

Nuclear Detonation Response Training

Module 2: Response

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Chapter 2: A Zoned Approach

Fallout Zones

(Approximate for a 10kT)

Dangerous Radiation Zone (DRZ)

- Bounded by radiation levels of 100 mGy/h (10 R/h)
- Acute Radiation Injury possible within the DRZ
- Could reach 15-30 km (10-20 miles) downwind
- Begins to shrink after about 1-2 hours

Hot Zone

- Bounded by radiation levels of 100 μ Gy/h (10 mR/h)
- Acute radiation effects unlikely, however steps should be taken to control exposure
- Could extend in a number of directions for 100s of km
- Begins to shrink after about 12-24 hours

Blast Zones

(Approximate for a 10kT)

Severe Damage Zone

(~ 1-km radius)

Most buildings destroyed, hazards and radiation initially prevents entry into the area; low survival likelihood.

Moderate Damage Zone

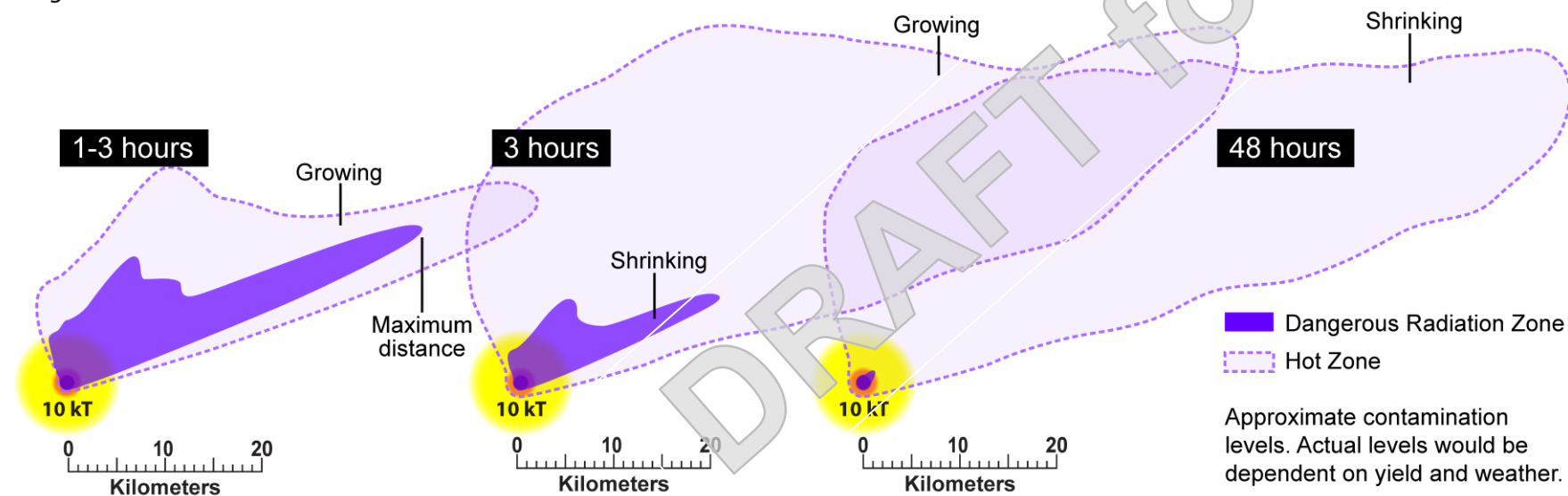
(~ 1- to 2-km radius)

Significant building damage and rubble, downed utility poles, overturned automobiles, fires, and many serious injuries. Early medical assistance can significantly improve the number of survivors.

Light Damage Zone

(~ 2- to 5-km radius)

Windows broken, mostly minor injuries that are highly survivable even without immediate medical care.



- This document defines five key radiation and blast zones for planning response operations and prioritizing actions.
- Each zone has different response priorities and survival implications.
- Radiation zones will overlap blast zones and initially grow over time, as fallout deposits downwind, then shrink as the radiation decays.



Hot Zone:

> 0.1mGy/h and 100s of kilometers distance from ground zero where actions should be taken to control exposure.

Severe Damage Zone Major Building Destruction

Light Damage Zone

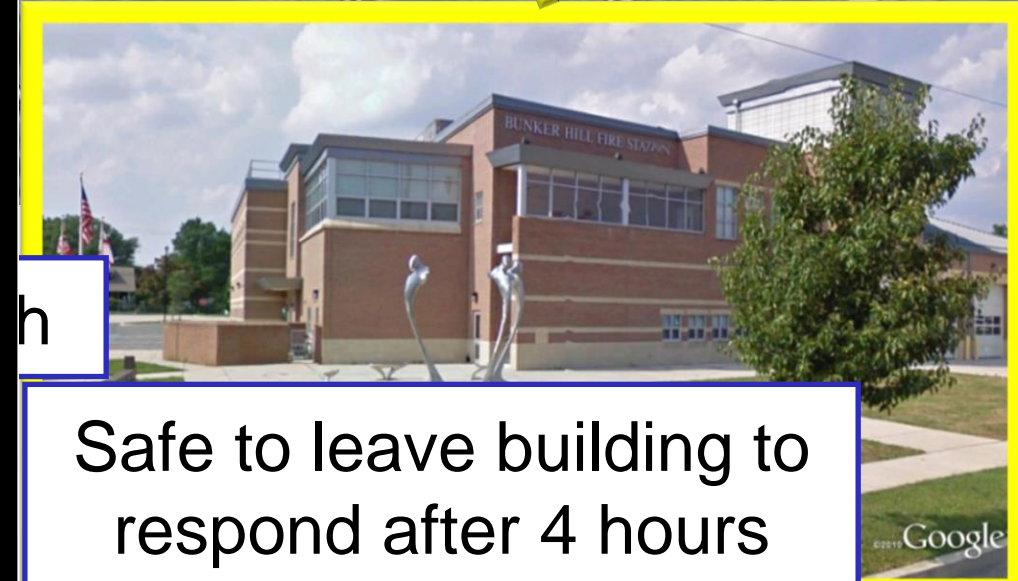
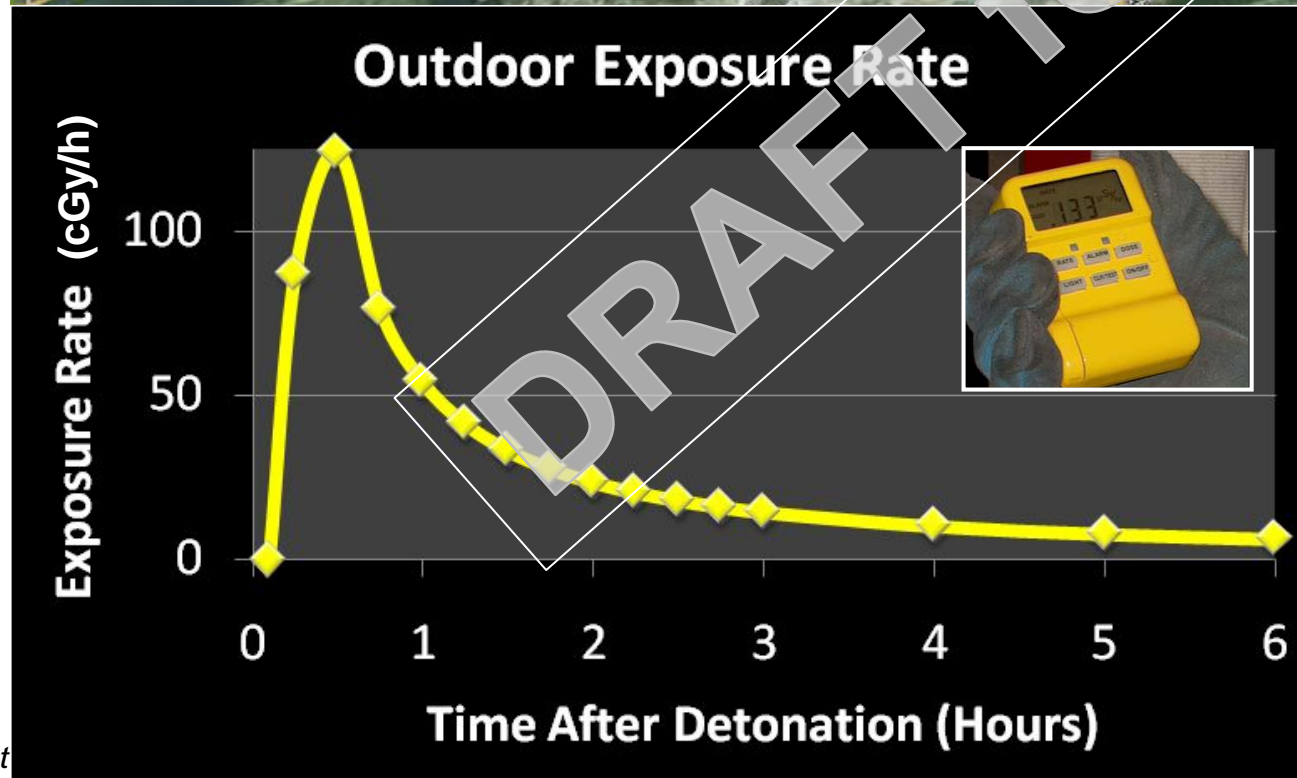
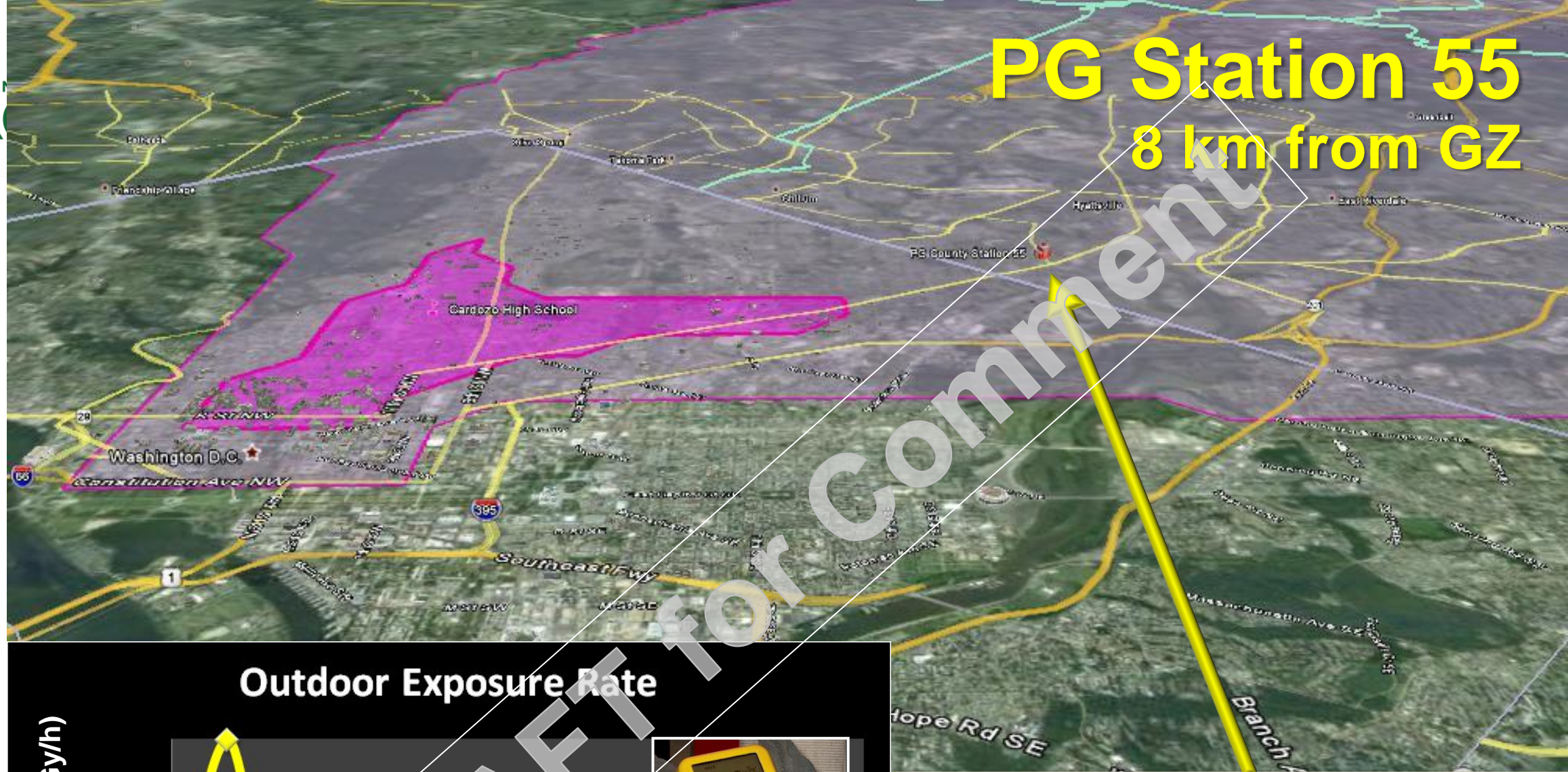
Defined by the prevalence of glass injuries and minor damage to structures.

Moderate Damage Zone Significant structural damage

Dangerous Radiation Zone (DRZ)

~ 20 to 30 km distance from ground zero where fallout presents an early and direct threat from fallout radioactivity. A radiation exposure rate of 100 mGy/h is used to delimit this region.

PG Station 55 8 km from GZ

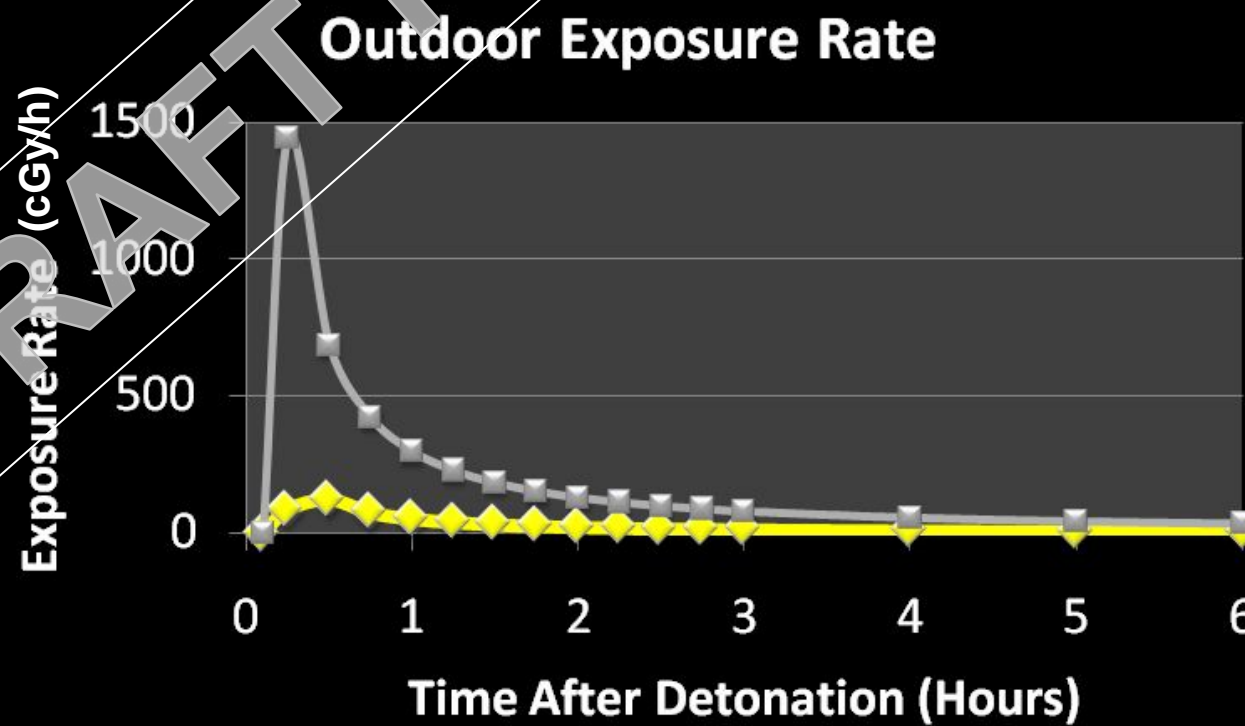
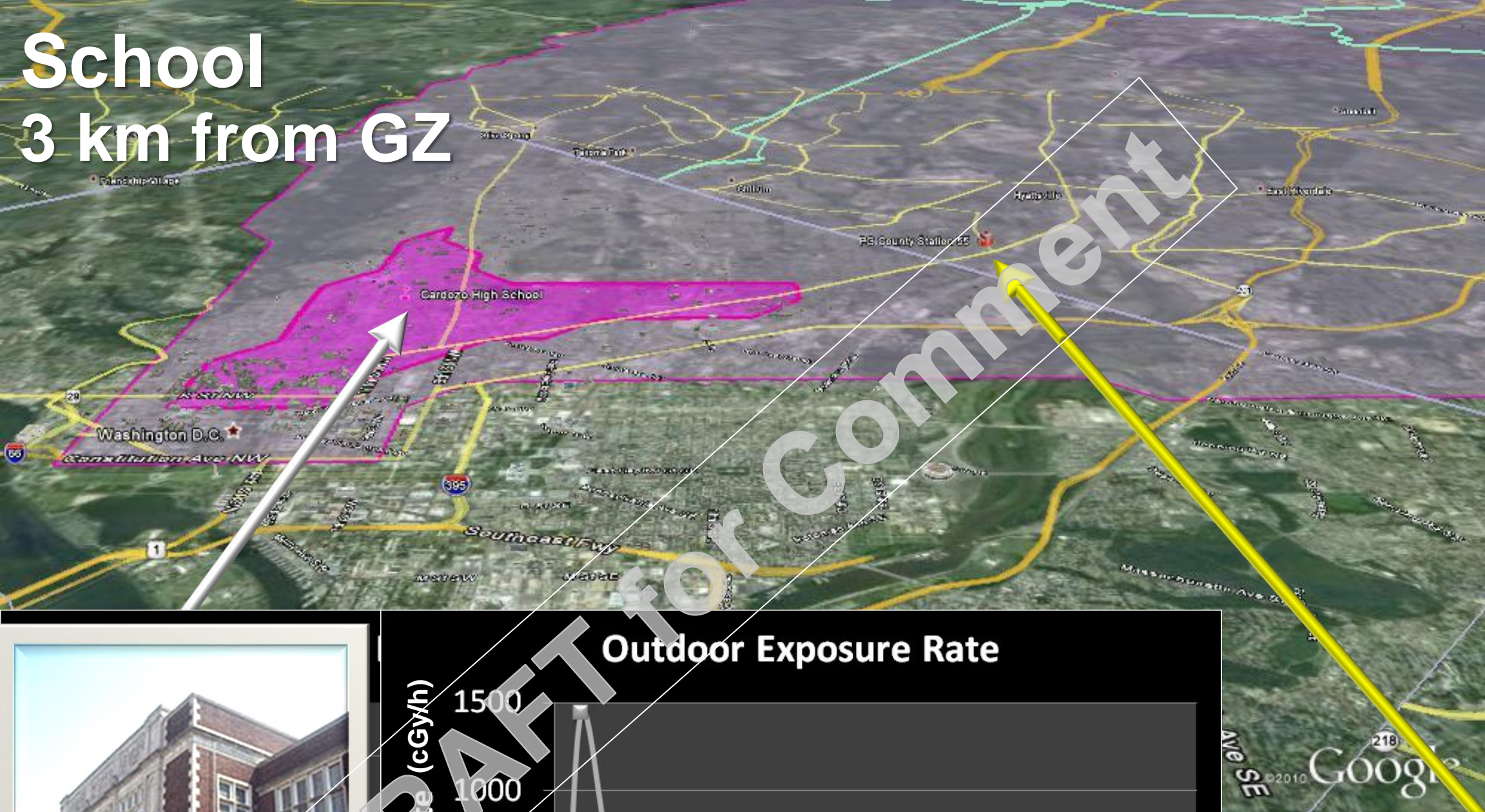


Safe to leave building to respond after 4 hours



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ENERGY

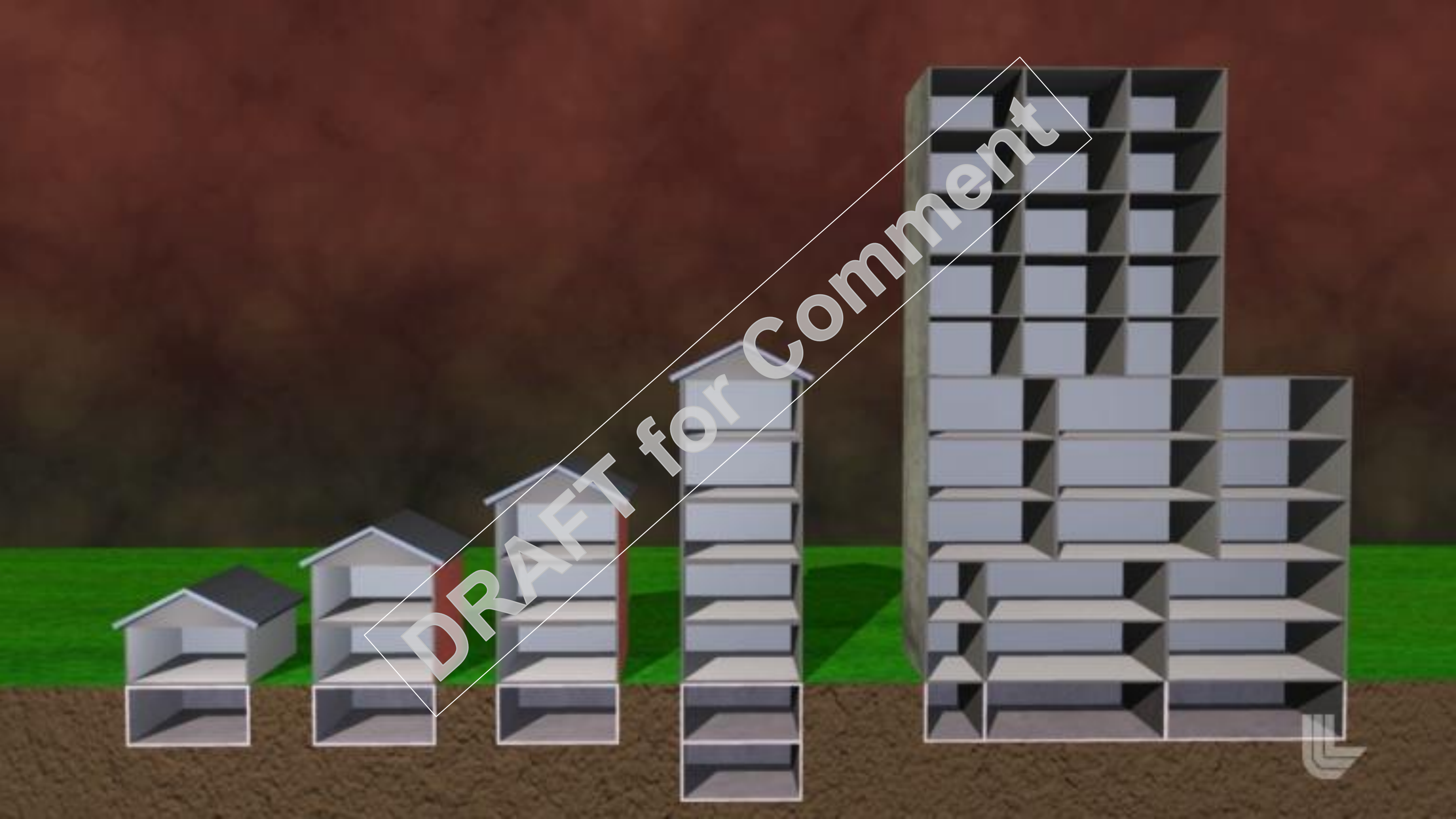
School 3 km from GZ



Key Fallout Considerations

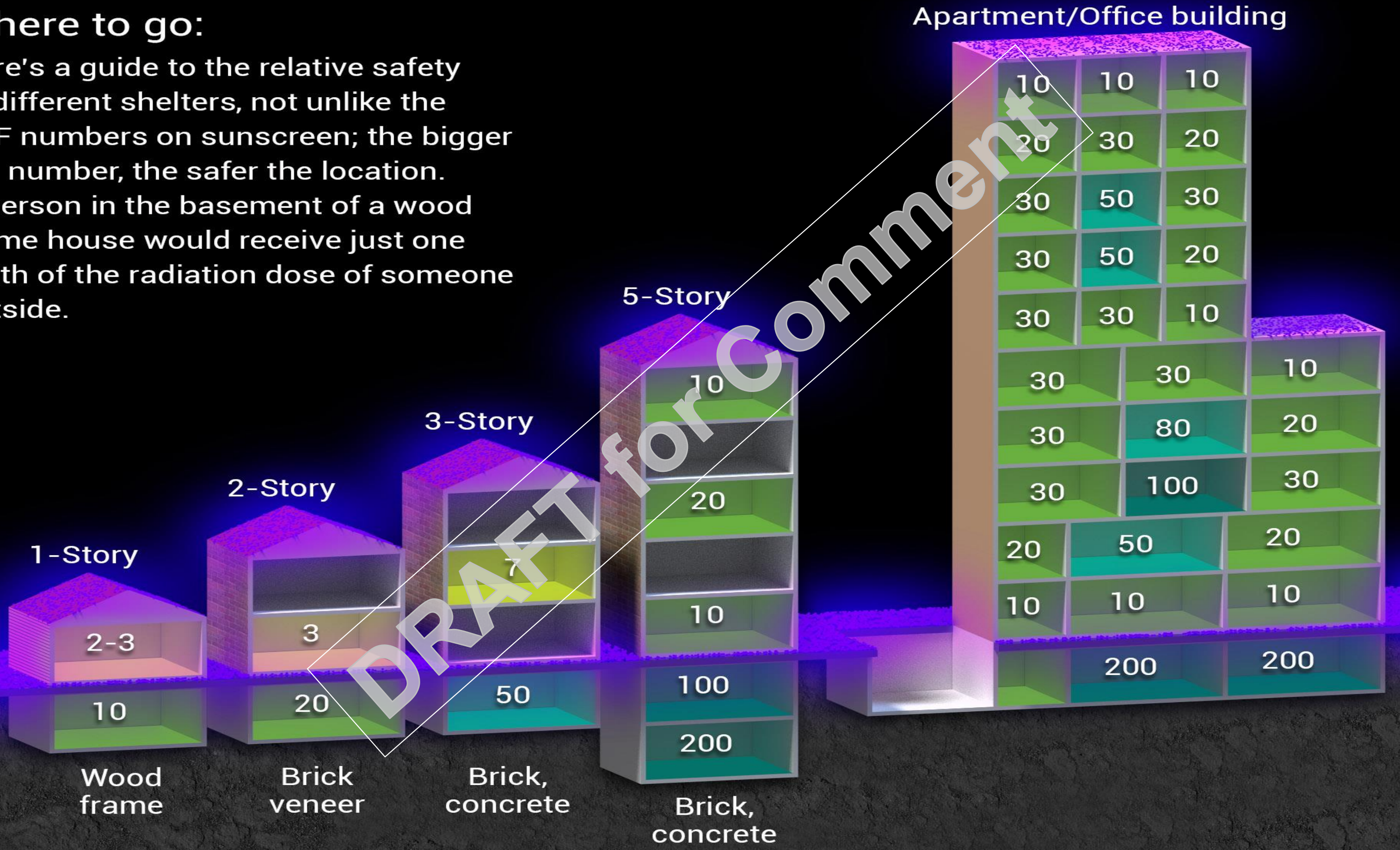
- ***Fallout Decays Rapidly*** (releasing more than half of its energy in the first hour)
- **Primary hazard from fallout is exposure to penetrating radiation from the particles**
- **Fallout is not a significant inhalation hazard**
- **Dangerous levels of fallout is visible as it falls**
- **Being outside or in a car will not protect you**
- **The radiation penetrates through windows and walls, but exposure decreases with distance and intervening materials (shielding).**





Where to go:

Here's a guide to the relative safety of different shelters, not unlike the SPF numbers on sunscreen; the bigger the number, the safer the location. A person in the basement of a wood frame house would receive just one tenth of the radiation dose of someone outside.



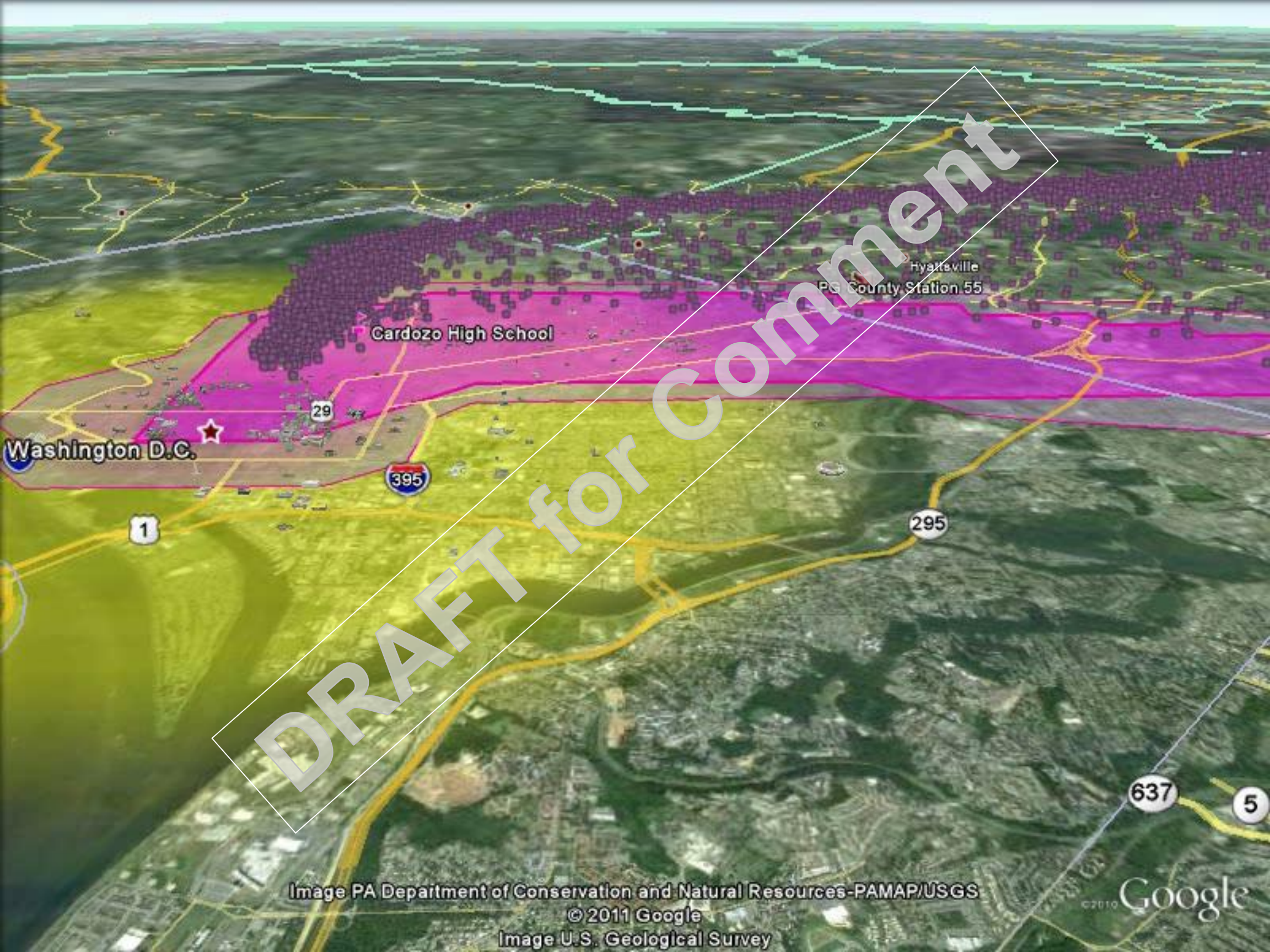


Image PA Department of Conservation and Natural Resources-PAMAP/USGS

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Image U.S. Geological Survey

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Survival Probable ▶ Increasing Risk of Death ▶ Certain Death
(Gy) 0.1 0.5 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

**Multi-story
Commercial/
Apartment/School
PF=10 to 100**

**2-3 Story
Brick
Residential or
Commercial
PF = 5 to 50**

**Single Story
House
PF=2-3**

**Outside
PF=1 to 2**

**Basement
PF=50-200+**

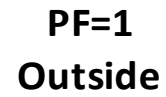
DRAFT for

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Significant Exposures by Shelter Type



Outdoor

PF=3
Small House

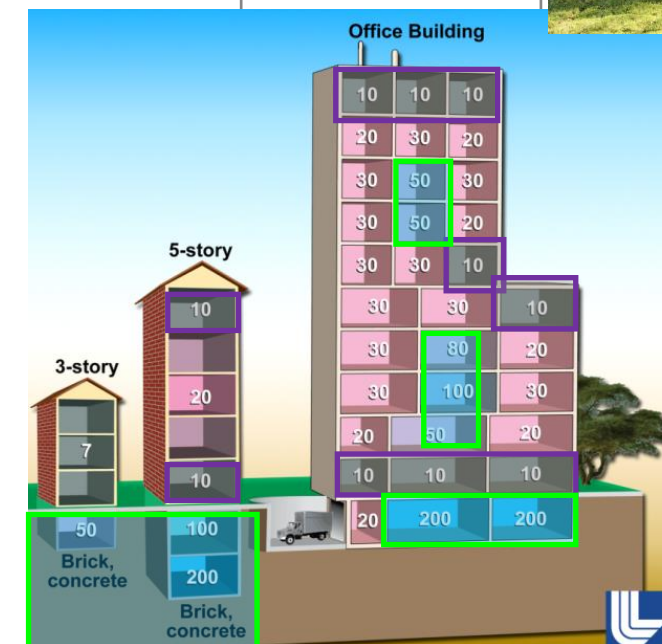
150,000 people saved from significant exposure

PF=10
Shallow Basement
Office Periphery

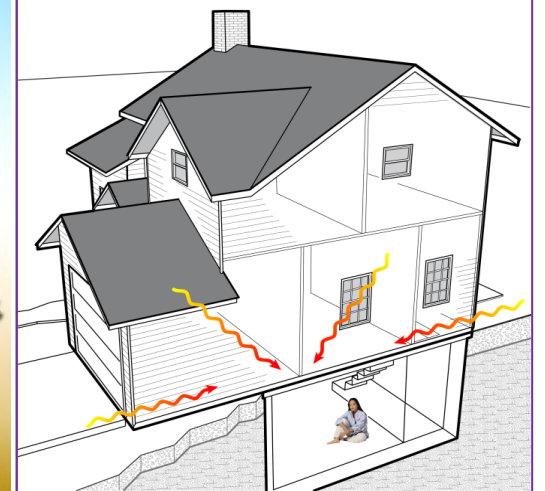
**245,000 people saved
from significant exposure**

PF=50+
Office Core
underground

**No significant exposures!
280,000 saved from doses
more than 1 Gy**



House with a basement



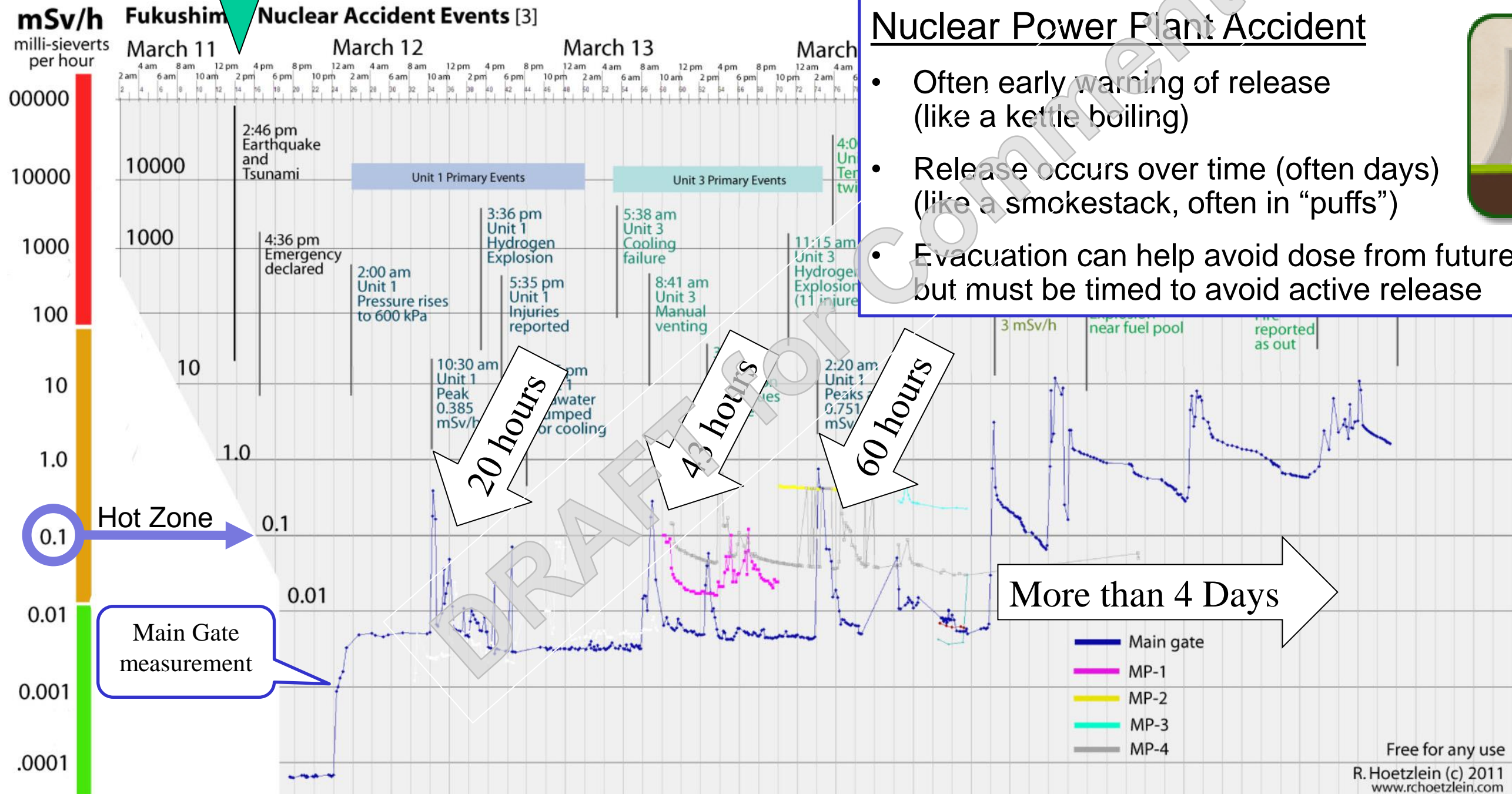
Fair protection

■ > 4.5 Gy ■ 3 – 4.5 Gy ■ 1 – 3 Gy ■ 24 hour exposure

DRAFT for Comment

Messaging

Nuclear Power Plant Accident Planning



Nuclear Power Plant Accident

- Often early warning of release (like a kettle boiling)
- Release occurs over time (often days) (like a smokestack, often in “puffs”)
- Evacuation can help avoid dose from future releases, but must be timed to avoid active release



A Different Kind of Response

- In the 1980s and 90s, most rad/nuc emergency response planning revolved around nuclear power reactor accidents.
- For a nuclear power accident, emergency planners and response officials had been trained that **early evacuation** was the answer for a nuclear emergency.
- For a nuclear detonation, **early evacuation will expose people** as it puts people outside when it is most dangerous.
- Currently working with response planners to help them understand the **shelter is the best strategy for a nuclear detonation.**

Nuclear Power Plant Accident

- Often early warning of release (like a kettle boiling)
- Release occurs over time (often days) (like a smokestack, often in “puffs”)
- Evacuation can help avoid dose from future releases, but must be timed to avoid active release

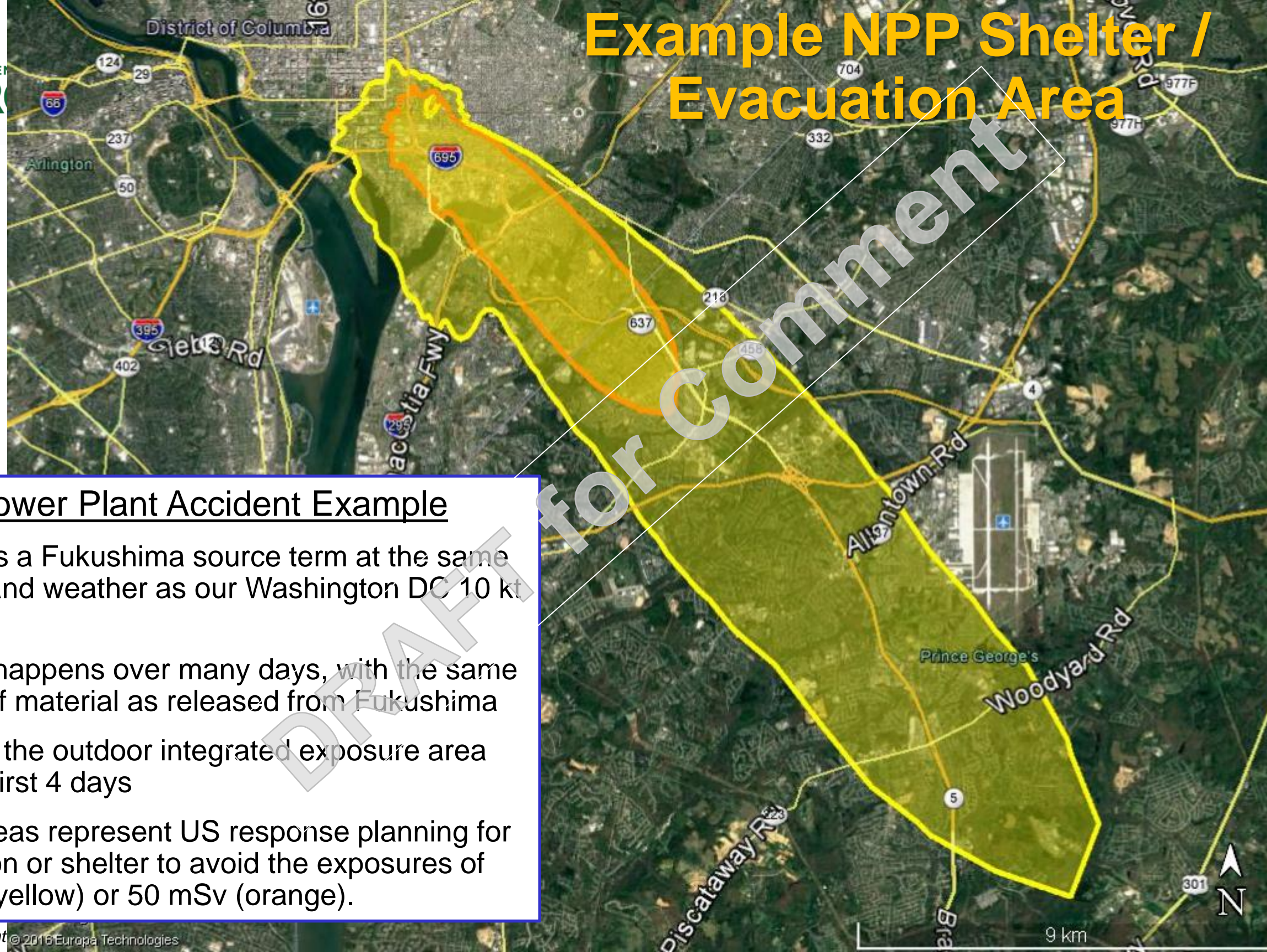


Nuclear Detonation

- Often occurs with little notice
- All material released at once
- 0.1 mGy/h area can be 100s of kilometers
- Early hazard is “direct shine” from fallout, not inhalation or ingestion
- Most dangerous outside in the first few hours and days

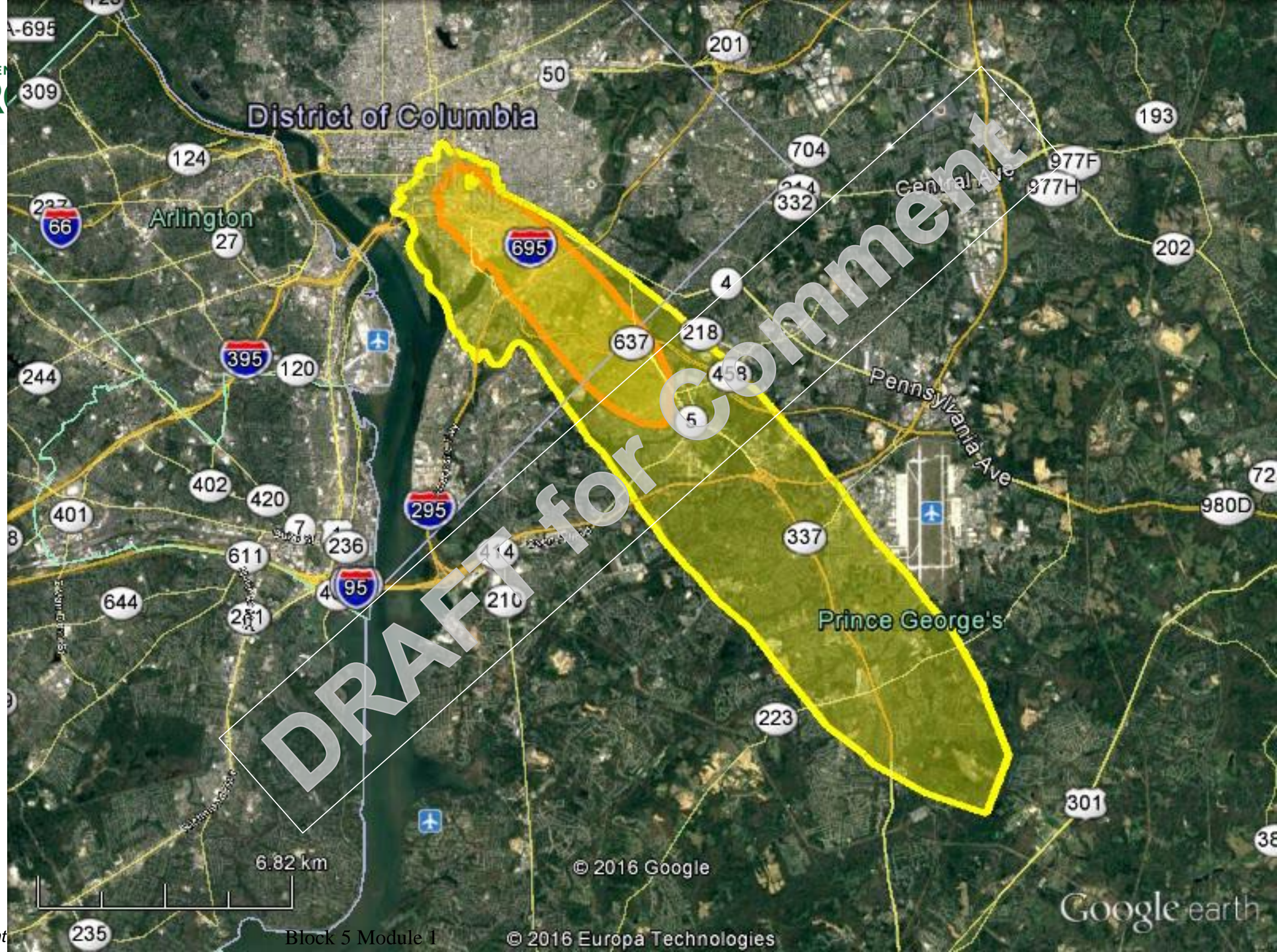


Example NPP Shelter / Evacuation Area



Nuclear Power Plant Accident Example

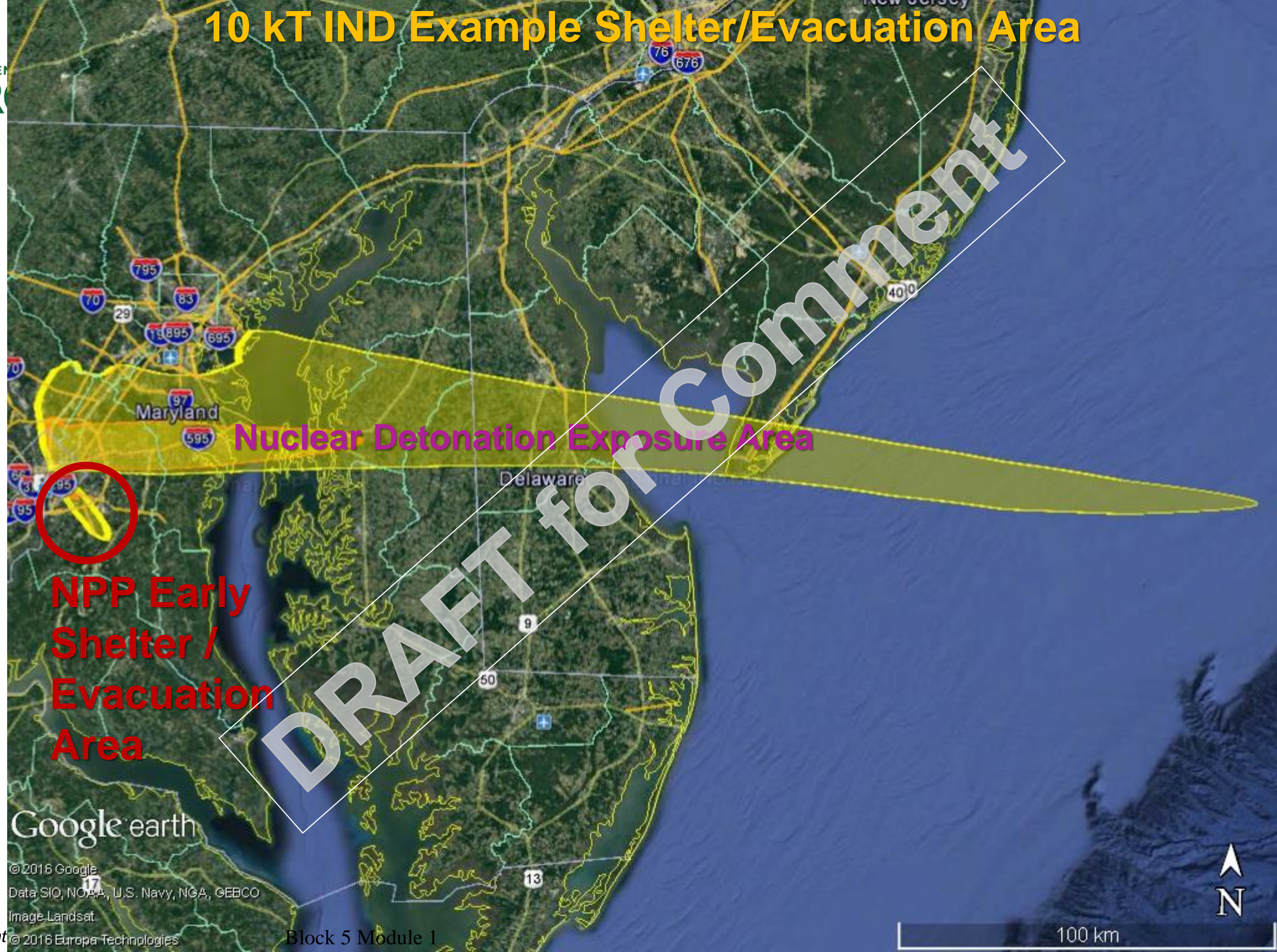
- Presumes a Fukushima source term at the same location and weather as our Washington DC 10 kt scenario
- Release happens over many days, with the same amount of material as released from Fukushima
- Shown is the outdoor integrated exposure area over the first 4 days
- These areas represent US response planning for evacuation or shelter to avoid the exposures of 10 mSv (yellow) or 50 mSv (orange).



10 kT IND Example Shelter/Evacuation Area



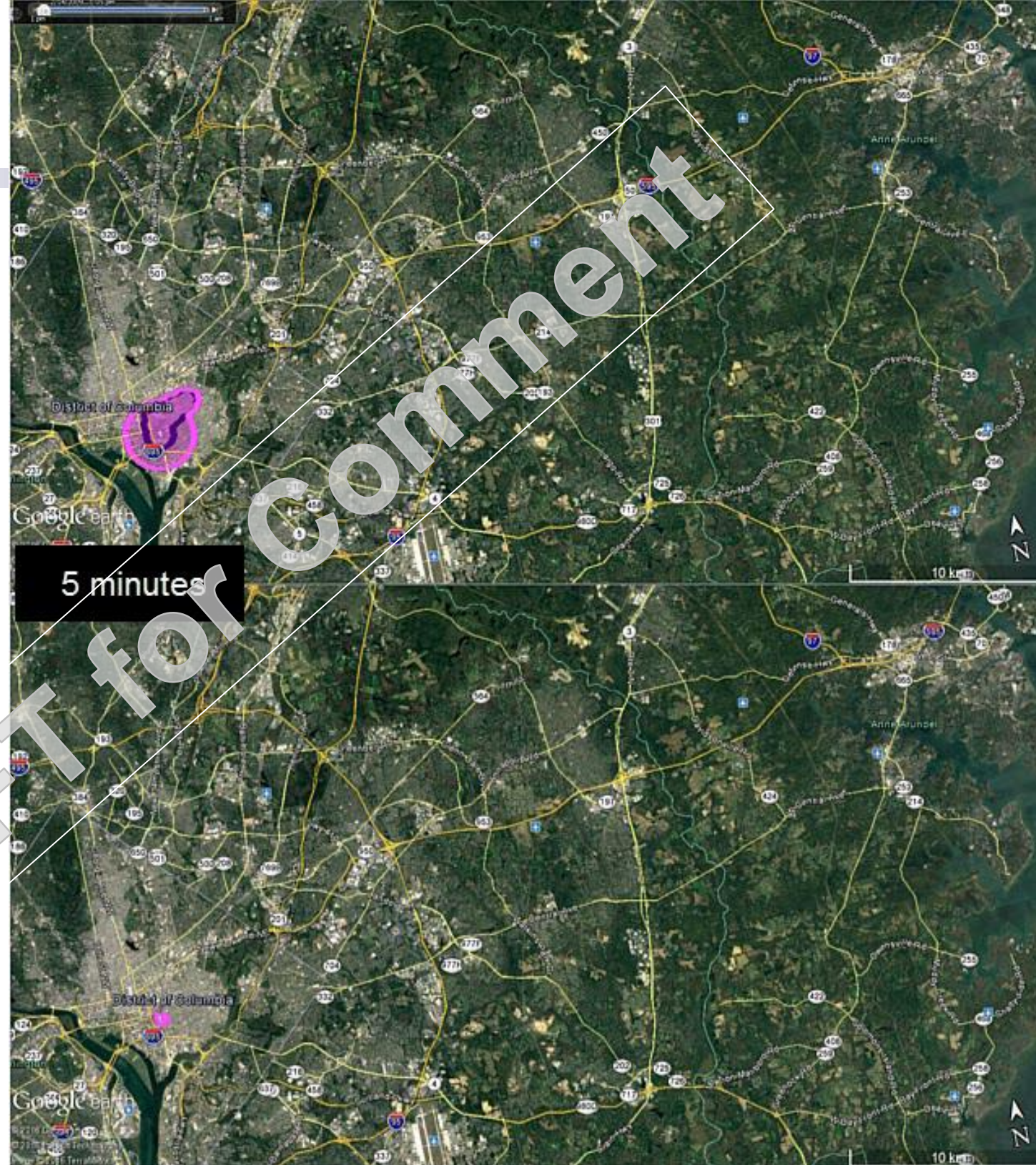
U.S. DEPARTMENT OF
ENERGY

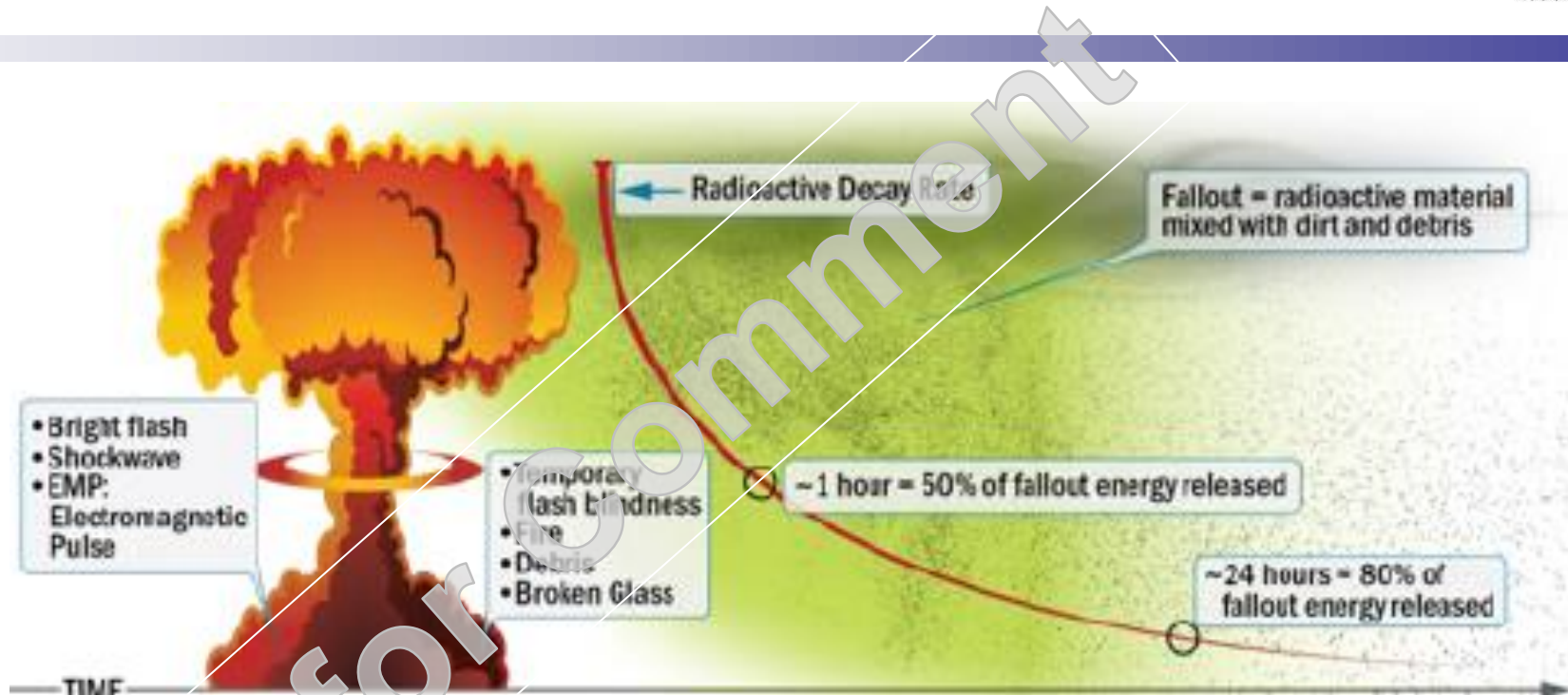


Timing Comparison:

**10 kT Nuclear
Detonation**

NPP Release
(Fukushima Incident
Source Term)





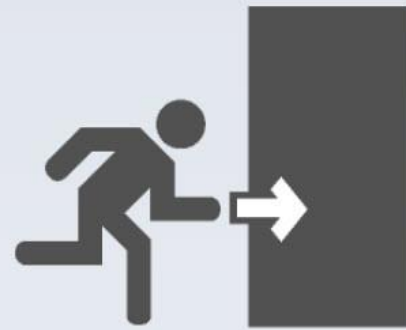
Before the Detonation			After the Detonation			Sustained Operations
		15 min before	15 min after	First day	Days to weeks	Months
Prepared-ness and education	Elevated Threat	Attack warning (if possible)	Rapid public messaging	Life-saving messaging and activates	Continued life saving & stabilization	Long-term recovery

Rapid Public Messaging

Immediate Response Action: Messaging



GET INSIDE. STAY INSIDE. STAY TUNED



GET INSIDE

Go to the basement or the middle of a building.



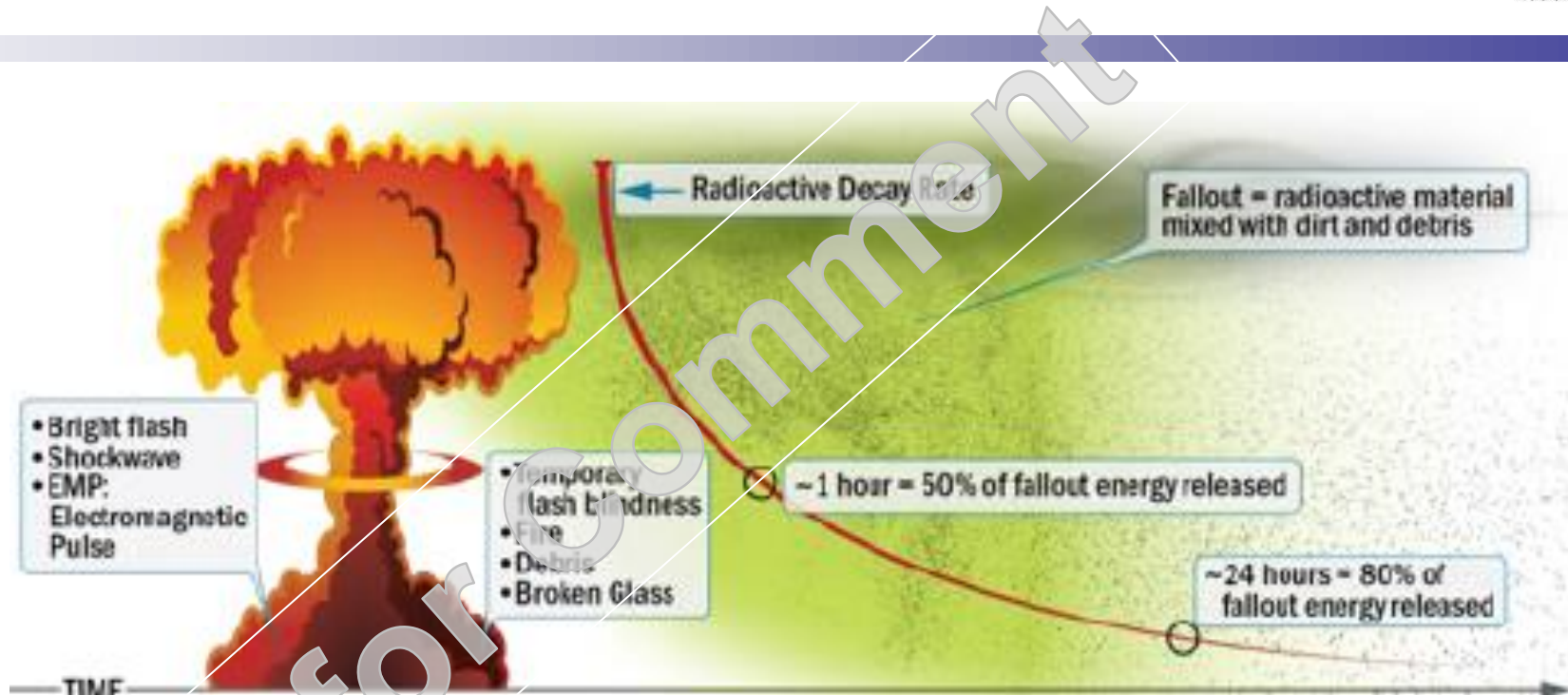
STAY INSIDE

Plan on 12 – 24 hours unless provided updated guidance.



STAY TUNED

AM/FM Radio is best, Cellular and Internet if available.



Before the Detonation			After the Detonation			Sustained Operations
		15 min before	15 min after	First day	Days to weeks	Months
Preparedness and education	Elevated Threat	Attack warning (if possible)	Rapid public messaging	Life-saving messaging and activates	Continued life saving & stabilization	Long-term recovery

Attack Warning

Alerts and Warnings

- In some cases, you may be warned of an impending nuclear attack.
- Quick action can reduce casualties and save lives.
- If you have a few minutes...
 - Get into the middle of the nearest large, sturdy structure or underground area (basement, underground parking garage, or subway system)
- If you only have seconds...
 - A blindingly bright flash of light is an indicator that a nuclear detonation has just exploded.
 - Immediately ducking down and covering exposed skin can help reduce burn and blast injuries



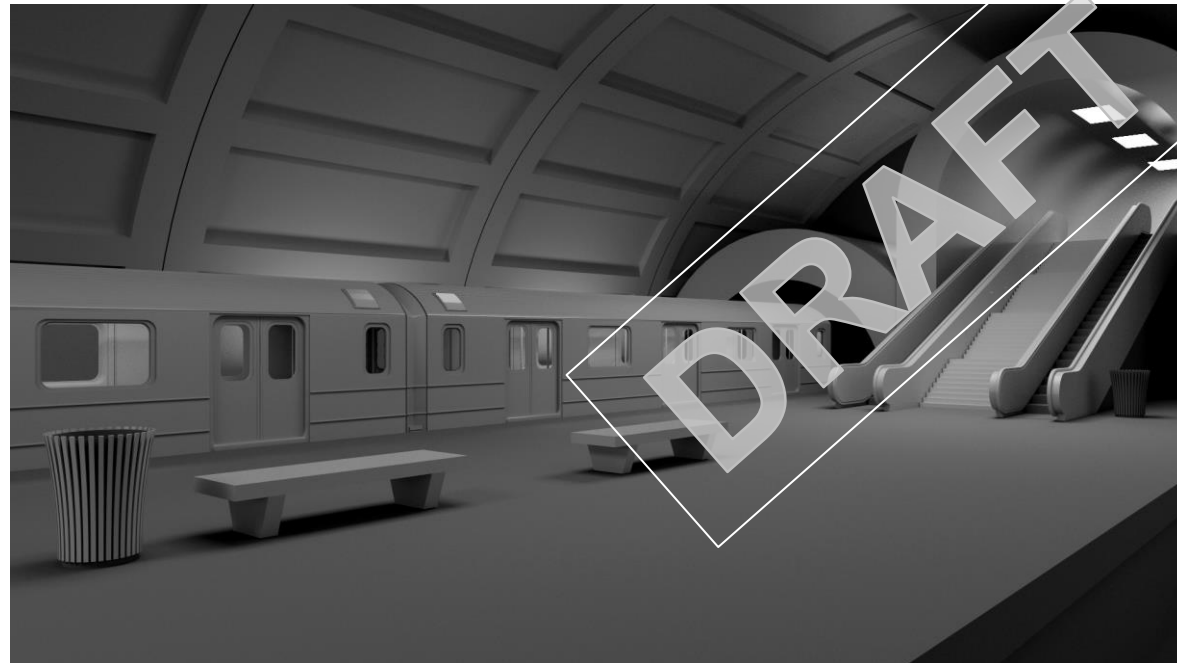
Immediate Response: “Duck and Cover”

A Bright Flash of Light could indicate a nearby Nuclear Detonation.

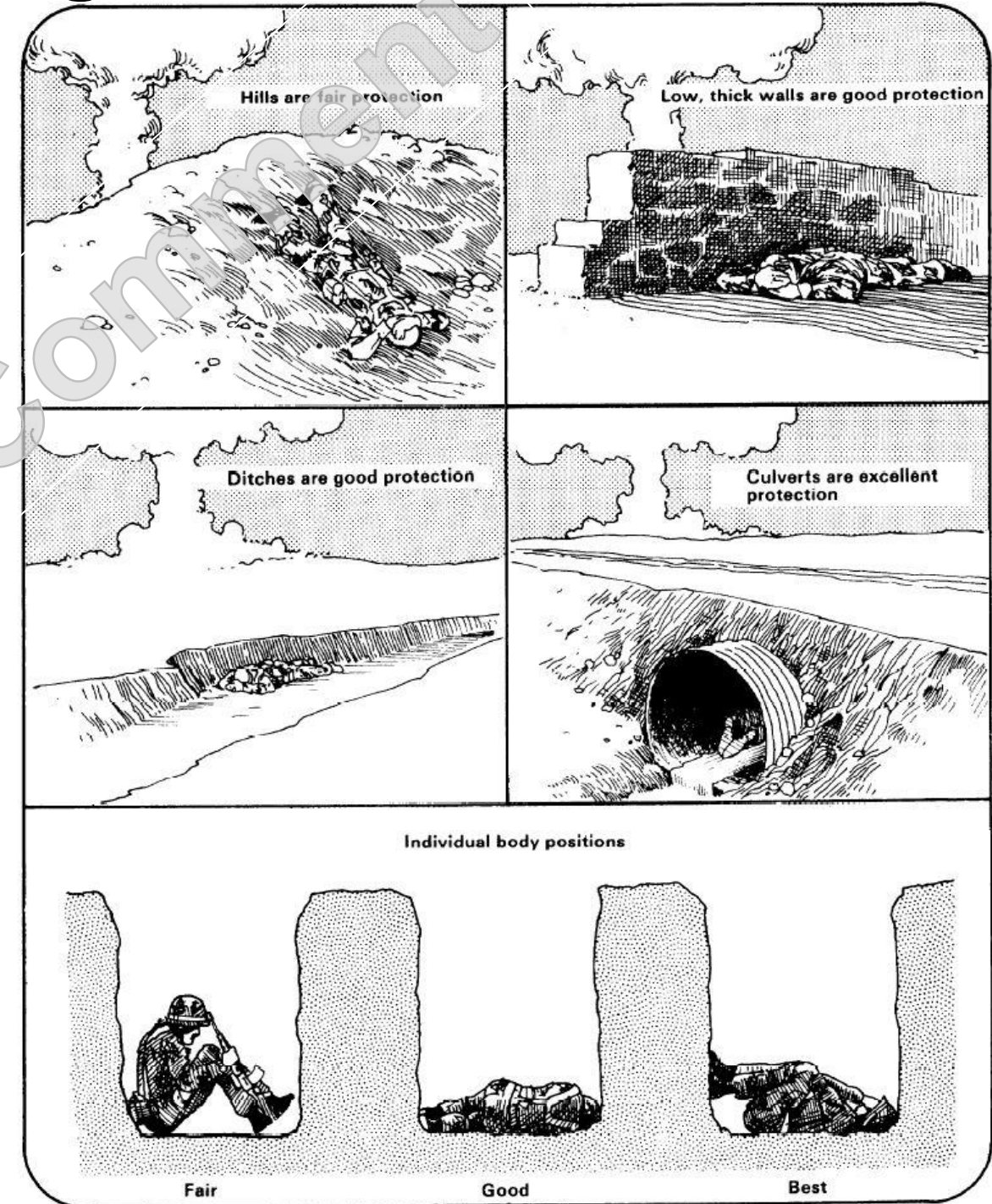
- For a large yields (> 10 kt), the thermal pulse can cause skin burns several kilometers away.
 - The pulse is intense, but short (a few seconds) so even covering with cloth or paper can protect you
- The shock wave can cause injury but may take several seconds to reach your location. You can be injured by:
 - Being knocked over and/or blown into structures
 - Flying and falling debris
 - Ear and lung injury if within kilometer
- Immediately ducking down and covering up can help protect you for these effects. This is the basis of the “Duck and Cover” program



Places to go if you have a few minutes of warning



Examples of expedient protective positions against initial nuclear effects



What If You Have Warning?

➤ Imminent Nuclear Threat

- Protective Actions for Prompt Effects
- May minutes to get into a good shelter for threat with warning
- Get inside a basement or central room away from windows and doors, stay inside, stay tuned for more information

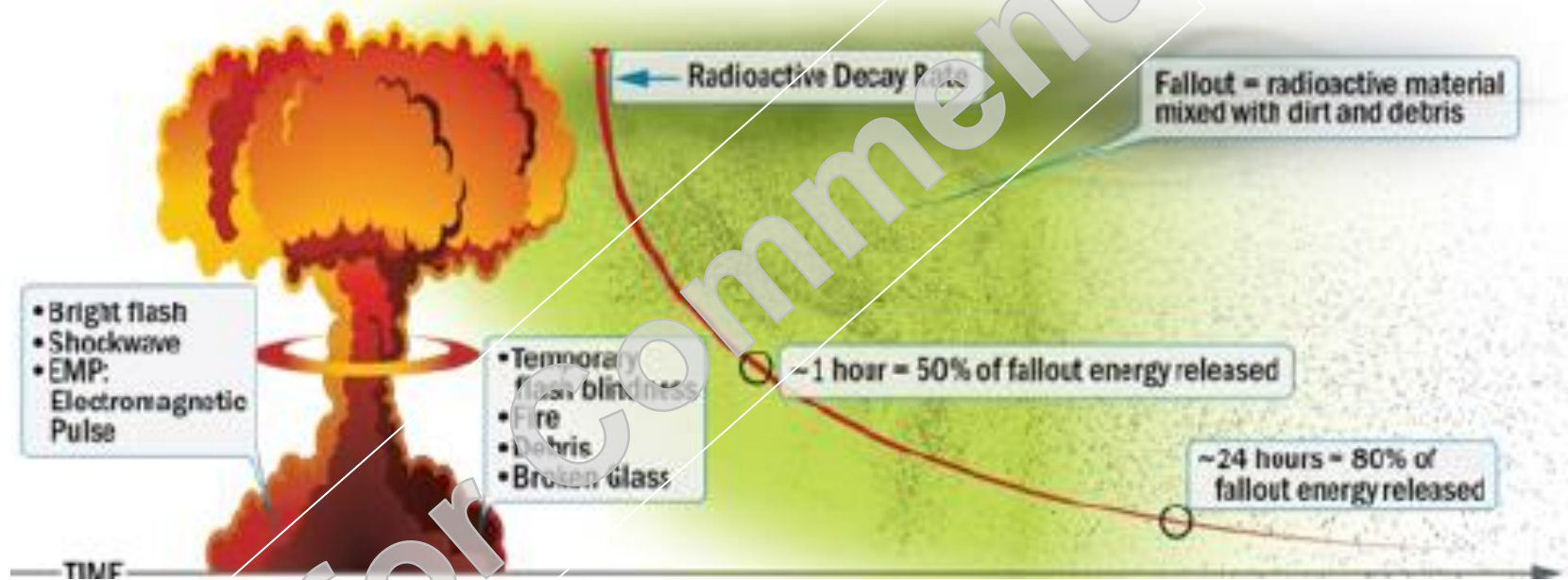
➤ No Notice Detonation

- “Duck and cover” for prompt effects protection
- Difficult without “hyper vigilance” for the flash

➤ Nuclear Fallout

- 15 minutes or more to take action after detonation
- Get inside a basement or central room, stay inside for 12-24 hours, stay tuned for more information





Before the Detonation		After the Detonation				Sustained Operations
Prepared-ness and education	Elevated Threat	15 min before	15 min after	First day	Days to weeks	Months
		Attack warning (if possible)	Rapid public messaging	Life-saving messaging and activates	Continued life saving & stabilization	Long-term recovery

Public awareness of proper actions

Prepared messaging critical for success

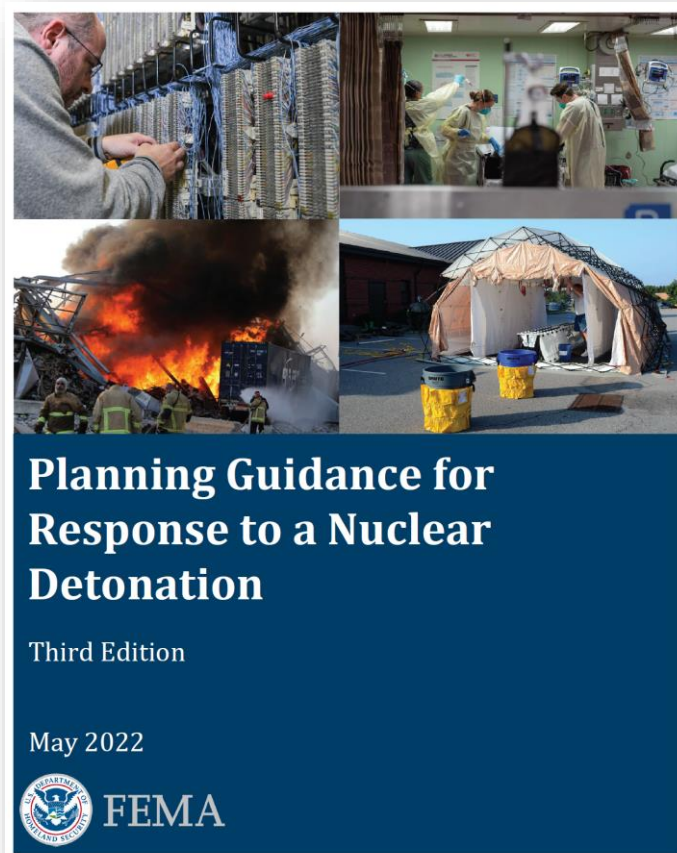


Response After The Detonation



Response Checklists and Zone Cards developed based on the Guidance

Provide state, local, tribal, and territorial governments with prioritized, operational guidance on how to initially respond to a nuclear detonation in or near their jurisdiction



<https://www.fema.gov/emergency-managers/practitioners/hazardous-response-capabilities/cbrn-tools>

Example Immediate Post-Detonation First Responder's Checklist

☐ **All responders:** Go inside a sturdy building immediately

Responders without radiation detection equipment:

- ☐ Shelter inside for up to 24 hours or until informed it is safe to respond

Responders with radiation detection equipment: Assess exposure rate outside

- ☐ If/ while outside radiation levels are greater than 10 R/hr, operate inside and sheltered from fallout
- ☐ When outside radiation levels are less than 10 R/hr, conduct life-saving activities outside

☐ Monitor total dose for each responder or use group dosimetry

Observe and Identify Immediate Impacts

Determine blast damage zone:

- ☐ **Light Damage Zone (LDZ):** Building façade damage; most windows broken; mostly minor injuries due to glass and falling debris.
- ☐ **Moderate Damage Zone (MDZ):** Large number of collapsed & unstable structures. Significant injuries.
- ☐ **Severe Damage Zone (SDZ):** Most sturdy buildings destroyed; few survivors.

Determine radiation hazard zone:

- ☐ **Hot Zone (HZ):** Greater than 0.01 R/hr (10 mR/hr)
- ☐ **Dangerous Radiation Zone (DRZ):** Greater than 10 R/hr

Assess other impacts in your area, including:

- ☐ Critical Infrastructure – especially blocked roadways
- ☐ Injuries – Types and severity
- ☐ Fires

Communicate Your Information

- ☐ Establish communication with firehouses, precincts, hospitals, EOCs, etc.
- ☐ Communicate blast damage zone, outdoor radiation levels, and other impacts to an EOC or operations center.

Save Lives

Refer to the Zone-Based Response Card for life-saving priorities:

- ☐ If in DRZ, refer to card #4, otherwise: LDZ #1; MDZ #2; SDZ #3; HZ #5
- ☐ MDZ is an early response priority with the greatest life-saving potential

Figure 1 First Responder's Checklist

**Response Card: #1
Light Damage Zone (LDZ)**

Life-Saving Priorities

Evacuation/ Shelter:

- Instruct public to shelter inside building
- Targeted evacuation of unsafe areas

Observed Indicators

- Nearly all windows broken
- Some mostly glass and debris

Major Hazard

- Inhalation hazard from fire/debris

**Response Card: #2
Moderate Damage Zone (MDZ)**

Life-Saving Operational Priorities

Evacuation/ Shelter:

- Instruct public to evacuate towards the Light Damage Zone (LDZ) & away from the Hot Zone

Observed Indicators

- Light building damage
- Blown out windows
- Significant number of injuries

Major Hazard

- Significant building damage
- Inhalation hazard from fire/debris

**Response Card: #5
Hot Zone (HZ)**

Life-Saving Operational Priorities

Evacuation/ Shelter:

- Instruct the public to shelter inside their building / home.
 - Large-scale public evacuation is not necessary in first 72 hours
- Direct self-evacuates towards safety / out of the hot zone. Do not prevent spontaneous evacuation.

Medical:

- Conduct life-saving activities, but minimize time outside when possible
- Prioritize rapid, dry decontamination

Infrastructure:

- Begin to stabilize and restore infrastructure, where possible

Special Consideration:

- The MDZ is an early response priority with the greatest life-saving potential. Consider sending support.

Observed Indicators

- Greater than 0.01 R/hr (10 mR/hr) radiation exposure rate; but less than 10 R/hr

Major Hazards

- Fallout may take several hours to arrive
- Outdoor radiation levels not life threatening and will significantly decrease over first 72 hours

Direction of Fallout

Pre-decisional Draft; Not for Distribution

Figure 2 Zone-Based Response Cards

Responder Checklist: Safety

Immediate Post-Detonation First Responder's Checklist

All responders: Go inside a thick-walled building/underground basement immediately

Responders without radiation detection equipment:

- ☐ Shelter inside for up to 24 hours or until informed it is safe to respond

Responders with radiation detection equipment: Assess exposure rate outside

- ☐ If outside radiation levels are greater than 100 mGy/h (10 R/h), stay inside and sheltered from fallout
- ☐ When outside radiation levels are less than 100 mGy/h (10 R/h), conduct lifesaving activities outside

Monitor total dose for each responder or use group dosimetry

Observe and Identify Immediate Impacts

Determine blast damage zone:

- Light Damage Zone (LDZ): Mostly building facade damage, nearly all windows broken,
- Moderate Damage Zone (MDZ): Large number of collapsed and unstable structures, significant injuries
- Severe Damage Zone (SDZ): Even sturdy buildings destroyed, few survivors

Determine radiation hazard zone:

- Hot Zone (HZ): Greater than 0.1 mGy/h (same as 100 uGy/h)
- Dangerous Radiation Zone (DRZ): Greater than 100 mGy/h

Assess other impacts in your area, including:

- Critical infrastructure, especially blocked roadways
- Injuries: types and severity
- Fires

Communicate Your Information

Establish communication with firehouses, police stations, hospitals, emergency operations centers (EOCs), etc.

Communicate blast damage zone, outdoor radiation levels, and other impacts to operations centers or an EOC

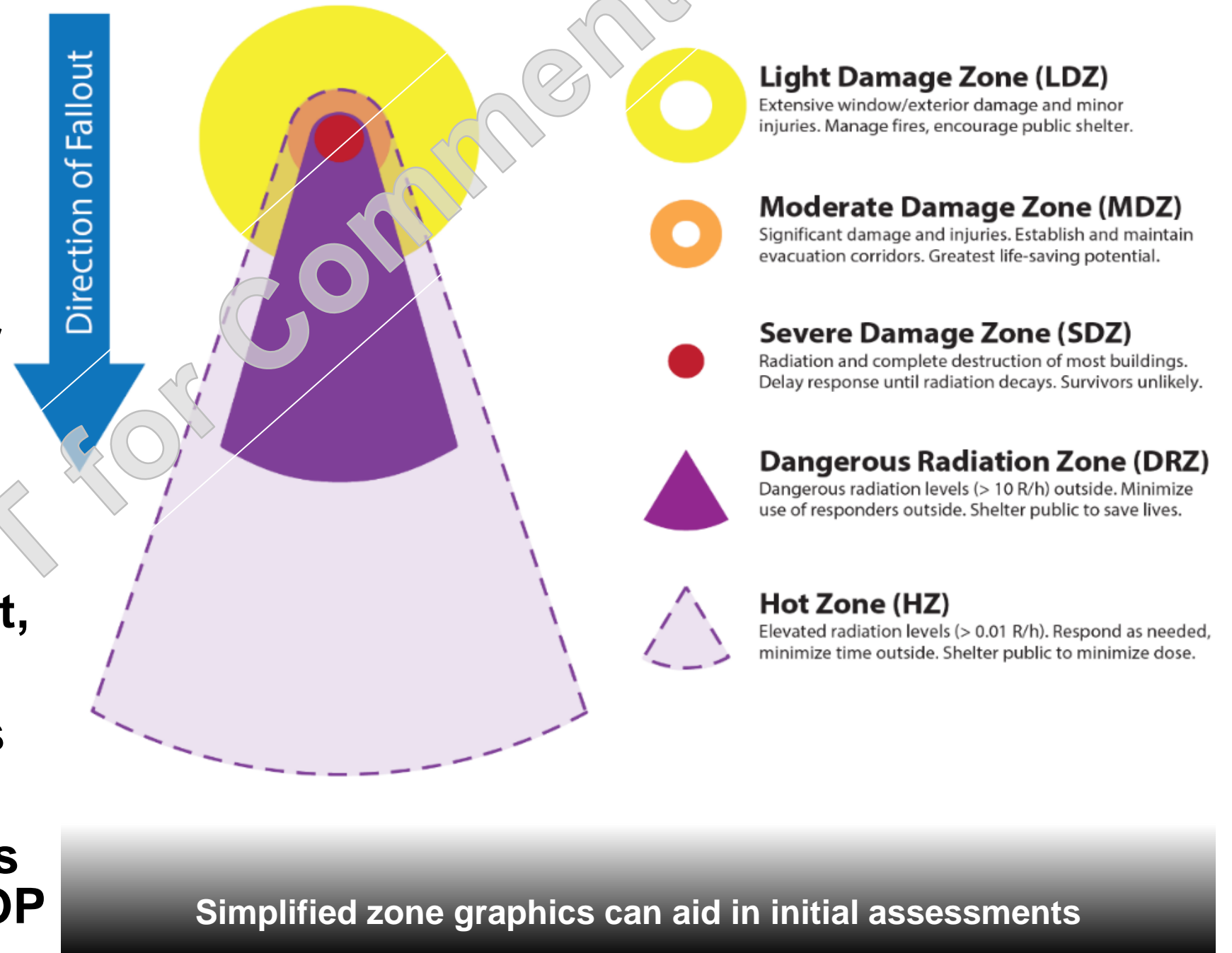
Save Lives

Refer to relevant zone-based Response Card for lifesaving priorities:

- MDZ is the early response priority with the greatest lifesaving potential

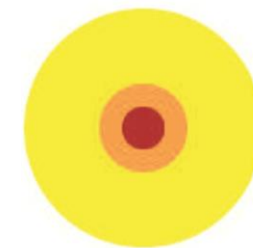
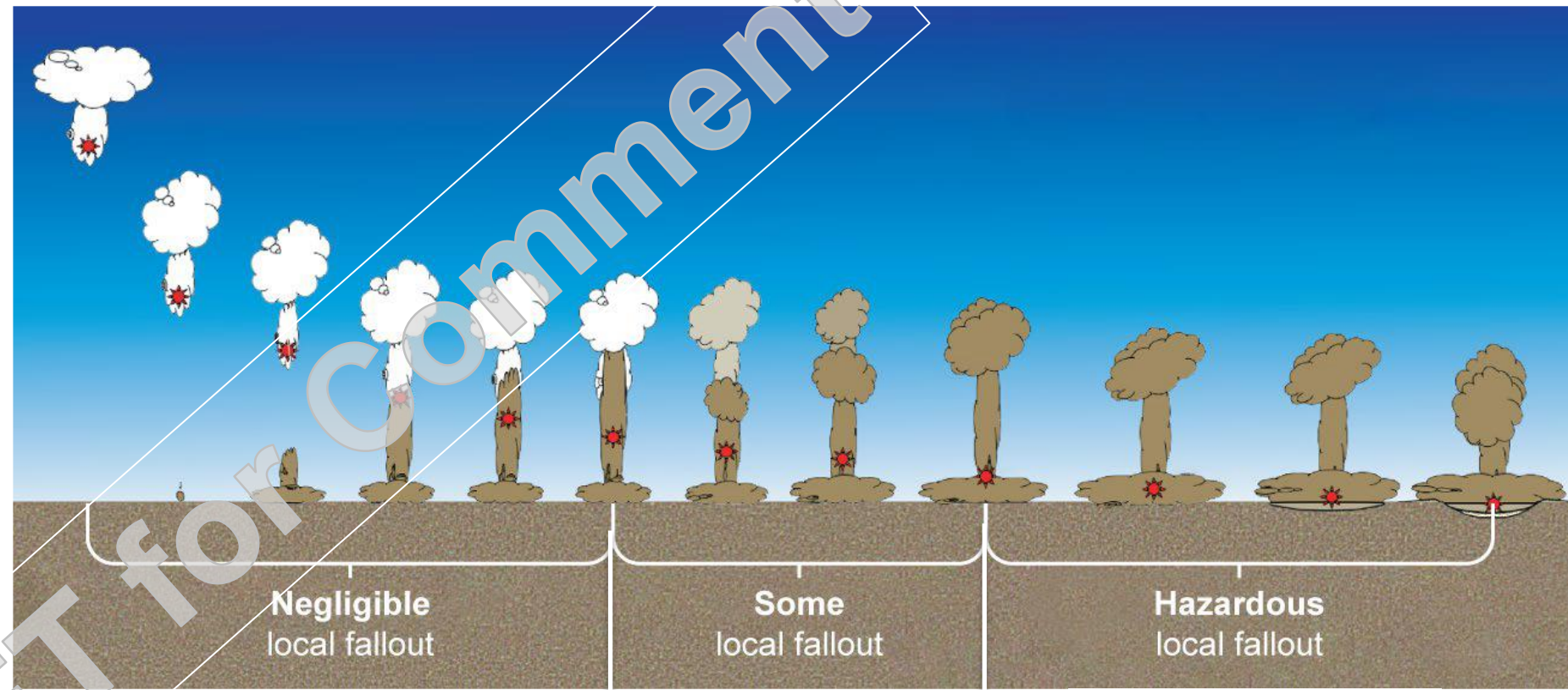
Develop a Common Operating Picture

- Establish communications with first response facilities and other assets, especially those in the Impacted Jurisdiction
- EOCs receive and map first-responder and facility observations on fallout, fire, blast, casualty, infrastructure impacts
- Designate and map hazard zones
- Coordinate to establish a single location where local observations impacts are aggregated into a COP

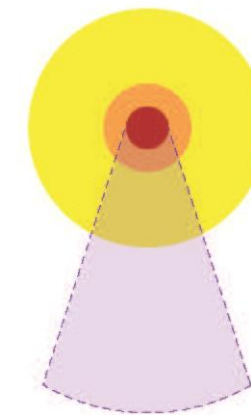


Variations Based on Height of Burst

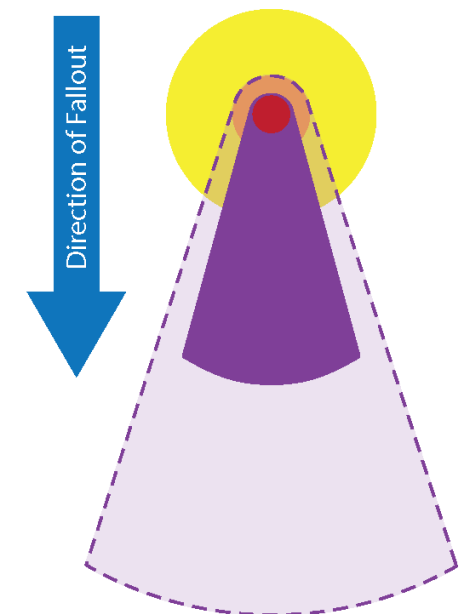
- For elevated detonations, Fallout related zones may be reduced or absent.



No hazardous
local fallout



Reduced fallout
intensity and
area (no DRZ)



Build a Common Operating Picture

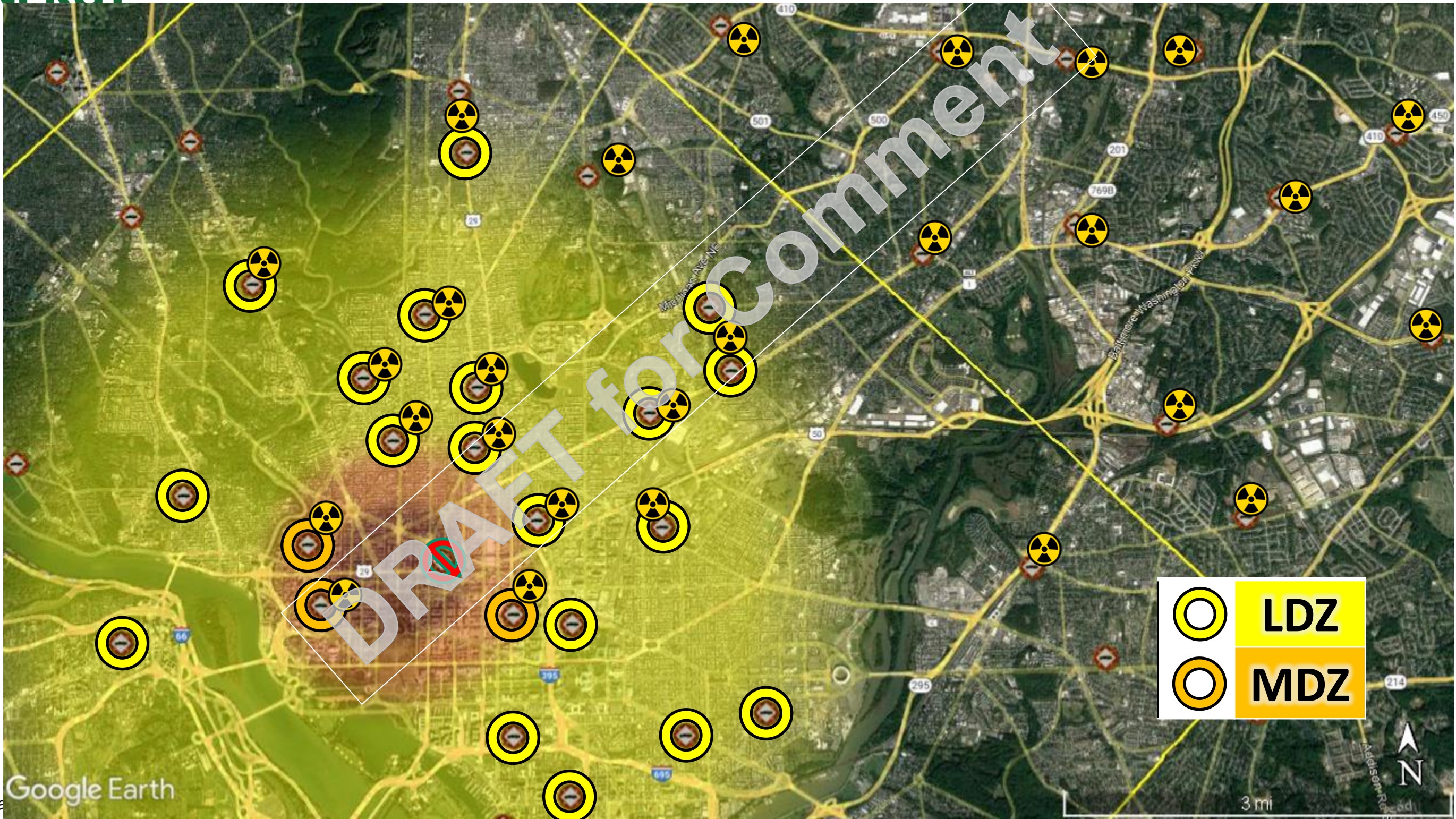
Zone	Observables
LDZ	Extensive window/exterior damage <ul style="list-style-type: none"> Structures intact, but most windows broken Some (mostly) minor injuries due to glass & debris Fires possible, especially near MDZ
MDZ	Significant Damage and Injuries <ul style="list-style-type: none"> Large number of collapsed & unstable structures Many fatalities and severely injured. Rubble and fires, potential for firestorm
SDZ	Complete destruction of most buildings <ul style="list-style-type: none"> The few survivors, only in large buildings or underground. High radiation hazard from activation and fallout.
DRZ	Dangerous radiation levels outdoors <ul style="list-style-type: none"> > 100 mGy/h outdoor dose rates Radiation hazard primarily first few hours, will overlap MDZ & LDZ Outdoor radiation hazard, recedes over first day
Hot Zone	Elevated radiation levels <ul style="list-style-type: none"> > 0.1 mGy/h outdoor dose rates Potentially large area (100s of miles), will overlap MDZ & LDZ Protective public to reduce reduce long term cancer concern. May take hours for fallout to arrive in outlying areas, recedes after a day

Zones are based on **observables** and **measurable** radiation levels.

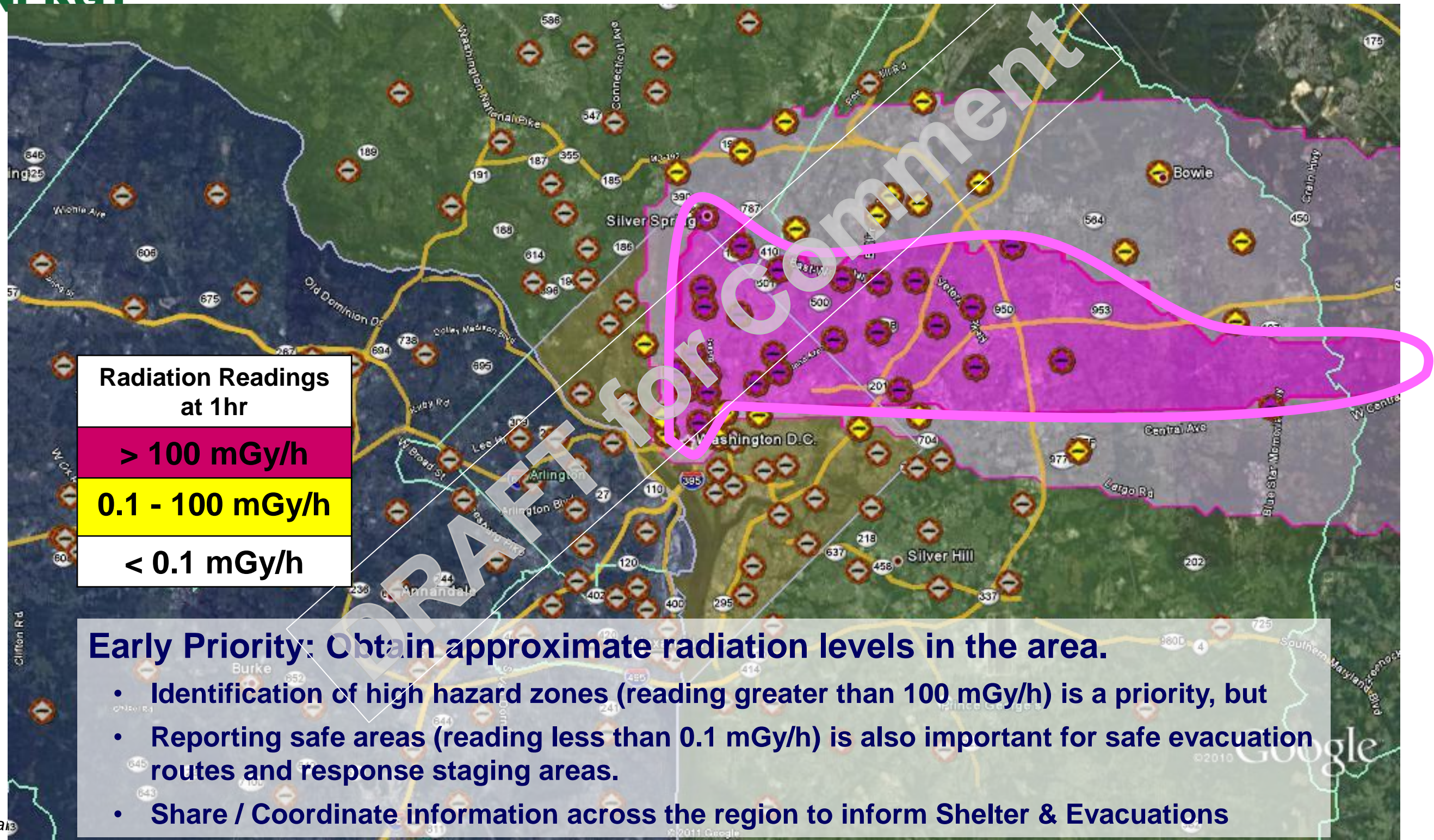
- Information should be reported back to a centralized location.



Fire Stations Radio Local Conditions



Emergency Management Builds Zone Map





Severe Damage Zone

**Nearly
Complete
Destruction**

Response Card: #4

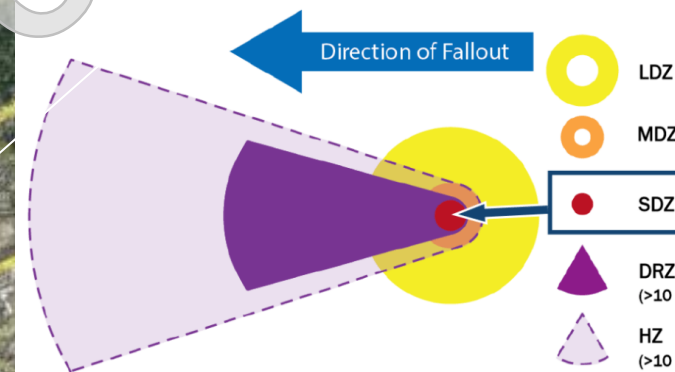
Severe Damage Zone (SDZ)

Observable Indicators:

- Nearly all buildings destroyed
- Few survivors
- Impassable, high piles of debris

Major Hazards:

- Immediate dangerous radiation levels outside. Shelter inside. Move if shelter threatened by fire or collapse.
- Significant secondary hazards: fire, smoke, etc. Avoid these hazards and wear appropriate PPE



Lifesaving Priorities (SDZ)

Evacuation/Shelter:

- **Everyone** – responders included – remain sheltered indoors
- **Seek very robust shelter:** Thick cement walls and deep subterranean structures
- Move if shelter threatened by fire, collapse, or other hazards
- Prepare to evacuate once radiation levels are less than 10 R/h
- Consider evacuating through subterranean structures (e.g., subways, tunnels), if possible

Medical:

- Conduct medical triage and stabilization indoors. May conduct outdoors if necessary and radiation levels are less than 10 R/h.
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

**Low
Initial
Priority**



Dangerous Radiation Zone Priorities

**Dangerous
Radiation
Levels Outside**

Response Card: #1

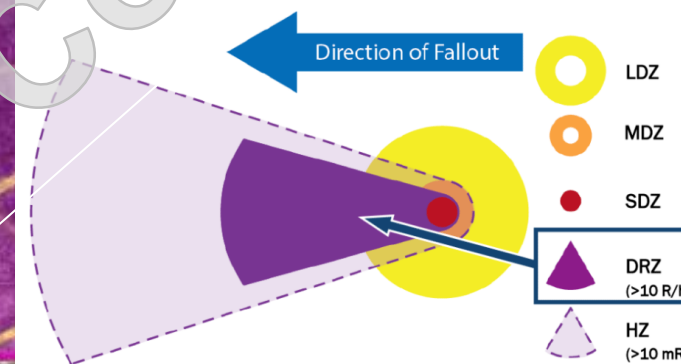
Dangerous Radiation Zone (DRZ)

Observable Indicators:

- Greater than 10 R/h radiation exposure rate

Major Hazards:

- Dangerous radiation levels outside. Shelter inside. Move if shelter threatened by fire or collapse
- Additional hazards if in **Light or Moderate Damage Zones** (e.g., toxic smoke, fire, debris). Avoid these hazards and wear appropriate PPE.



Lifesaving Priorities (DRZ)

Evacuation/Shelter:

- **Everyone** – responders included – remain sheltered indoors
- Prepare to evacuate **once radiation levels are less than 10 R/h** (likely in 12-24 hours)
- Consider evacuating through subterranean structures (e.g., subways, tunnels), if possible

Medical:

- Responders already in **DRZ**: Establish ad hoc triage/treatment sites inside sturdy, thick-walled structures
- Conduct only quick, critical, lifesaving activities outdoors in the **DRZ**
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces

Infrastructure:

- Conduct remote/unmanned damage assessment and fire management, if possible
- Stabilize hazardous infrastructure if failure presents immediate danger to life and safety

Special Consideration:

- Responders with radiation detection equipment should closely monitor their exposure/total dose

**Messaging
Priority**

Moderate Damage Zone Priorities

**Significant
injuries**

Response Card: #3

Moderate Damage Zone (MDZ)

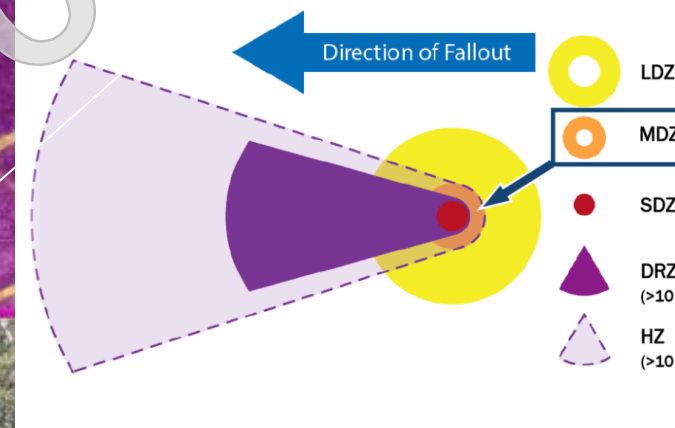
Outside of the Dangerous Radiation Zone

Observable Indicators:

- Light buildings destroyed
- Blown out interiors of larger buildings
- Significant number of major injuries

Major Hazards:

- Significant building damage
- Rapidly spreading fires
- Inhalation hazard from toxic smoke from fire/debris. Avoid smoke, wear appropriate PPE



**High
Priority**

Lifesaving Priorities (MDZ)

Evacuation/Shelter:

- Instruct public to evacuate towards the **Light Damage Zone (LDZ)** and away from the **Hot Zone (HZ)**
- Prioritize assisted evacuation for the non-ambulatory
- Recruit volunteers to support evacuation

Medical:

- Conduct search and rescue operations
- Stabilize life-/limb-threatening injuries
- Transport injured to hospitals or ad hoc triage/treatment sites in **Light Damage Zone (LDZ)** or beyond
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

Infrastructure:

- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) from the **Light Damage Zone (LDZ)**
- Use defensive fire tactics to protect transportation corridors
- Stabilize hazardous infrastructure



**All
Windows
Broken**

Light Damage Zone Priorities

Response Card: #2

Light Damage Zone (LDZ)

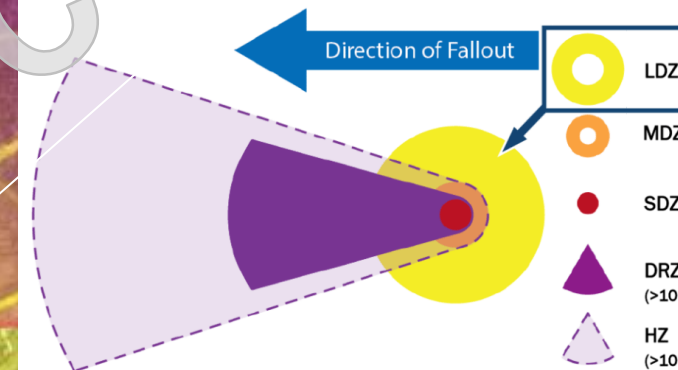
Outside of the Dangerous Radiation Zone

Observable Indicators:

- Nearly all windows shattered
- Damage to building facades
- Mostly injuries from flying glass and debris

Major Hazards:

- Inhalation hazards from toxic smoke from fire/debris. Avoid these hazards and wear appropriate PPE.



**Moderate
Priority**

Lifesaving Priorities (LDZ)

Evacuation/Shelter:

- Instruct public to shelter inside
- **Targeted evacuation of unsafe areas** (e.g., fires, heavy smoke, unstable structures)
- Do not prevent spontaneous evacuation. Direct self-evacuees towards safety and away from the **Hot Zone** (area > 10 mR/h).

Medical:

- Establish ad hoc triage/treatment sites for injured evacuees
- Stabilize life-/limb-threatening injuries
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces

Infrastructure:

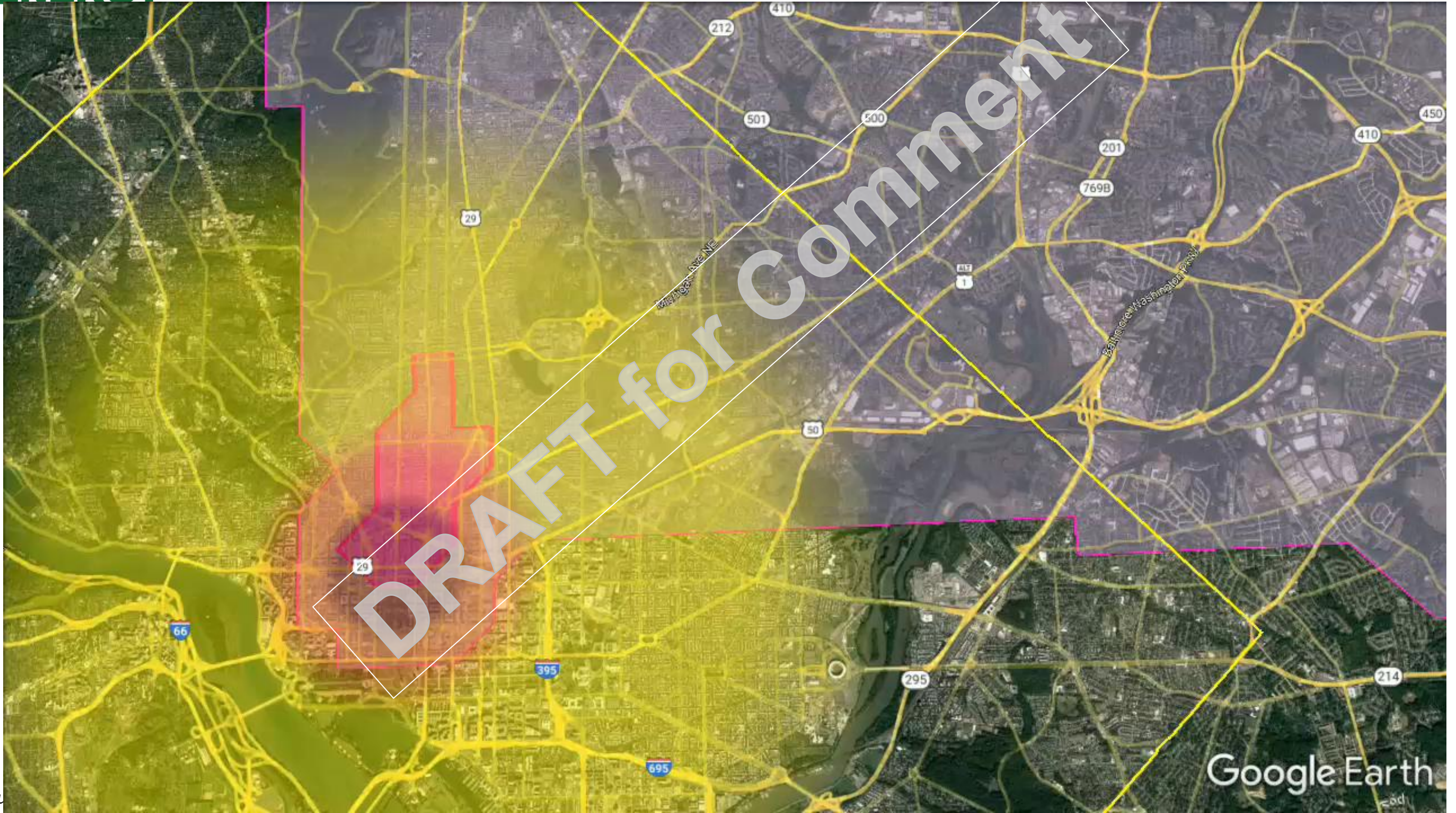
- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) from the **Moderate Damage Zone (MDZ)** to supporting areas outside the LDZ
- Isolate and manage spot fires
- Stabilize hazardous materials and infrastructure

Special Consideration:

- The **Moderate Damage Zone (MDZ)** is an early response priority with the greatest lifesaving potential: **Consider responding to MDZ first.**



Hot Zone Priorities





Hot Zone Priorities

Messaging Priority

Response Card: #5

Hot Zone (HZ)

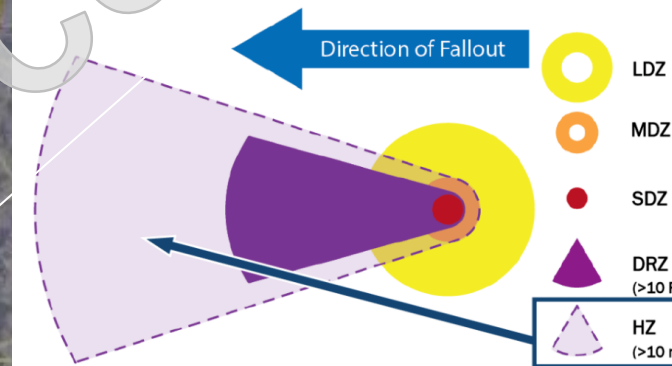
Outside of the Light & Moderate Damage Zones

Observable Indicators:

- Greater than 0.01 R/h (same as 10 mR/h) radiation exposure rate, but less than 10 R/h

Major Hazards:

- Fallout may take several hours to arrive
- Outdoor radiation levels not life-threatening and will significantly decrease over first 48 hours



Lifesaving Priorities (HZ)

Evacuation/Shelter:

- Instruct public to shelter inside their building/home. Large-scale public evacuation is not necessary in first 72 hours.
- Do not prevent spontaneous evacuation. Direct self-evacuees towards safety/away from **Hot Zone (HZ)**.

Medical:

- Conduct lifesaving activities, but **minimize time outside when possible**
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

Infrastructure:

- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) into the **Light Damage Zone (LDZ)**
- Begin to stabilize and restore infrastructure, where possible

Special Consideration:

- The **Moderate Damage Zone (MDZ)** is an early response priority with the greatest lifesaving potential: **Consider responding to MDZ first.**

Messaging Priority

Pop Quiz: What is the Right Emergency Worker PPE?

1. No PPE Needed
2. Uniform and Respirator
3. Level B / FF Turnouts + SCBA
4. Level A

2



Uniform and Respirator

3



Level B / FF Turnouts + SCBA

4



Level A

Personal Protective Equipment (PPE)

- **SCBAs, Respirators, Firefighter “turnouts”, Level A, B, or C HAZMAT suits do not protect against the primary hazard - the penetrating gamma radiation given off by fallout.**



- Radiation / dose monitoring primary protection
- Inhalation & ingestion is a secondary concern compared to the external exposure.
- Turnouts and anti-contamination clothing can help ease decontamination after entries, but not required for time-critical, life saving activities.



“Reducing the time spent in high dose-rate areas is the greatest protective measure. Bulky isolation suits and elaborate respiratory protection methods may actually increase exposure as they reduce the speed, the ability to communicate, and worker efficiency.”

~Key Response Planning Factors for the Aftermath of Nuclear Terrorism

Emergency Worker Safety Requirements

- **Emergency worker:**
 - Not just firefighters and police officers; may include other public/private sector staff supporting the response
- **Personal protective equipment (PPE):**
 - PPE, other than rad detection equipment, should be selected based on non-radiological hazards (e.g., sharp debris, silica dust, fires, unstable structures)
- **Emergency dosimetry:**
 - Establish dose decision-points
 - Implement group dosimetry techniques
 - Observe ALARA (“as low as reasonably achievable”)

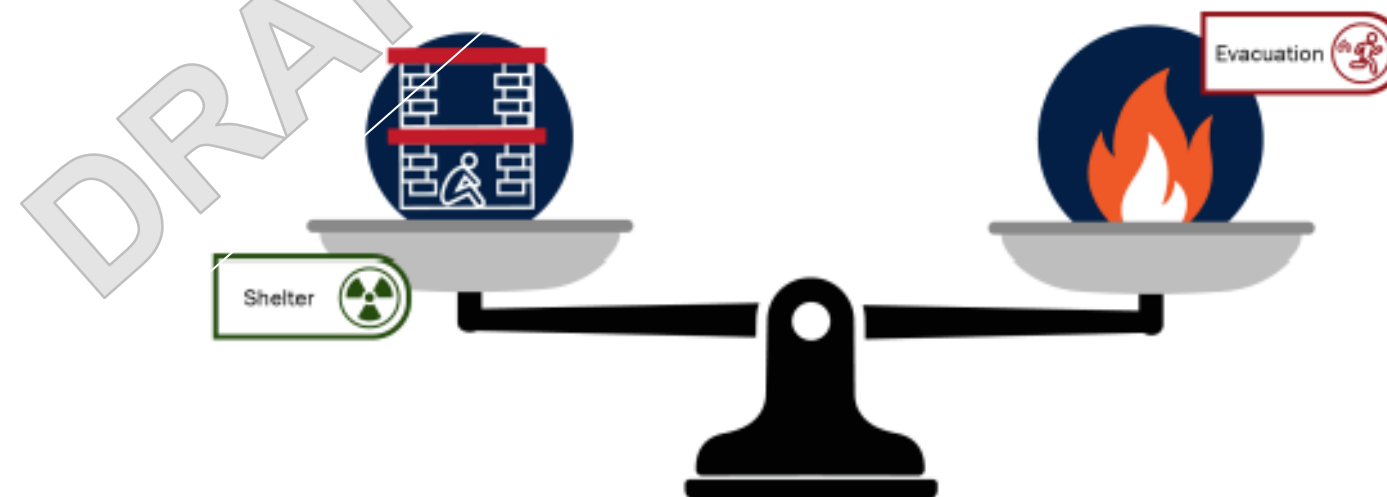
Decision Point	Activity	Condition
50 mSv (5 rem ^a)	All occupational exposures	All reasonably achievable actions have been taken to minimize dose.
100 mSv (10 rem ^a)	Protecting valuable property necessary for public welfare	Exceeding 100 mSv unavoidable & all actions taken to reduce dose.
250 mSv (25 rem ^a)	Lifesaving or protection of large populations	Monitoring available to project or measure dose
250 mSv (>25 rem ^a)		All conditions above & only for people fully aware of the risks.
500 mGy (50 rad ^b)		NCRP recommended decision-point for whether to withdraw a responder from the hot zone.

^a EPA Protective Action Guides Manual. 2017. ([link](#)).

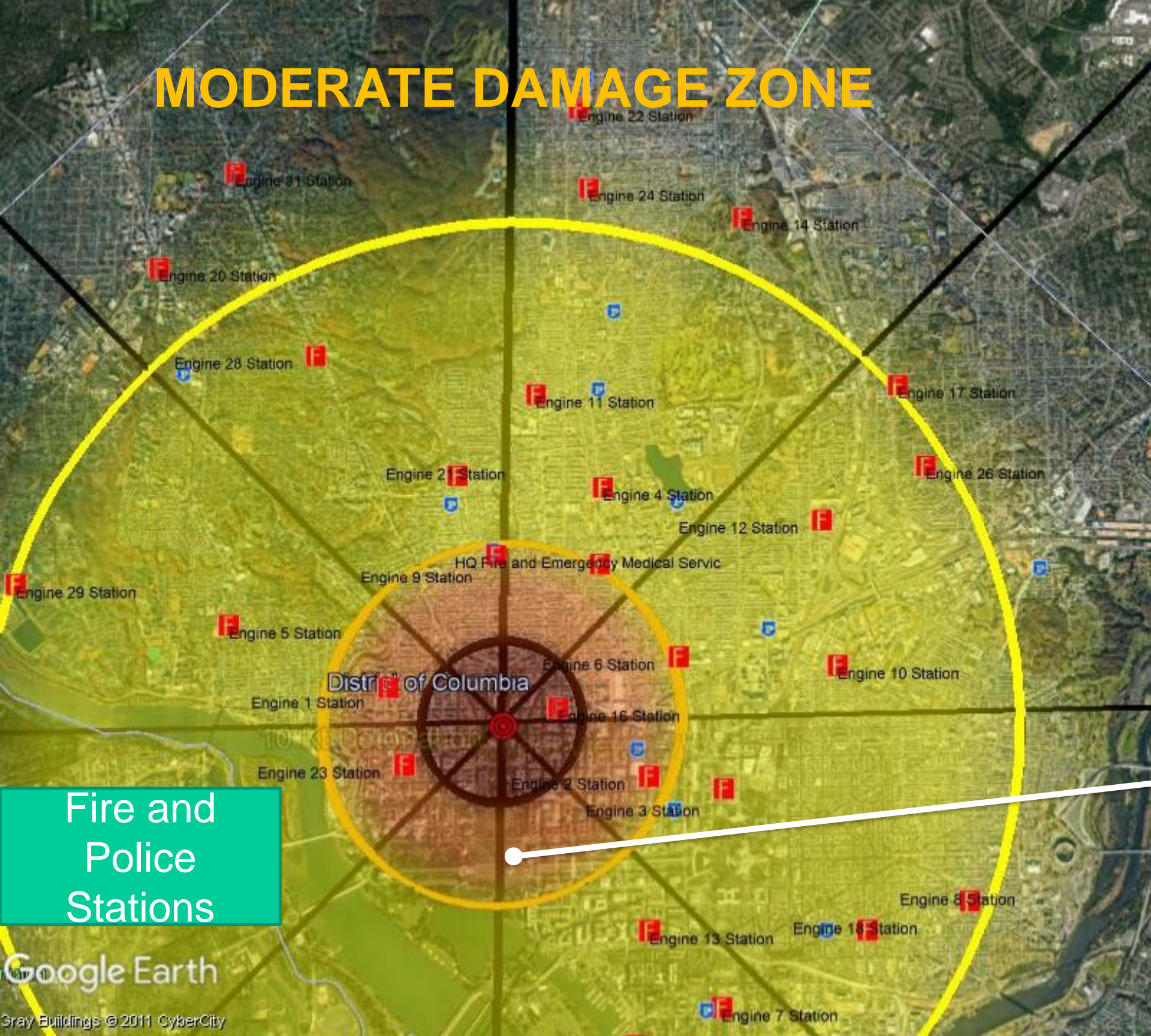
^b NCRP Commentary No 28

Manage Sheltered Populations and Fires

- **The EOC should make continuous identification and tracking of fires a priority and be prepared to adjust life safety operations as conditions change.**
 - **For example, this may require earlier-than-planned evacuation of sheltered people or relocation of emergency operations.**
 - **Due to limited resources and access, fires may expand and combine, blocking passageway and putting responders and sheltered public in danger.**
- **Be especially vigilant in identifying and tracking fires if the detonation was an air-burst, since more surface would be exposed to the fireball's heat**

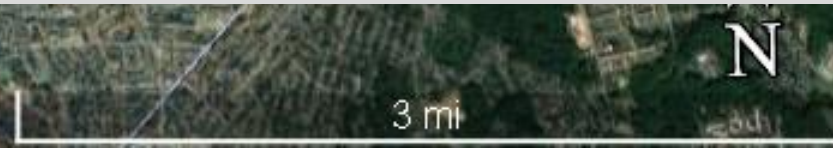


MODERATE DAMAGE ZONE

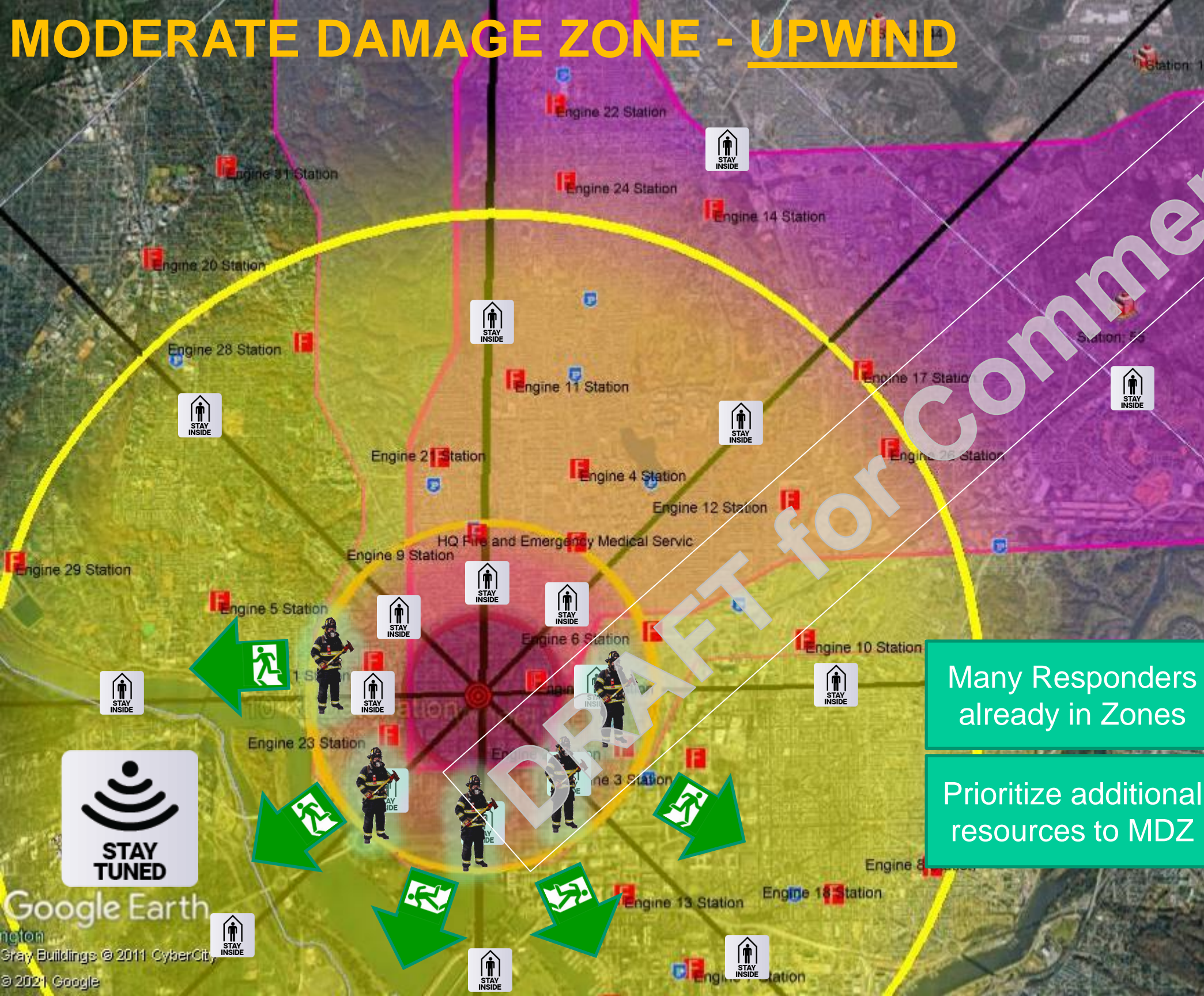


IMPACTS

- Moderate to Major damage, large number of collapsed or partially collapsed structures
- Large number of fatalities and severely injured
- No power, though most battery-operated equipment should function
- Fires



MODERATE DAMAGE ZONE - UPWIND



PUBLIC ACTION

- Shelter unless threatened by fire or collapse
- Tune in and evacuate where and when safe to do so

RESPONSE PRIORITIES

- Defensive firefighting tactics; maintain evacuation corridors
- Rapid, assisted evacuation
- Triage and forward injured to care centers

RESPONDER SAFETY

- PPE for non-radiological hazards (sharps, silica dust, fire, & unstable piles)
- Monitor radiation levels, do not enter SDZ or DRZ without plan
- Gross decon after shift

MDZ Evacuation will Initially be Done with Minimal Resources



- **Resources not available for traditional urban search and rescue**
- **Conduct defensive actions to maintain evacuation corridor**
- **Use whatever communication method you can (including bullhorns)**
- **Promote self-help and volunteers to evacuate injured**

ZONE RESPONSE WITH FALLOUT DECAY

Decay of fallout
96 hrs

- Emergency worker access to downwind areas will increase with time
- Do not perform outdoor operations in DRZ without a plan
- Closely monitor radiation levels and dose
- Remote fire management if possible
- Enable public egress where safe to do so



Zone Based Response Summary

Zone-Based Objectives for Response and Shelter/Evacuation

This table provides suggested initial life-saving objectives for emergency response and public shelter/evacuation. As the response develops and command systems integrate, these objectives should be revised and integrated into incident response plans.

Zone	Response Objectives	Shelter/Evacuation Objectives
Light Damage Zone	<i>Reactive Intervention</i>	<i>Encourage Public Shelter</i>
	<ul style="list-style-type: none"> • Support responder access to MDZ: <ul style="list-style-type: none"> ○ Isolate and manage spot fires ○ Move resources into and between LDZ, MDZ ○ Clear essential roads for vehicle access • Care for survivors: <ul style="list-style-type: none"> ○ Establish ad-hoc triage sites ○ Direct injured evacuees to care ○ Support self-initiated egress from MDZ 	<ul style="list-style-type: none"> • PRIORITY: Promote shelter • PRIORITY: Case-by-case evacuation if areas are unsafe to remain in while sheltering • BE AWARE: Do not prevent self-evacuation • BE AWARE: If in <i>Hot Zone</i>, keep people moving away from contamination or seek shelter
Moderate Damage Zone	<i>Proactive Evacuation</i>	<i>Prioritize Public Evacuation</i>
	<ul style="list-style-type: none"> • Establish and maintain escape routes: <ul style="list-style-type: none"> ○ Defensive fire tactics to protect evacuation corridors ○ Recruit volunteers to support evacuation • Get survivors out: <ul style="list-style-type: none"> ○ Evacuate everyone in zone ○ Direct injured to care centers 	<ul style="list-style-type: none"> • PRIORITY: Promote and support evacuation • BE AWARE: Significant building damage and rapidly spreading fires may present hazard
Severe Damage Zone	<i>Enter Only as Last Resort</i>	<i>Public and Responder Shelter Unless Threatened by Fire or Collapse</i>
	<ul style="list-style-type: none"> • Protect responder safety: <ul style="list-style-type: none"> ○ Delay response until radiation decays ○ Prioritize long-term response ability • Few immediate survivors in SDZ, fewer after radiation decays 	<ul style="list-style-type: none"> • BE AWARE: Near complete building destruction, impassable • BE AWARE: Significant outdoor hazards • IF NECESSARY: Consider novel extraction methods (e.g., subway tunnels)

➤ **Sheltering can save lives!**

- Shelter population and responders out to 80 km (50 miles) until fallout direction and magnitude is established.
- Use visual observations of the damage, early fallout cloud, and detector readings to determine the magnitude to fallout and effects.

➤ **Use the Zone-based response approach to:**

- Quickly build a common operating picture
- Establish priority zones
- Establish appropriate public and responder actions within each zone
- Establish responder safety protocols

➤ **Responder Safety**

- Those without radiation detection should wait until hazard extent established
- Primary radiation hazard is EXTERNAL grounds shine, not a respirable hazards.
- PPE requirements should be selected based on the NON-Radiological hazards.

DRAFT for Comment

Thank You!

Translation of Get Inside, Stay Inside, Stay Tuned

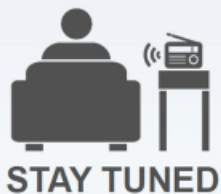
GET INSIDE. STAY INSIDE. STAY TUNED



Go to the basement or the middle of a building.



Plan on 12 – 24 hours unless provided updated guidance.



AM/FM Radio is best, Cellular and Internet if available.

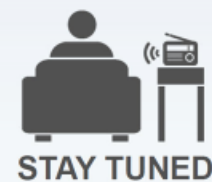
ЗАХОДІТЬ В СЕРЕДИНУ. ЗАЛИШАЙТЕСЯ В СЕРЕДИНІ. СЛІДКУЙТЕ ЗА ПОВІДОМЛЕННЯМИ



Ідіть у підвал або середину будівлі.



Плануйте знаходитись там 12–24 години, якщо не буде оновлених вказівок.



Найкраще користуватися АМ/ФМ-радіо, стільниковим зв'язком та Інтернетом, якщо є.

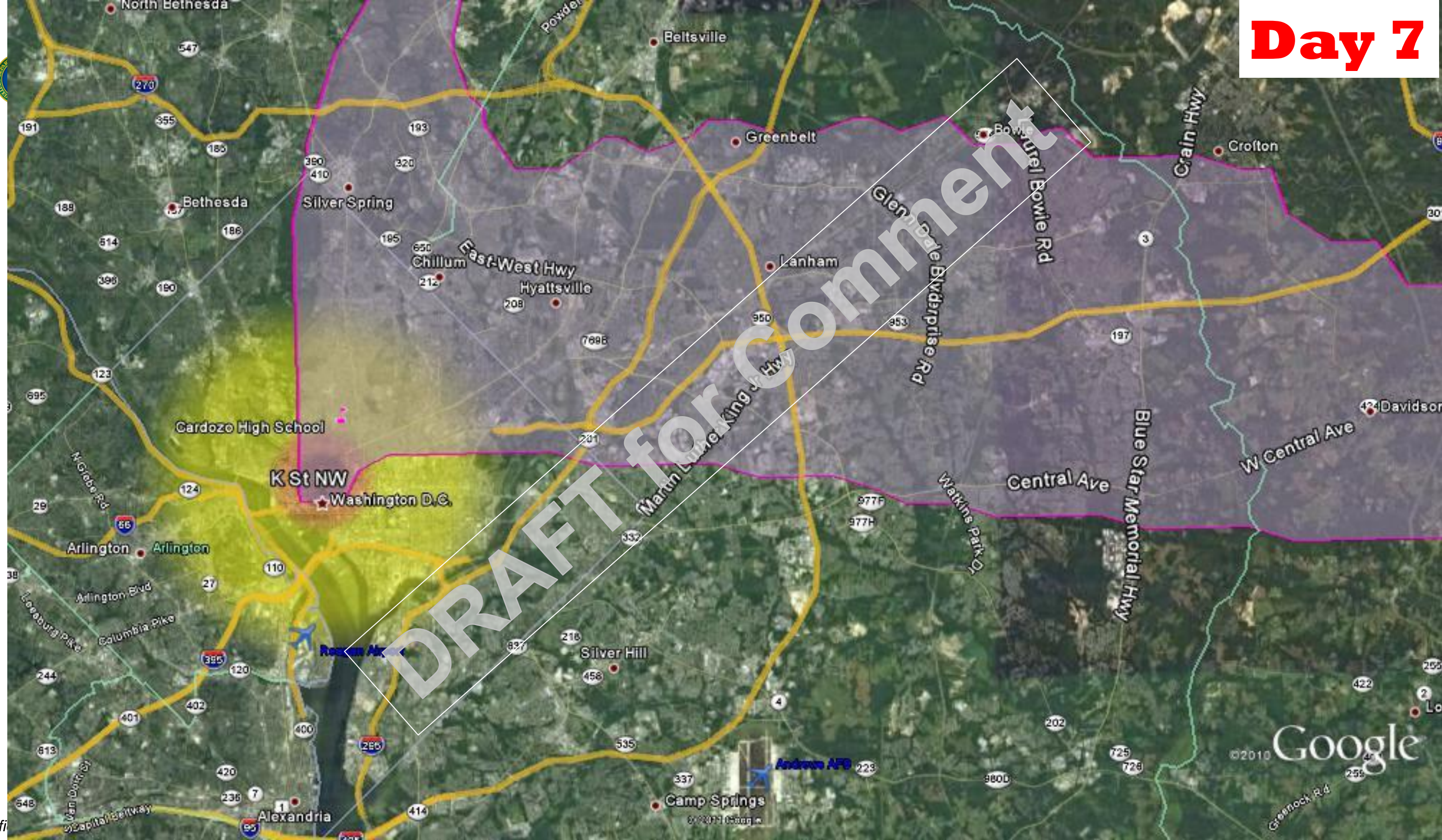
Recommendations from the Audience (+Google Translation)

- **Ховайся, Чекай, Слухай**
- **Підвал, Чекай, Слухай**
- **Сховайся. Не виходь. Слухай радіо**
- **Сховайся, залишайся, слухай**
- **В укриття!**
- **всім в укриття**
- **сховайся глибше! сиди довше! слухай уважно**
- **залишайся в укритті**
- **слухай повідомлення**
- **Hide, Wait, Listen**
- **Basement, Wait, Listen**
- **hide don't go out Listen to the radio**
- **Hide, stay, listen**
- **In shelter!**
- **everyone in the shelter**
- **hide deeper! sit longer! listen carefully**
- **stay in cover**
- **listen to the message**

Recommendations from the Audience (+Google Translation)

- **Негайно в укриття! Залишайся там! Слухай радіо**
- **В УКРИТТЯ! ЗАЛИШАЙСЯ В УКРИТТІ!! СЛУХАЙ ПОВІДОМЛЕННЯ!**
- **У будівлю. Не виходь. Будь на зв'язку**
- **Прямуйте до найближчого укриття! Залишайтесь там і прислухайтесь до рекомендацій рятувальників!**
- **Підтримуй зв'язок**
- **Загроза ядерной атаки!!**
- **Take shelter immediately! Stay there! Listen to the radio**
- **IN SHELTER! STAY UNDER COVER!! LISTEN TO THE MESSAGE!**
- **Into the building. don't go out Be in touch**
- **Head for the nearest shelter! Stay there and listen to the advice of the lifeguards!**
- **Keep in touch**
- **Threat of nuclear attack!!**

Day 7



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