Radiological Emergency Preparedness (REP)

Nuclear Power Station Emergencies and the Public

- People fear things they don't understand
- Unseen threat cannot see, smell, or taste radiation
- Presence of contamination will escalate fear and anxiety
- Decontamination = loss of possession
- Emergencies and evacuations are extremely stressful
- Pets and livestock may be left behind
- Abandoning most or all of their possessions
- Will they be able to return
- Few individuals have even a basic understanding of radiation
- Even basic radiation principles can be difficult to grasp

Fission Product Barriers

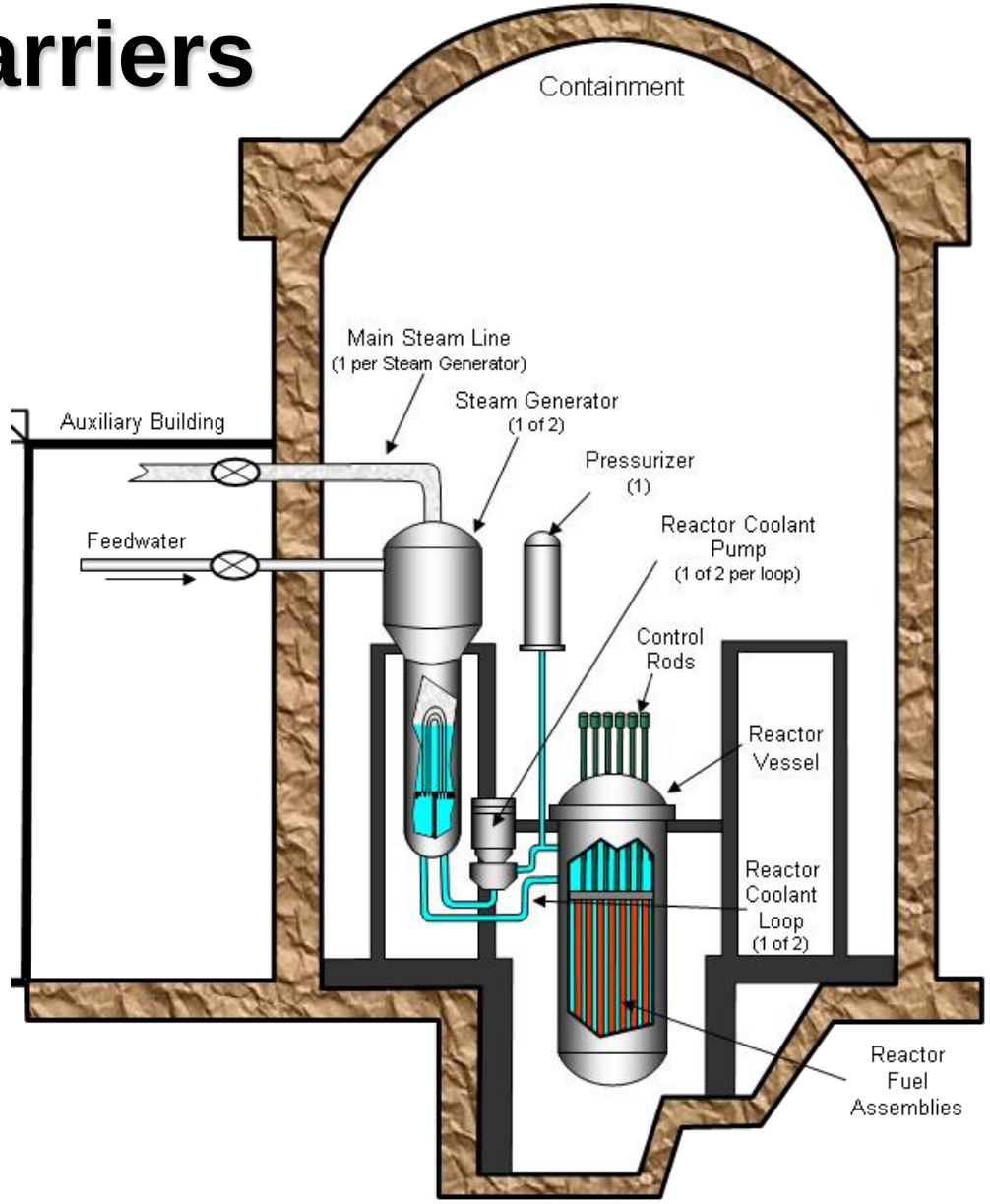
Fuel Clad (FC) - Fuel Clad Barrier consists of cladding material that contains the fuel pellets.

Reactor Coolant System (RCS) - RCS primary side and its connections

Containment (CTMT) - Reactor Building and connections up to and including the outermost containment isolation valves.

This barrier also includes the main steam, feedwater, and blowdown line extensions outside the Reactor Building up to and including the outermost secondary side isolation valve.

Containment Barrier thresholds are used as criteria for escalation of the Emergency Classification Level from Alert to a Site Area Emergency or a General Emergency.



Barrier Loss and Potential Loss

Loss

The barrier no longer assures containment of radioactive materials

Potential Loss (P-Loss)

Infers an increased probability of barrier loss and decreased certainty of maintaining the barrier

- **ALERT** – Loss **or** Potential Loss of EITHER: Fuel Clad or RCS
- **SAE** –Loss **or** Potential Loss of any two barriers
- **GE** –Loss of any 2 barriers **and** Loss or Potential Loss of third barrier.

Emergency Classifications

	Emergency Action Levels			
	UNUSUAL EVENT	ALERT	SITE AREA	GENERAL
Description of plant conditions	Events which indicate a potential degradation of the level of safety of the plant	Events which involve an actual or potential substantial degradation of the level of safety of the plant.	Events which involve actual or likely major failures of plant functions.	Events which involve actual or imminent substantial fuel degradation or melting with potential for loss of containment.
	Emergency Plan			
Radiation Dose to the public	Radioactivity release detectable by plant radiation monitors and may be from 0.1 to 1 mR/hr measurable offsite.	Radioactivity release detectable by plant radiation monitors and may be from > 10 to <100mR/hr measurable offsite.	Radioactivity release detectable by plant radiation monitors and may be from > 100 to < 1000mR/hr measurable offsite.	Radioactivity release detectable by plant radiation monitors and may be > 1000 mR/hr measurable offsite.

Emergency Classification Levels (ECLs)

- Increase sequentially based on plant conditions and/or increased risk to the public
- A radiological release can occur at any Emergency Classification Level
- Generally, actions to protect the public are not initiated until a General Emergency is declared
- Radiation levels outside of the plant boundary can be significantly above background (400+ times background)
- Very little information is communicated to the public prior to the declaration of a General Emergency and the initiation of protective actions

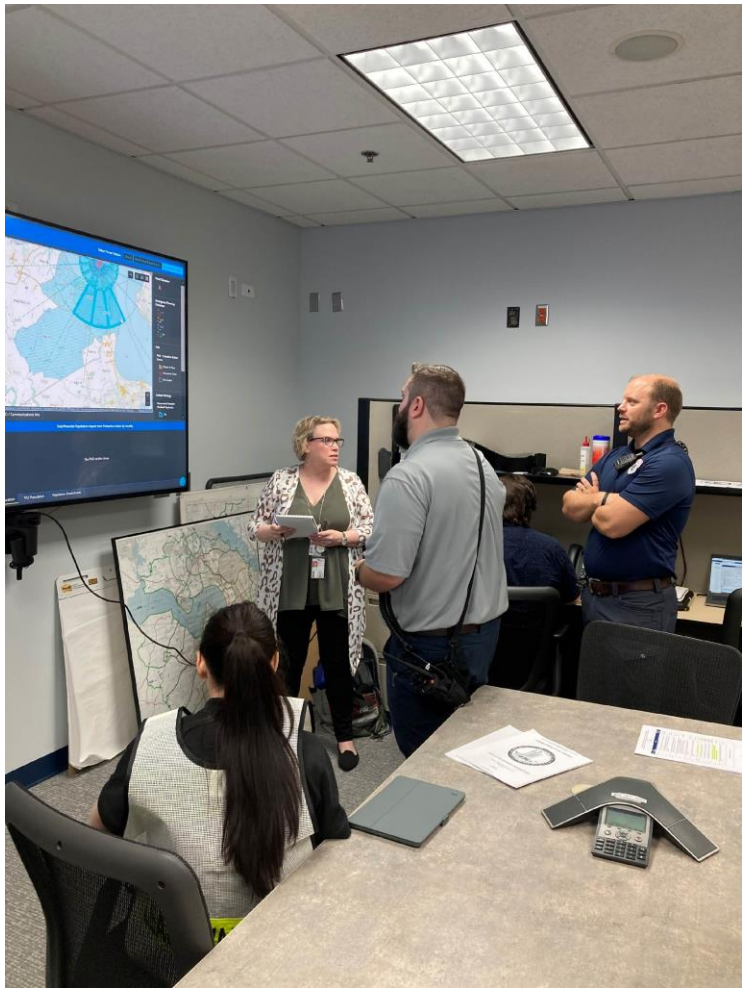
State Response to a Nuclear Power Station Event

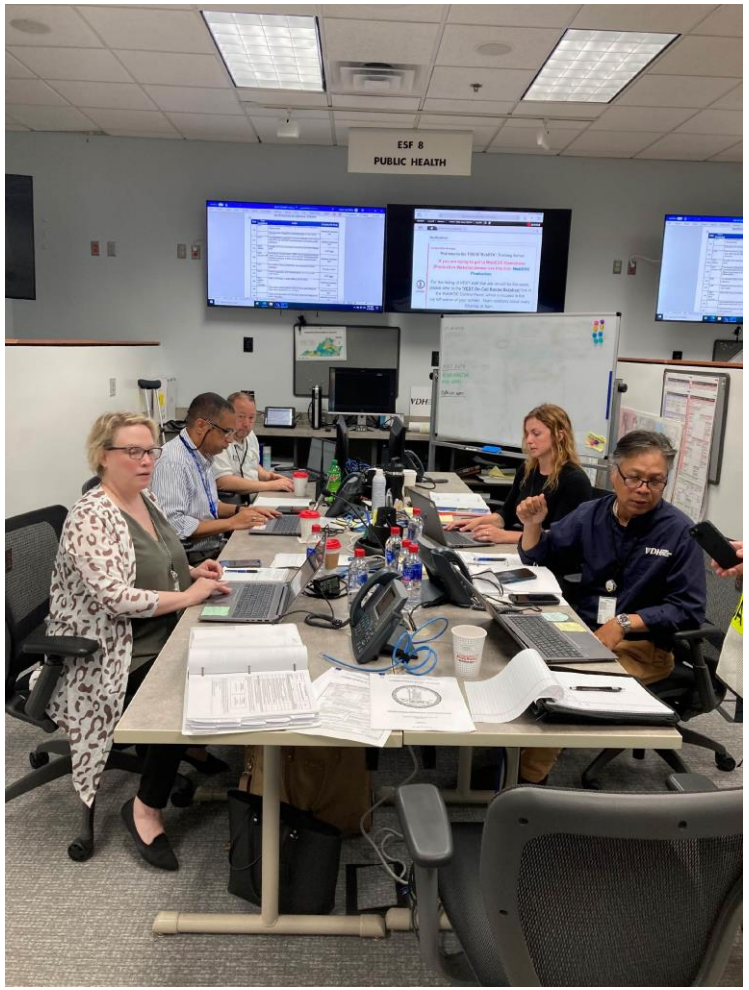
- The Commonwealth mobilizes three distinct response groups
  - **Virginia Emergency Operations Center**
    - *Overall Command and Control*
    - *Interface Between Emergency Support Function Groups (ESFs)*
    - *Development of Protective Actions*
  - **Dominion Energy Corporate Emergency Response Center (CERC)**
    - *Interface with Dominion Energy Emergency Response*
    - *Dose Assessment*
    - *Provide situational awareness on plant conditions and protective actions*
  - **Staging Area and Field Teams**
    - *Equip, brief, and deploy field teams*
    - *Analyze various samples*

Dominion Energy CERC

Dominion Energy CERC

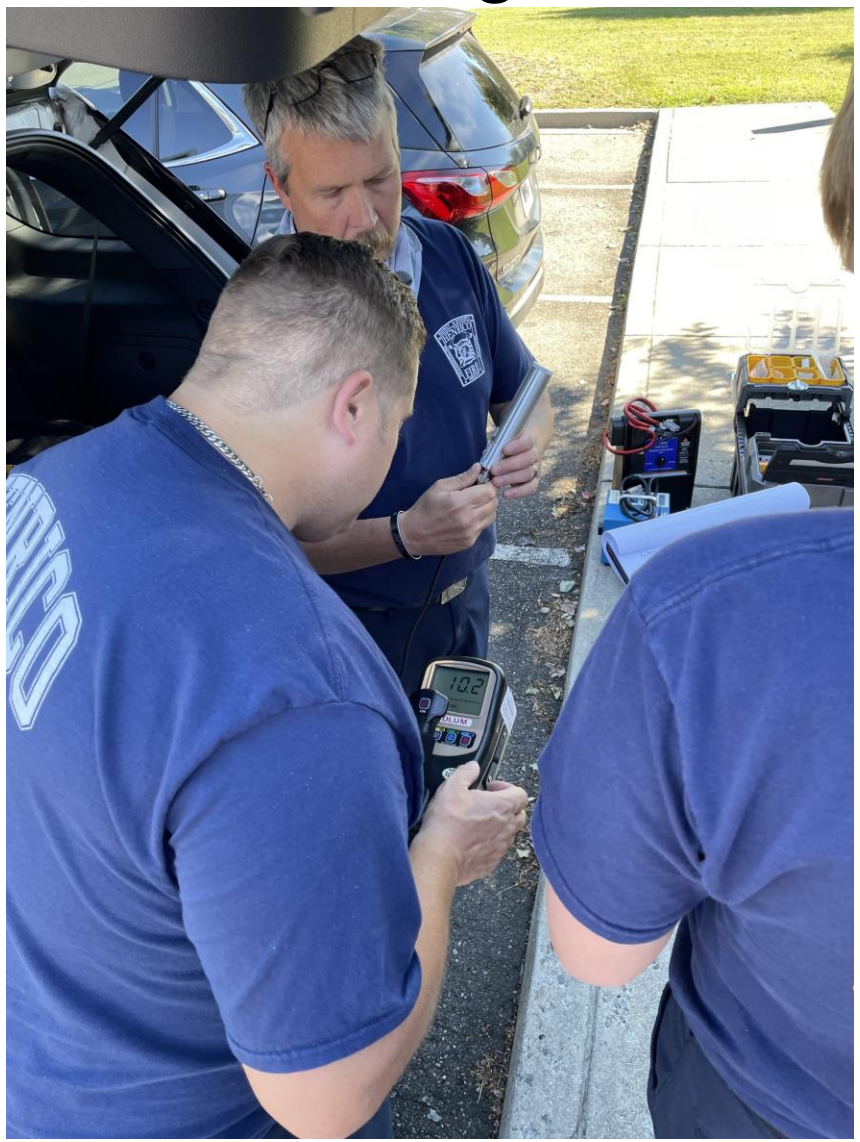
State Emergency Operations Center (State PAR)





VDH VIRGINIA DEPARTMENT OF HEALTH

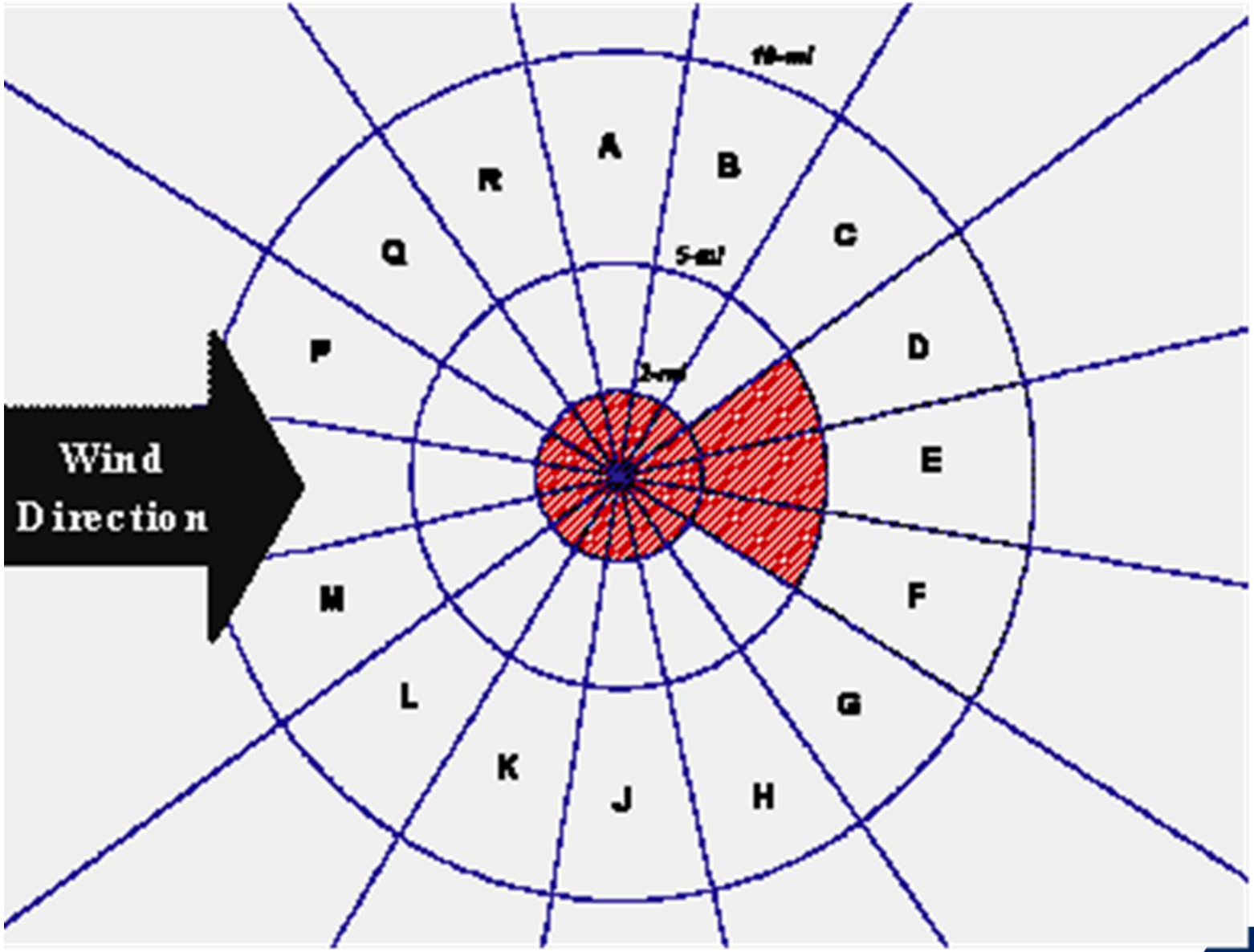
Field Monitoring



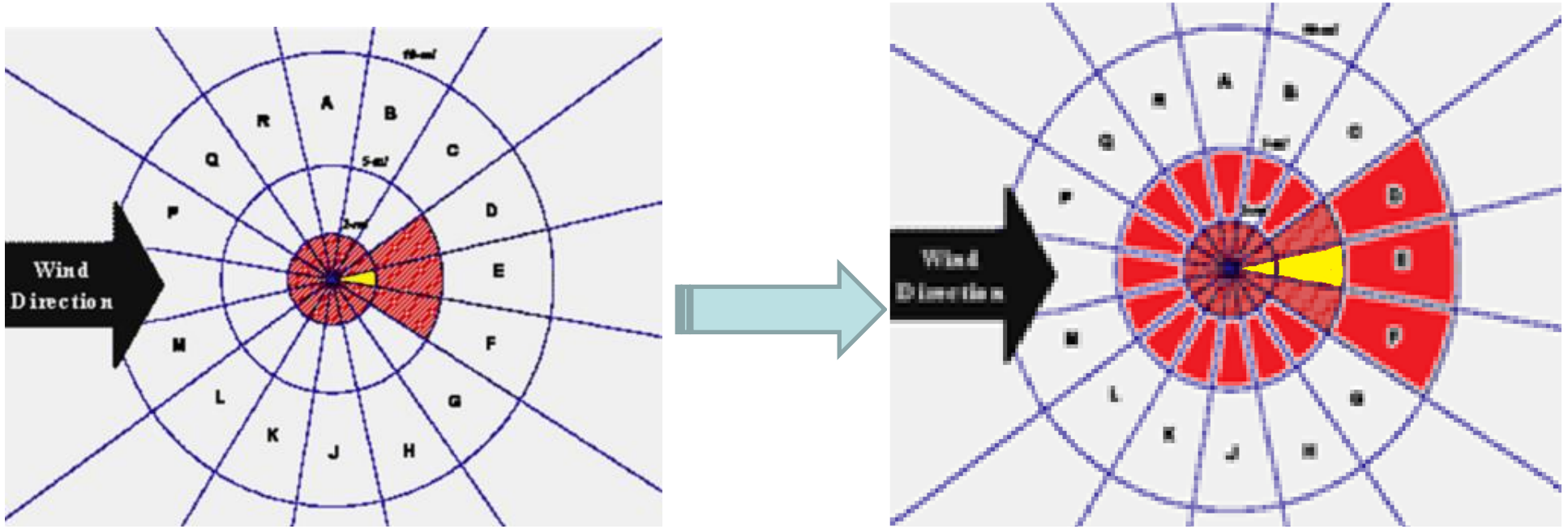
Factors Driving Protective Actions

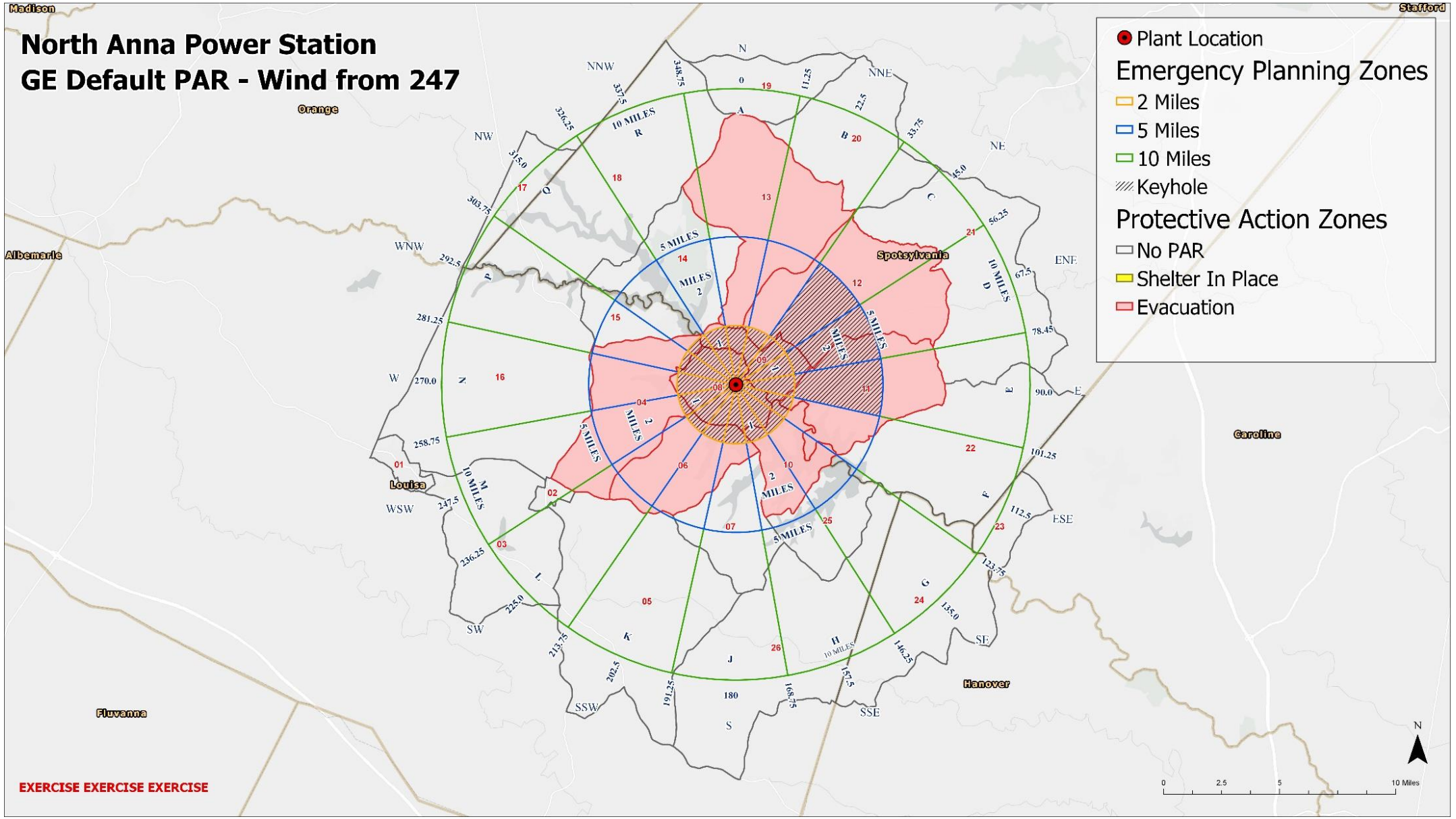
- Plant conditions
  - A Protective Action Recommendation (PAR) is made whenever the plant upgrades to a General Emergency regardless of radiological releases
  - Evacution is the default protective action outside of HAB incidents
- Radiological Factors (Dose Assessment and/or Field Data)
  - > 1R TEDE – Whole Body Dose
  - > 5R Adult CDE – Thyroid Dose
- Potassium Iodide
  - >5R Child CDE – Thyroid Dose

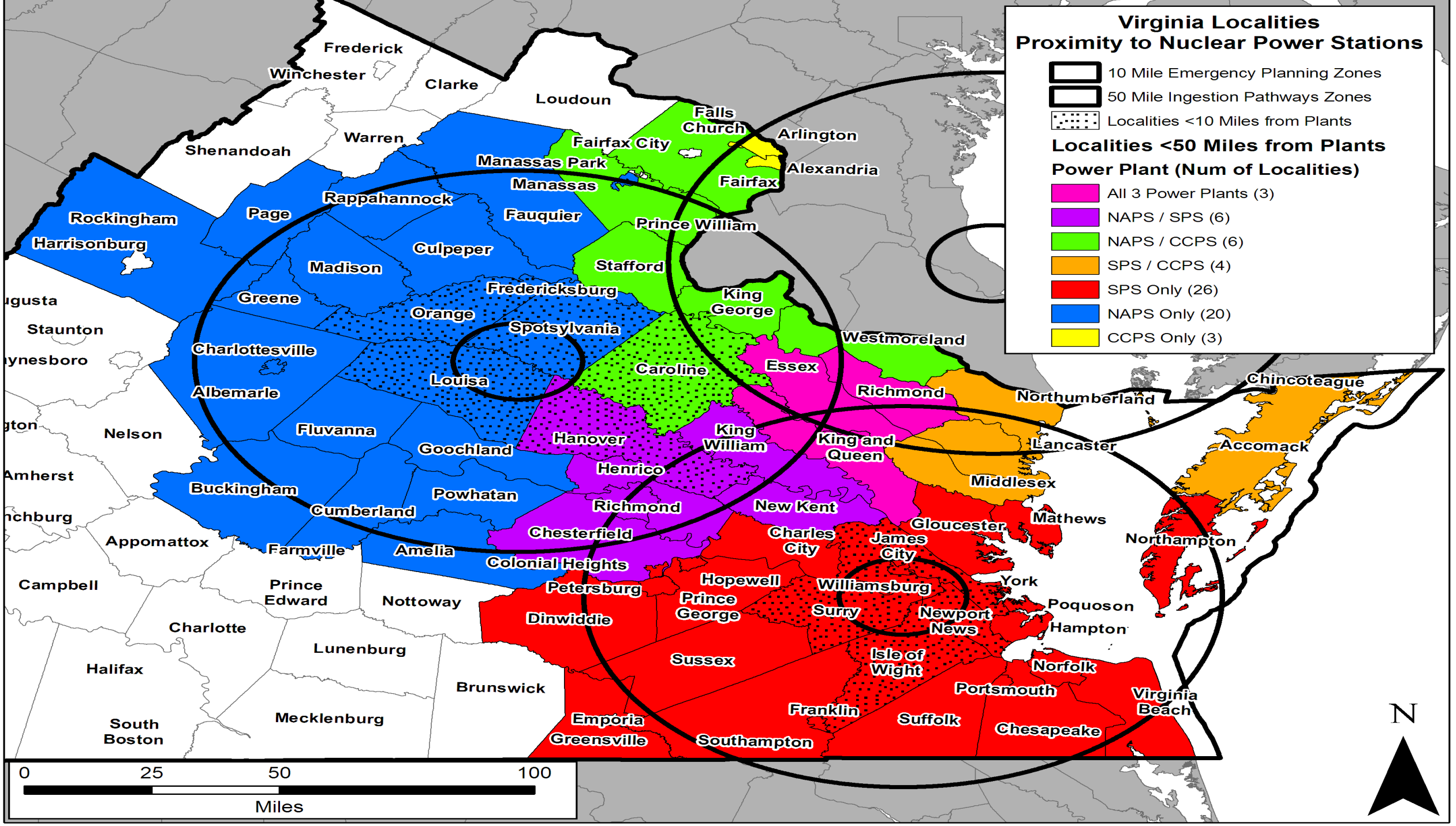
Protective Actions (Evacuation)



Protective Actions (Escalation)




North Anna Power Station
GE Default PAR - Wind from 247
Plant Location
Emergency Planning Zones
2 Miles
5 Miles
10 Miles
Keyhole
Protective Action Zones
No PAR
Shelter In Place
Evacuation
Madison
Stafford
Orange
Albemarle
Spotsylvania
Caroline
Louisa
Fluvanna
Hanover
N
NNW
NNE
NW
NE
WNW
ENE
W
E
WSW
ESE
SW
SE
SSW
SSE
S
0
2.5
5
10 Miles
EXERCISE EXERCISE EXERCISE


Virginia Localities
Proximity to Nuclear Power Stations
10 Mile Emergency Planning Zones
50 Mile Ingestion Pathways Zones
Localities <10 Miles from Plants
Localities <50 Miles from Plants
Power Plant (Num of Localities)
All 3 Power Plants (3)
NAPS / SPS (6)
NAPS / CCPS (6)
SPS / CCPS (4)
SPS Only (26)
NAPS Only (20)
CCPS Only (3)
Frederick
Winchester
Clarke
Loudoun
Warren
Shenandoah
Falls Church
Arlington
Fairfax City
Manassas Park
Alexandria
Manassas
Fairfax
Rappahannock
Page
Fauquier
Rockingham
Prince William
Harrisonburg
Culpeper
Madison
Stafford
Fredericksburg
King George
Greene
Orange
Spotsylvania
Staunton
Westmoreland
Charlottesville
Caroline
Essex
Louisa
Richmond
Albemarle
Northumberland
Chincoteague
Nelson
Fluvanna
King William
King and Queen
Hanover
Lancaster
Accomack
Goochland
Henrico
Middlesex
Buckingham
Powhatan
New Kent
Cumberland
Richmond
Mathews
Gloucester
Chesterfield
Charles City
James City
Northampton
Appomattox
Farmville
Amelia
Colonial Heights
Hopewell
York
Campbell
Petersburg
Williamsburg
Prince Edward
Nottoway
Prince George
Poquoson
Surry
Newport News
Dinwiddie
Hampton
Charlotte
Lunenburg
Isle of Wight
Sussex
Norfolk
Halifax
Brunswick
Portsmouth
Virginia Beach
Franklin
Suffolk
Mecklenburg
Emporia
Chesapeake
South Boston
Greensville
Southampton
0
25
50
100
Miles
N

Protective Action Development

- State PAR is communicated to all of the Emergency Planning Zone localities
- If all localities agree with the proposed State PAR it is presented to the State Coordinator (or his/her designee) at the Virginia Department of Emergency Management
- If approved by the State Coordinator the State PAR is presented to the Governor (or his/her designee).
- Once approved by the Governor the State PAR becomes the official Protective Action Decision (PAD)
- The PAD is communicated to the localities where it is put into action