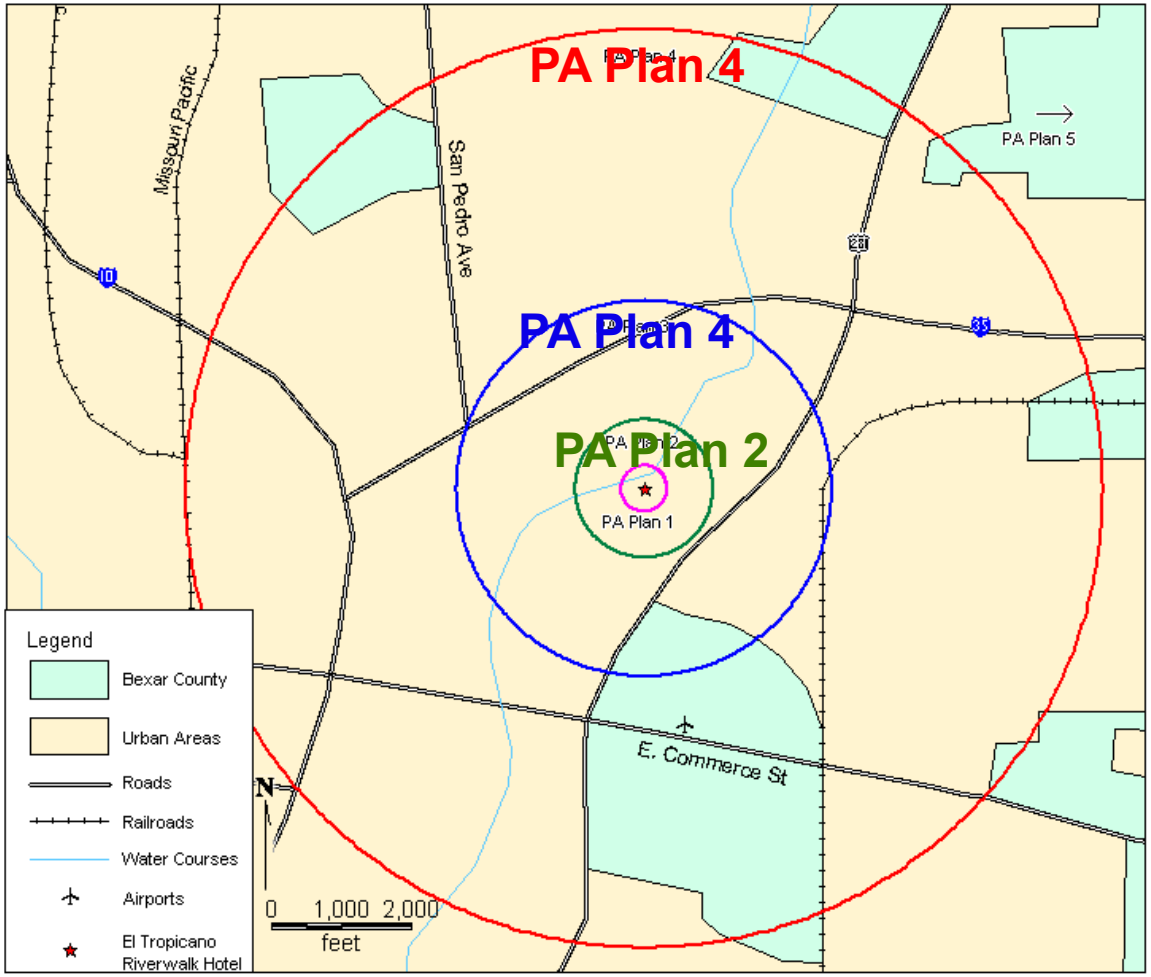
ELECT TO PERFECT

Protective Action Plan Maps



Shelter or Evacuation?

- Must be appropriate for each affected population
- Complex evaluation required
- Rarely enough time to evaluate
- Combinations may be required
- Rapid work aid needed
  - Based on key research findings

Key Research Results

- Contamination enters buildings via natural diffusion and HVAC systems
- Inside concentration is a complex function
- Evaluating building shelter effectiveness is a complex, real-time issue
  - Not yet practical for Incident Commander (IC) use in early decisions

Key Research Results

- All buildings (even leaky buildings) can be effective shelters
- Short-term shelters
  - for ~ 1/2 hour to 1 hour
  - doors and windows closed
  - *EVEN WITH VENTILATION ON*
- Longer-term shelters
  - For ~ 1 hour (or longer)
  - doors and windows closed
  - VENTILATION IS OFF

Key Research Results

- AFTER plume passage, exposure situation usually reverses
- Evacuate sheltered personnel AFTER plume passage
  - Re-enter after building air has been flushed and monitored
    - Unless outdoor area is contaminated (e.g., particulate release) or
    - Unless released material is heavy gas and may be pooled

Shelter/Evacuation Work Aid

- Distills key research findings - as applied to SNL/NM
- Is simple reference tool useable in field
- Relates condition of plume release to actions for:
  - Isolation Zone
  - Downwind portion of Protective Action Zone
  - Upwind portion of Protective Action Zone
- Additional work aid used for determining downwind portion of Protective Action Zone

Example

Reliable met data available?	Evacuation practical?	Plume release condition	Sheltering and evacuation guidance		
			Isolation Zone	Protective Action Zone	
				Downwind portion	Upwind portion
YES	NO	ALL release conditions	Shelter, then monitor or evacuated when practical after plume passes	Shelter, then monitor or evacuated when practical after plume passes	Precautionary shelter
	YES	Release condition is UNKNOWN	Shelter, then determine release condition and reevaluate	Shelter, then determine release condition and reevaluate	Precautionary shelter, then determine release condition and reevaluate
		Release is anticipated but not imminent	Evacuate	Shelter, consider evacuation	Precautionary shelter, consider evacuation
		Release is occurring or imminent AND…			
		Longer than about 30 min	Evacuate within 30 min if HVAC is turned on; evacuate within 1 hour if HVAC is turned off	Evacuate within 30 min if HVAC is turned on; evacuate within 1 hour if HVAC is turned off	Precautionary shelter, evacuate if wind shifts may occur
		Shorter than about 30 min	Shelter, then monitor or evacuate after plume passes	Shelter, then monitor or evacuate after plume passes	Precautionary shelter, consider evacuation
		Release is over and plume is gone	Monitor or evacuate	Monitor or evacuate	Monitor to confirm no impacts

Implementation

- Used for about 3 years at SNL/NM
- EAL document
  - 11 facilities at SNL/NM
    - Changes based on screening, demolition, construction
  - Also 2 special sets of EALs for onsite transportation
  - Potential consequences of hundreds of events
    - Conservative (worst case)
- Protective Action Plans document
  - 2 Volumes
  - PA Plans grouped by facility
  - PA Plans numbered 1-5 based on severity (5 = worst)
- Many other events analyzed in EPHAs
  - Each event identifies PA Plan (if any) to implement

Use at SNL/NM

- Used by:
  - Incident Commanders (ICs)
  - Consequence Assessment Team (CAT)
  - Emergency Operations Center
- Pre-defined PA Plans can be adjusted on the fly
  - Usually adjusted by ICs
  - CAT recommends reduction based on analyses

Key Results of Implementation

- Improved onsite PAs and offsite PARs
  - Faster notifications
- PA Plans have identified:
  - Buildings requiring sheltering
  - Ventilation shut off capabilities for buildings
    - Allows for extended sheltering
  - When evacuation might be considered
- Rapidly identifies conservative PA distances
  - Tied to all events analyzed in EPHAs
- Improved interface with offsite agencies
  - Better understanding of PARs

Issues Discovered

- Having EALs and PA Plans in separate documents is inefficient
  - Need to have both together
- Lack of personnel to implement onsite PAs
  - Security forces needed for traffic control points
- Sometimes confusion over PA Plan zone distances
  - Discrete distances associated with each PA Plan
  - IC can set up PA and Isolation zones to any distance

Issues Discovered

- PA Plans are ultra-conservative
  - Impacts effective emergency response
    - Staging areas and command posts too far from event limit ability to:
      - Analyze event
      - Effect rescue
      - Implement offensive actions
- Can utilize actual weather conditions to shrink zones
  - Increases effectiveness of emergency actions at the scene

Issues Discovered

- Need for rapid communication of PAs for onsite personnel
- Need multiple (redundant) mechanisms to communicate PAs to onsite personnel
  - Must decide which mechanism is most appropriate
    - Geocast
    - Tone Alert Radio (TAR)
      - Building-wide messages are slower, but more focused
      - Zone-wide messages are faster, but limited by # of zones
    - Email system (SDN)
    - Evacuation Captains (paged)

Acknowledgement

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Questions