Environmental Consequences of Radioactive Material following a Nuclear or Radiological Incident

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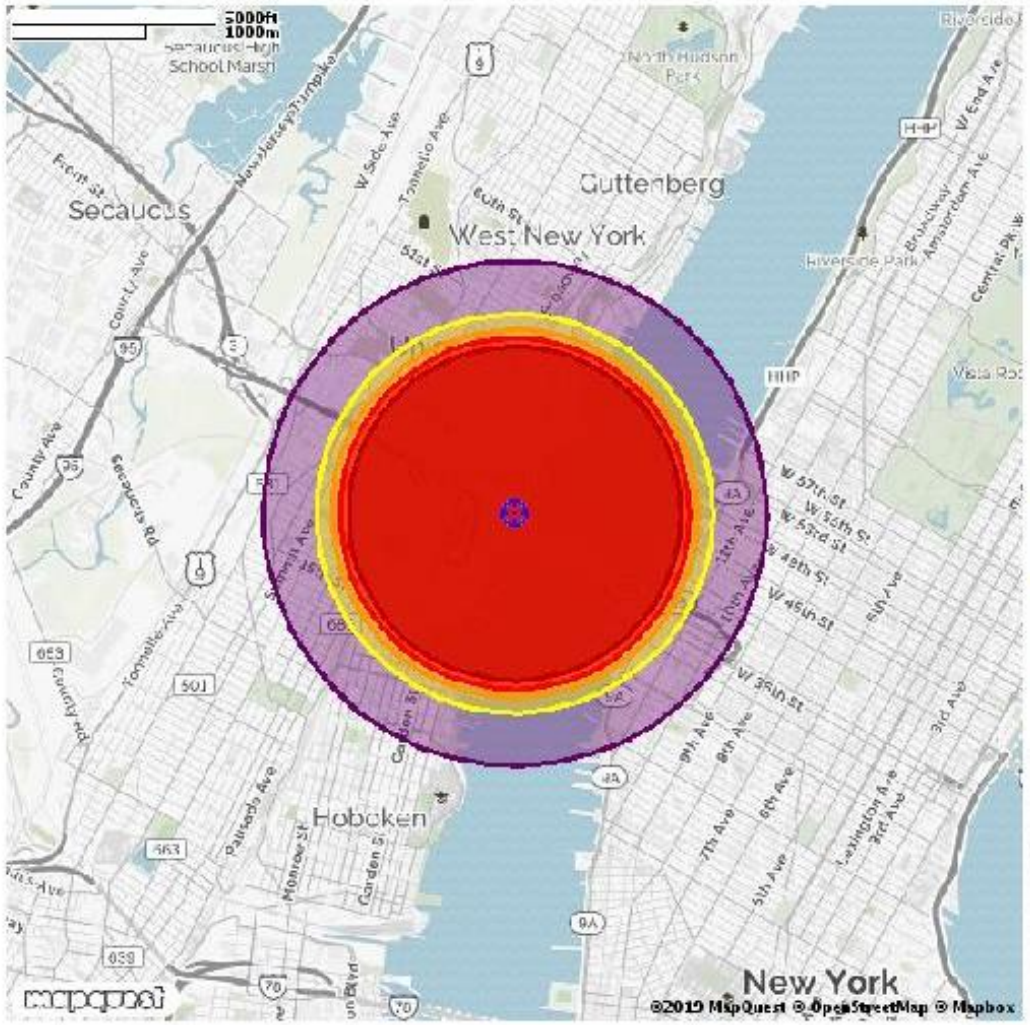
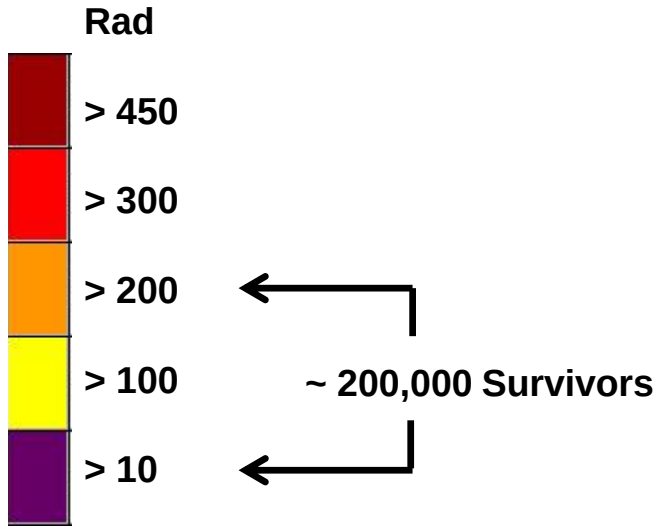
1. **10 kT surface burst**
2. **100 kT high altitude burst**
3. **Nuclear power plant accident**
4. **Radiological dispersal device**

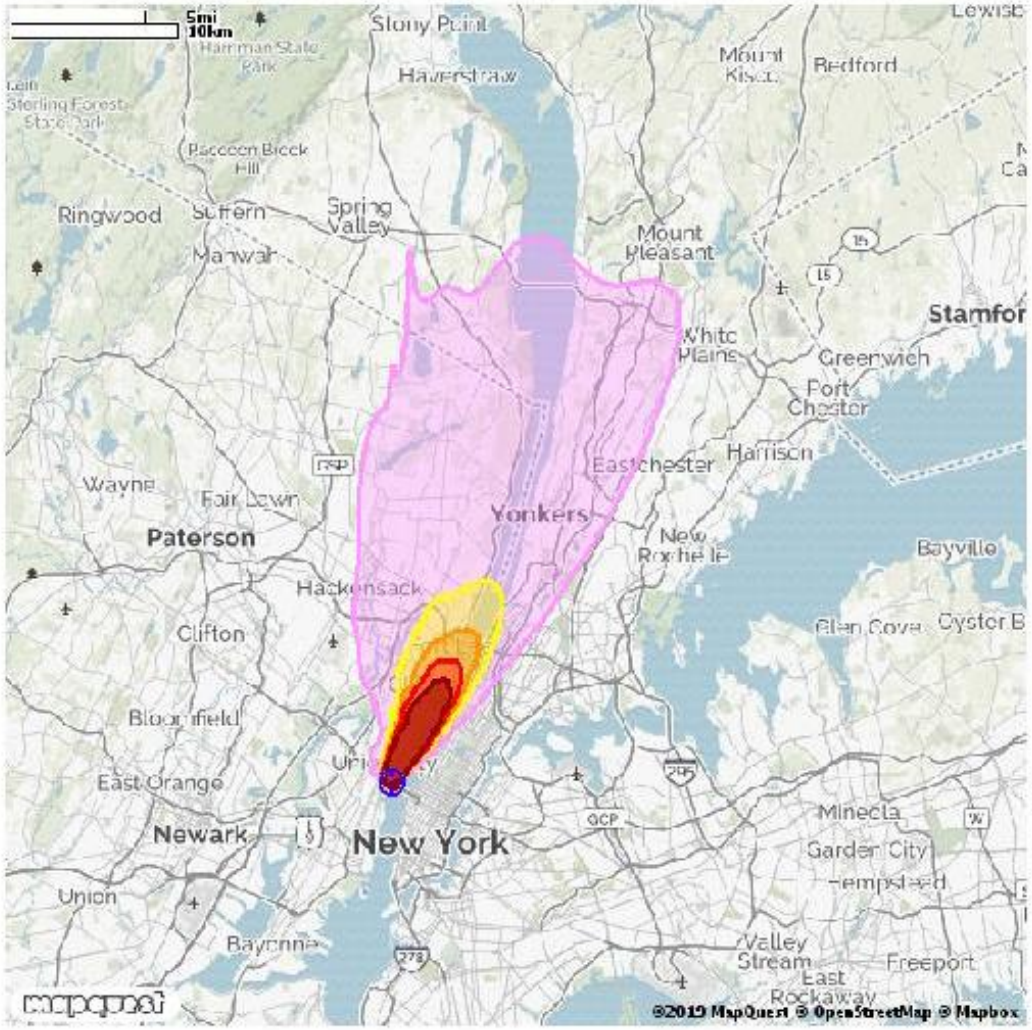
Caveat: Responders – special case and not encompassed

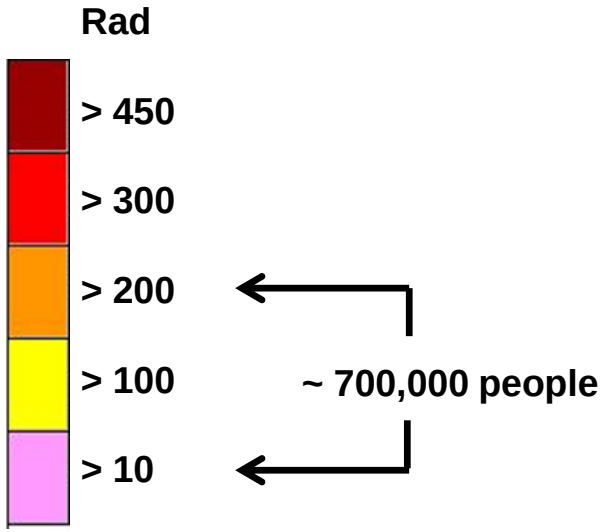
10 kT Surface Burst – Prompt Effects



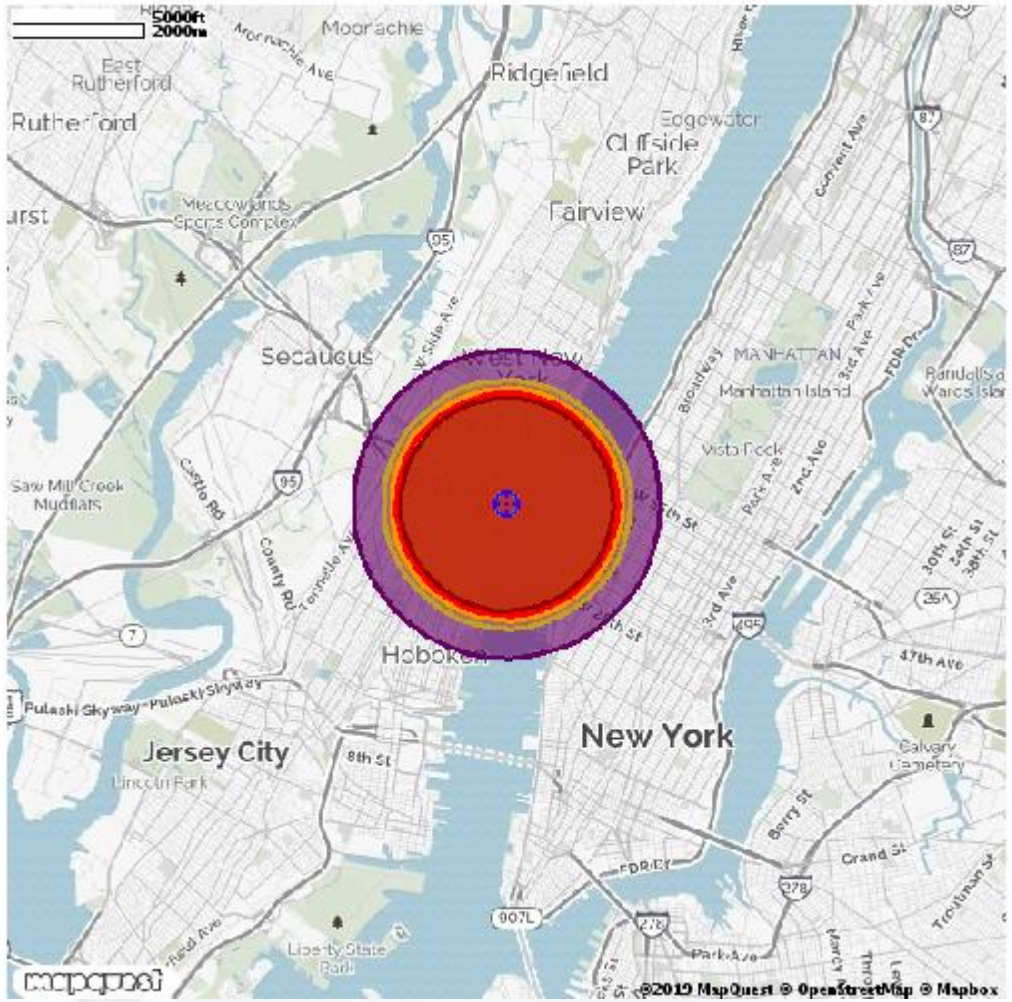


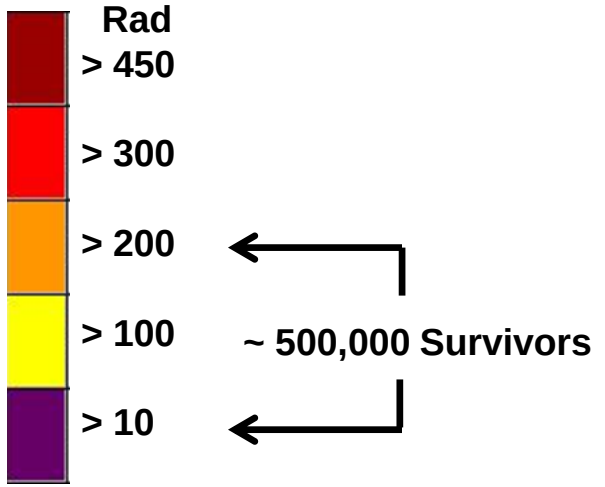
10 kT Surface Burst – Fallout Effects



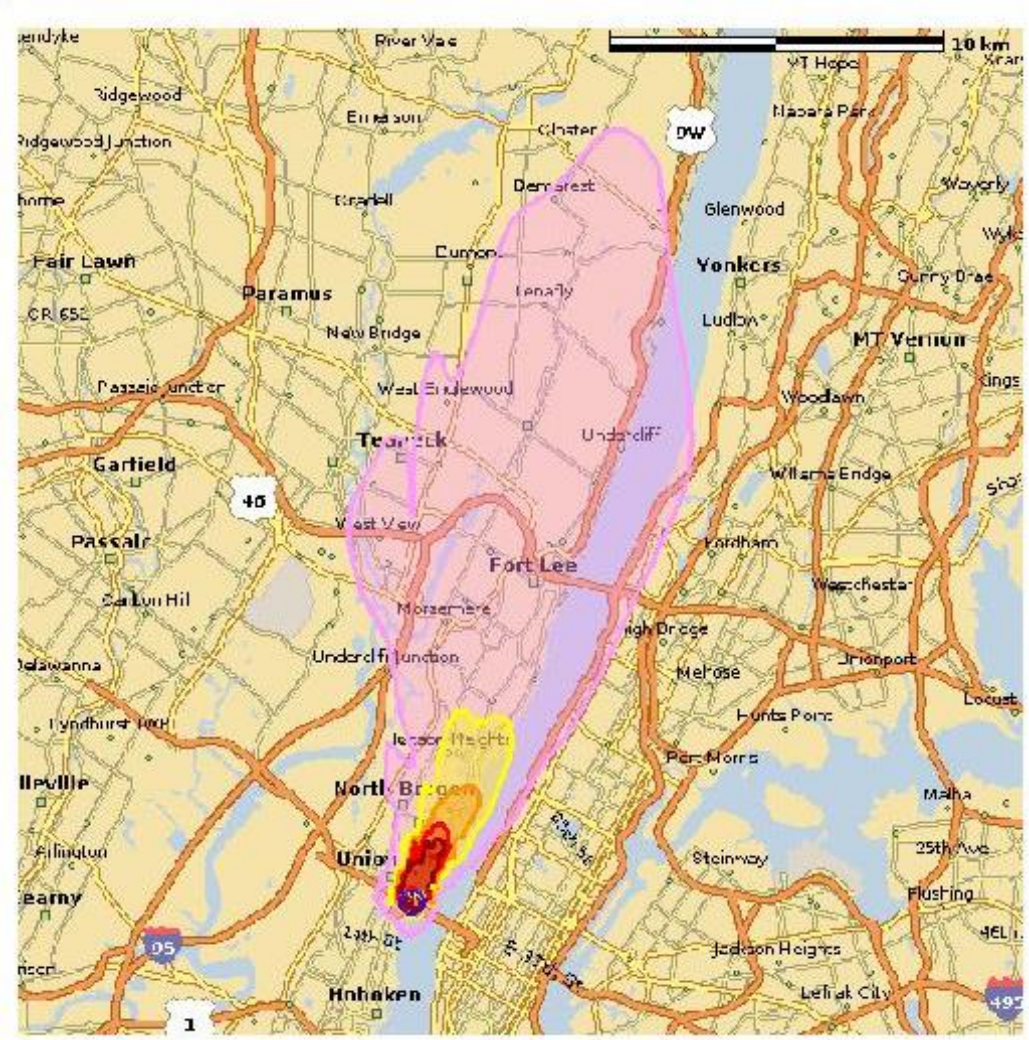


100 kT Burst at 1000 Feet – Prompt Effects

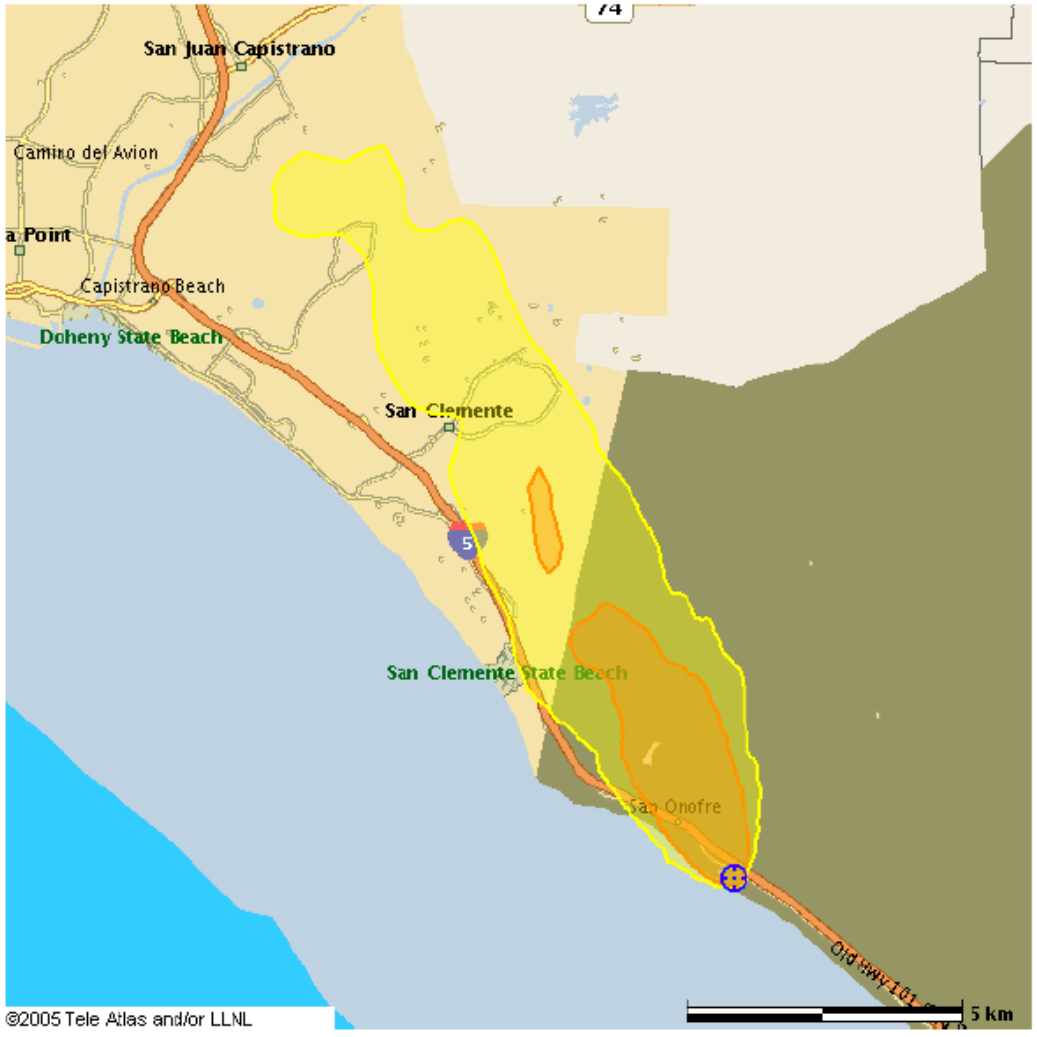




100 kT Burst at 1000 Feet – Fallout Effects



Nuclear Power Plan Accident



Projected Dose

> 5 rem

> 1 rem

- **25,000 people**
- **Dose is avoided, but public perception may require follow up**

Nuclear Power Plant Accident - ^{131}I

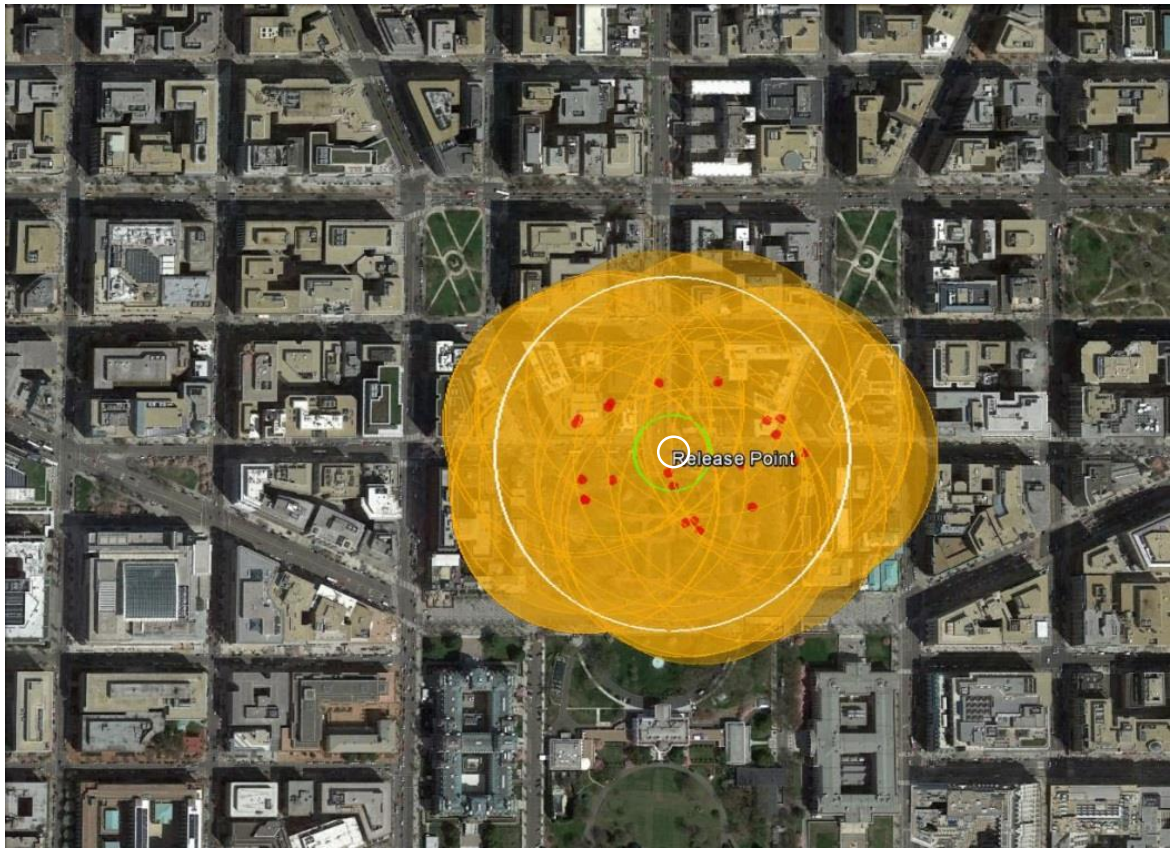
Exceed guidelines for fresh produce ready for harvest

Exceeds guidelines for milk (grass-cow-infant)

- **Contour does not indicate dose to people.**
- **Assumed dose from ingestion of contaminated products continuously for one year and VERY conservative!**
- **If the public sees this graphic designed for decision-makers, unintended consequence may be perceived exposure and desire for health monitoring.**

(over 1,000,000 people within the contour)

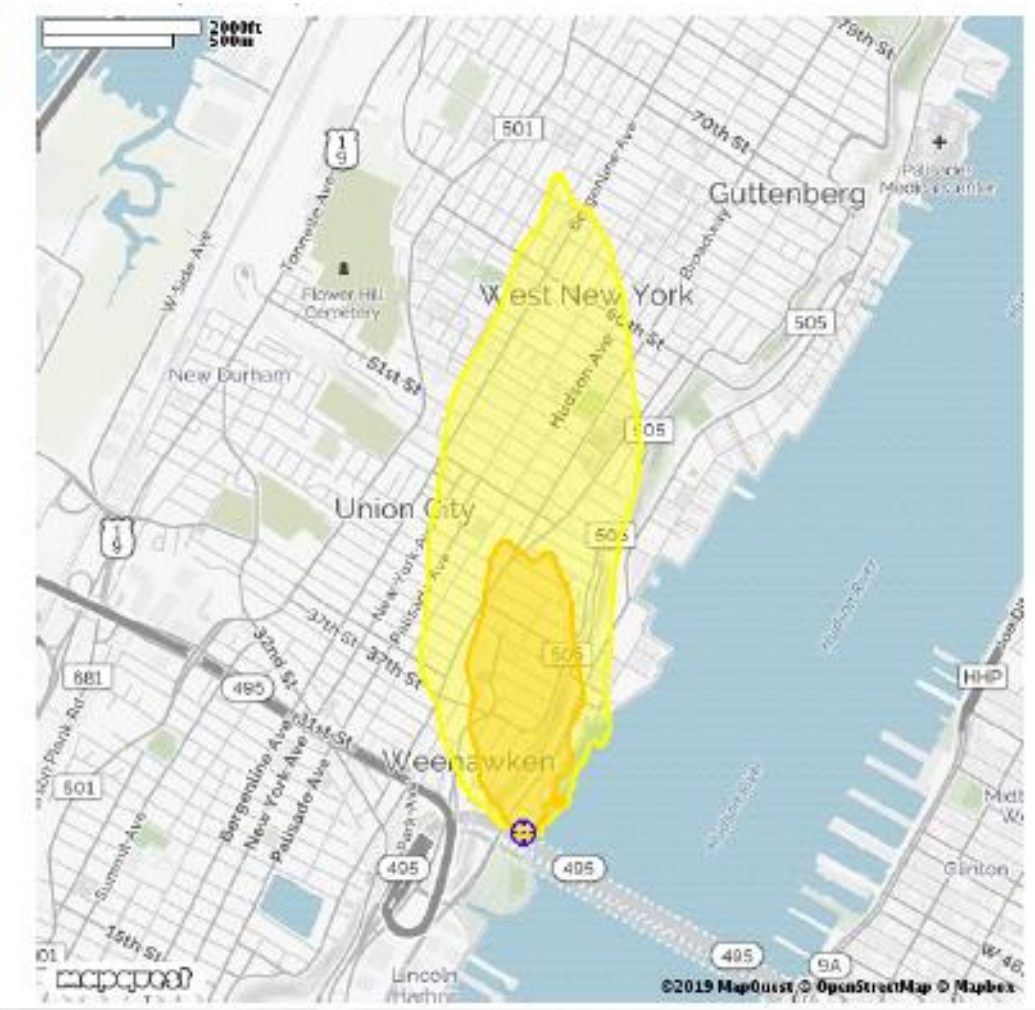
Radiological Dispersal Device – High Activity Source



- 10 mR/hr (NCRP hot zone)
- 10 R/hr (NCRP dangerous rad zone)

- **Dispersal: Fragments (> 90% of material)**
- **Cleaned up and restored to normal**
- **No large population involved**

Radiological Dispersal Device – High Activity Source



If the device produced a large aerosol fraction

~ 50,000 people

But very low dose

What information can be made available to responders, how fast, and how?

Nuclear Power Plant Accident – Best Case

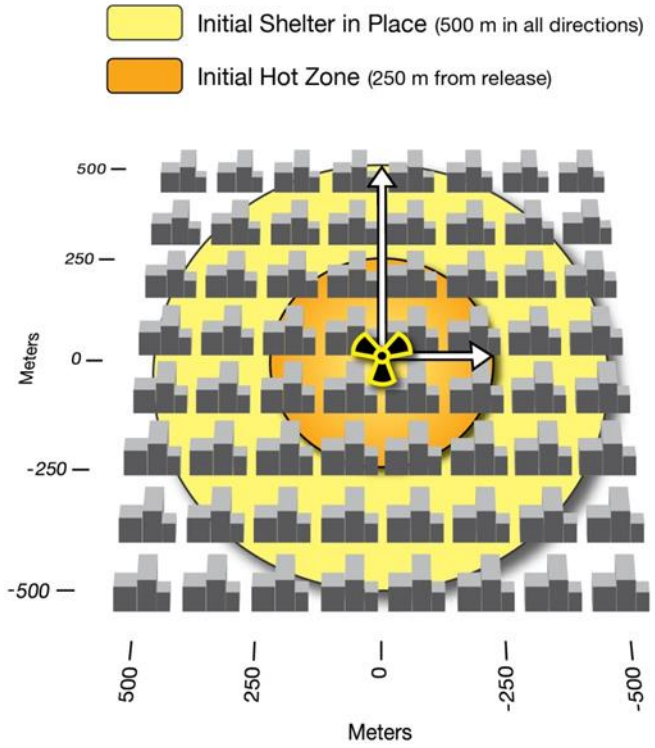
- Evolve slowly
  - If containment failure occurs, time frame is many hours to days
- Plant operator in direct communication with the Nuclear Regulatory Commission and the State
- Responders are warned long before a release occurs
- Likely a release would be detected and monitored in real-time
- Plant personnel (others if pre-deployed) would make field measurements and share data

Nuclear Detonation – Not so best case

- Occurs “out of the blue”
  - Local observations – Flash, “thump”, mushroom cloud
  - IMACC product zero – keyhole plot can be issued State/Local
  - IMACC issues a model within ~30 Minutes
- State and local Emergency Operations Centers are not fully staffed at time of detonation
- Some local communications within the first hours may be hampered by damage to infrastructure
- Local first response in the first 24-48 hours will be self-organized in varying degrees
  - The ability to communicate will depend on the degree of preparedness and infrastructure of the affected region.

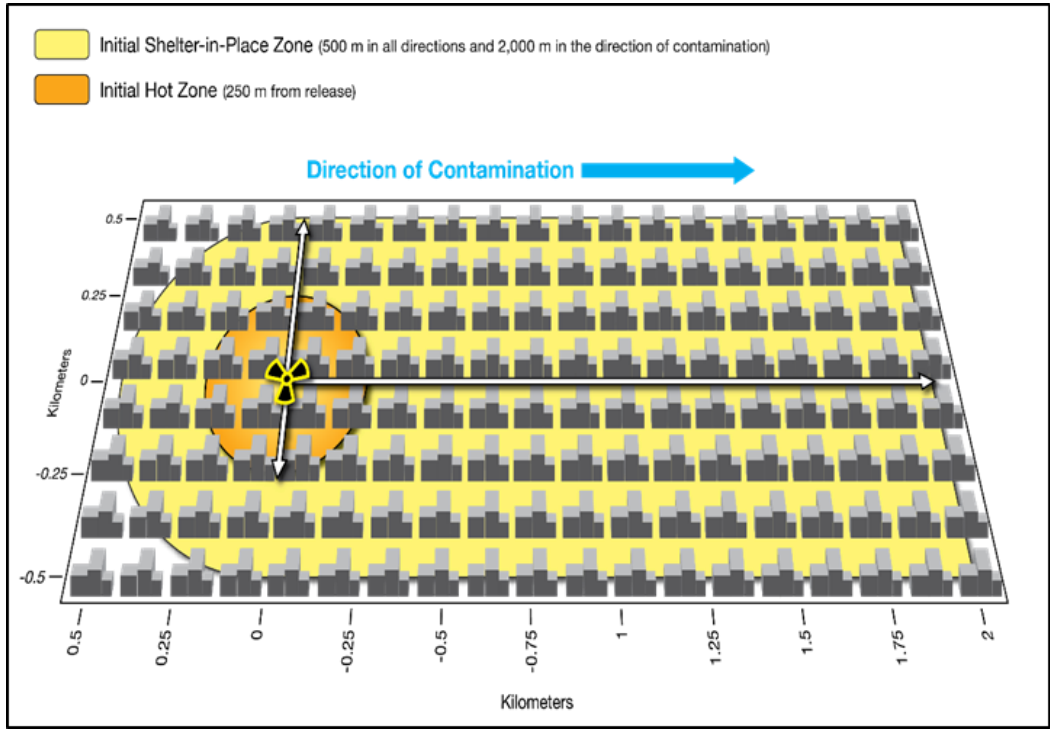
Radiological Dispersal Device – Worst Case

- Time to recognition variable
  - First responders equipped with radiation detectors – within minutes
  - If not equipped, must wait for a HAZMAT Team to arrive, could be an hour
  - Then issue a default Shelter-in-Place protective



Radiological Dispersal Device – Worst Case

- Time to identify the actual footprint of contamination and notify the affected area ~1-2 hours



Conclusion

- Nuclear detonation – Registry for a very large number of people

- Everything else – Driven by perception of risk and possible need to prove a negative