

# The U.S. Nuclear Industry's Response to Natural Disasters

David Crawley, PIM Manager

2019 NUPIC Conference  
Jacksonville, FL  
June 19, 2019



# U.S. Response to Fukushima

Following the Fukushima Daiichi nuclear accident in March 2011, the Nuclear Regulatory Commission (NRC) formed a task force to provide the agency with recommendations for regulatory improvements for the commercial U.S. nuclear fleet. As a result, the Nuclear Regulatory Commission issued Order Enforcement Action EA-12-049 to all U.S. commercial nuclear licensees.

The U.S. nuclear industry developed the FLEX strategy to fulfill the requirements as set forth in the NRC Order. FLEX is the “Diverse and Flexible Coping Strategies” as described in Nuclear Energy Institute’s document, NEI 12-06.

The FLEX strategy further ensures that U.S. nuclear sites are prepared for Beyond Design Basis External Events (BDBEE), *e.g.*, seismic events, hurricanes, floods, tidal waves, volcanic activity, etc.



# NRC Order EA-12-049



EA-12-049  
All Power Reactor Licensees and  
Holders of Construction Permits in  
Active or Deferred Status  
SUBJECT: ISSUANCE OF ORDER TO MODIFY LICENSES WITH REGARD TO  
REQUIREMENTS FOR MITIGATION STRATEGIES FOR  
BEYOND-DESIGN-BASIS EXTERNAL EVENTS

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Order that modifies the  
current license for your facility. The Order requires provisions for mitigation strategies for  
beyond-design-basis external events, and applies to all addressees listed in Attachment 1 to the  
enclosed Order.

Following the earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant in March  
2011, the NRC established a senior-level task force referred to as the Near-Term Task Force  
(NTTF). The NTTF conducted a systematic and methodical review of the NRC regulations and  
processes to determine if the agency should make safety improvements in light of the events in  
Japan. As a result of this review, the NTTF issued SECY-11-0293, "Near-Term Report and  
Recommendations for Agency Actions Following the Events in Japan," SECY-11-0124,  
"Access and Management System (ADAMS) Accession No. ML11196A360," SECY-11-0124,  
"Recommendations to be Taken Without Delay from the Near-Term Task Force Report,"  
ADAMS Accession No. ML112911571 and SECY-11-0137, "Prioritization of Recommendations  
Actions to be Taken in Response to Fukushima Lessons Learned." ADAMS Accession  
No. ML11212A111 were issued to establish the NRC staff's prioritization of the recommendations.  
Recommendation 4.2 concerning mitigation strategies was determined to be a high-priority  
action. This Order is based upon the NTTF recommendation.

The events at Fukushima Dai-ichi highlight the possibility that extreme natural phenomena could  
challenge the prevention, mitigation and emergency preparedness defense-in-depth layers. At  
Fukushima, innovations in time and unpredictable conditions associated with the accident  
significantly challenged attempts by the responders to preclude core damage and containment  
failure. During the events in Fukushima, the challenges faced by the operators were beyond any  
faced previously at a commercial nuclear reactor. It was determined that additional  
requirements must be imposed to mitigate beyond-design-basis external events. These  
additional requirements impose guidance and strategies to be available if the loss of power,  
motive force and normal access to the ultimate heat sink to prevent fuel damage in the reactor  
and spent fuel pool affected all units at a site simultaneously.

The NRC staff has determined that continued operation does not pose an imminent risk to public  
health and safety; however, the additional requirements outlined in this Order are necessary in  
light of insights gained from the events at Fukushima Dai-ichi. The requirements of this Order  
are immediately effective and are expected to remain in place until superseded by Order or rule.

Order Requires a three-phase approach for mitigating beyond-design-basis external events to maintain or restore core cooling, containment and spent fuel pool cooling functions

Phase I – Use of plant installed equipment and resources

Phase II – Transition to portable **onsite** emergency equipment

Phase III – Transition to portable **offsite** emergency equipment to sustain functions indefinitely





The Pooled Equipment Inventory Company (**PEI**Co) joined forces with **Framatome** to create the SAFER Team to develop and manage a FLEX national response center program as part of the PEICo's existing Pooled Inventory Management (**PIM**) Program for the U.S. nuclear industry.





- Program established in 1980
- All U.S commercial nuclear licensees (electric generation) are members
- Utility directed and managed by Southern Nuclear Services
- \$205 Million in Inventory (Safety & Non Safety Related)
- 10CFR50 App B Program
- NUPIC audited



# SAFER Program

- Meets NEI 12-06 and NRC EA-12-049 requirements for **FLEX Phase III** off-site emergency response
- NRC Endorsement – September 2014
- Two Proof of Concept Drills with the NRC
- Successfully completed two NRC Inspections with no findings
- Aspects of PEICo's 10CFR50 App B Program applied to SAFER Program
- NRC's endorsement of SAFER includes understanding that audits will be conducted through NUPIC
  - NUPIC Audited as part of PIM Program Audit – 2013 & 2016
  - Duke led audit - May 2019
- Managed by Southern Nuclear Services



# National SAFER Response Centers

- Two National SAFER Response Centers (NSRCs)
  - Memphis, TN
  - Phoenix, Arizona
- \$55 million custom developed emergency response equipment (both NSRCs)
- Equipment in each NSRC is duplicated
- If one NSRC is “non-operational” then the other NSRC would deploy
- Each NSRC provides equipment to support 4 reactors (2 Sites)



**SAFER®**  
STRATEGIC ALLIANCE  
FOR FLEX EMERGENCY RESPONSE



# Phoenix NSRC





# Emergency Response Equipment

- Non-Safety Related Equipment
- 5 sets (N+1) of “generic” equipment at each NSRC
- Additional sets of “non-generic” (site-specific) equipment as required at each NSRC
- Standardized electrical and mechanical connections and compatible with U.S. nuclear fleet’s Phase II equipment



1MW 4160VAC Turbine Generator



Standardized Electrical Connections



Standardized Mechanical Connections

# Equipment Design

238 pieces of “first-in-kind” equipment

- Transportable by ground, fixed wing and helicopter
- Designed to fit through the cargo door of a wide body jet
- 8,500 lb. weight restriction for helicopter operations
- - 40°F to +130°F operability range for extreme environmental conditions
- Diesel operated with 12-hr run time



Pre-staged Equipment (Immediate Deployment)



## Equipment Examples



Water Treatment Systems



4160V Cable



1Mw 480VAC Turbine Generator



5000 GPM Suction Lift Booster Pump



1000 GPM Dewatering Pump



1000 Gal. Boration System



# Key Deployment Contracts/Agreements

## Transportation

- Drive/ Fly- FedEx Custom Critical
- Helicopter (Stranded Site)
  - Contracts with 5 commercial heavy-lift helicopter companies
  - Air Guard
  - Department of Defense

## Agreements

- Equipment - Sunbelt and United Rentals
- Fuel – PS Energy Group (Staging Area Equipment)



**SAFER**<sup>®</sup>  
STRATEGIC ALLIANCE  
FOR FLEX EMERGENCY RESPONSE



# Logistics

- 24 Hr. Response to any U.S. nuclear site from either NSRC
- 61 Site Specific Response Plans
- 61 FAA preapproved special congested flight plans – (renewed annually)
- 61 Fixed wing load plans (site specific)

The image shows a "Congested Area Lift Plan (FAR Part 133)" form. The form is from CROMAN CORPORATION. It contains fields for Lift Site, Address, City, State, Zip, Contact, Date of Lift, Time, Phone, Aircraft Type, and Airworthiness Category. The form is filled out with information for the North Anna Nuclear Power Plant. The form also includes a "Description of Load" section with fields for Estimate number of lifts, Maximum Weight, Type of Load, and Estimated Length of Attachment means.

# Activation

- SAFER Control Center
  - Lynchburg, VA (primary)
  - Birmingham, AL (back-up)
- 24/7 call-in number for activation
- Trained equipment personnel deployed with the equipment



SAFER Control Center – Lynchburg, VA



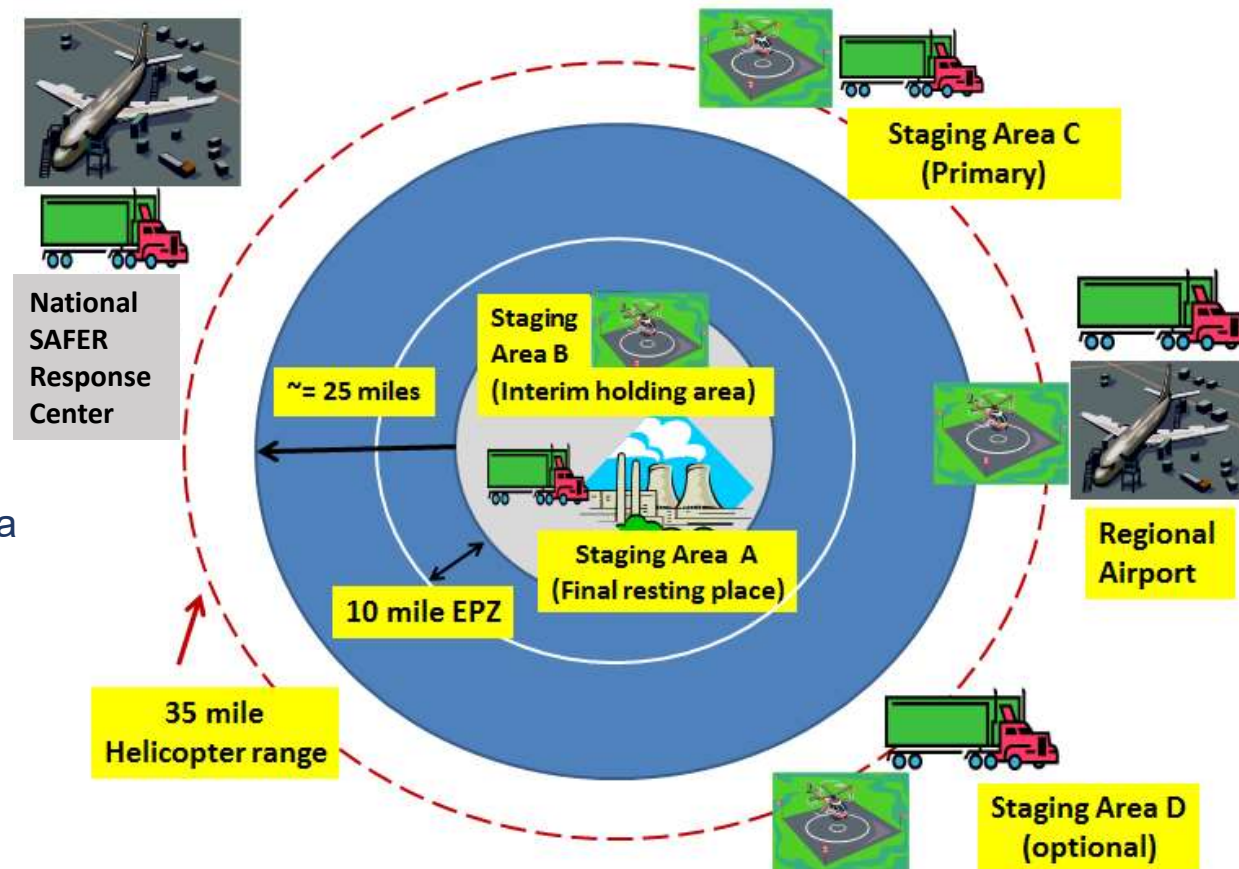


# SAFER Deployment

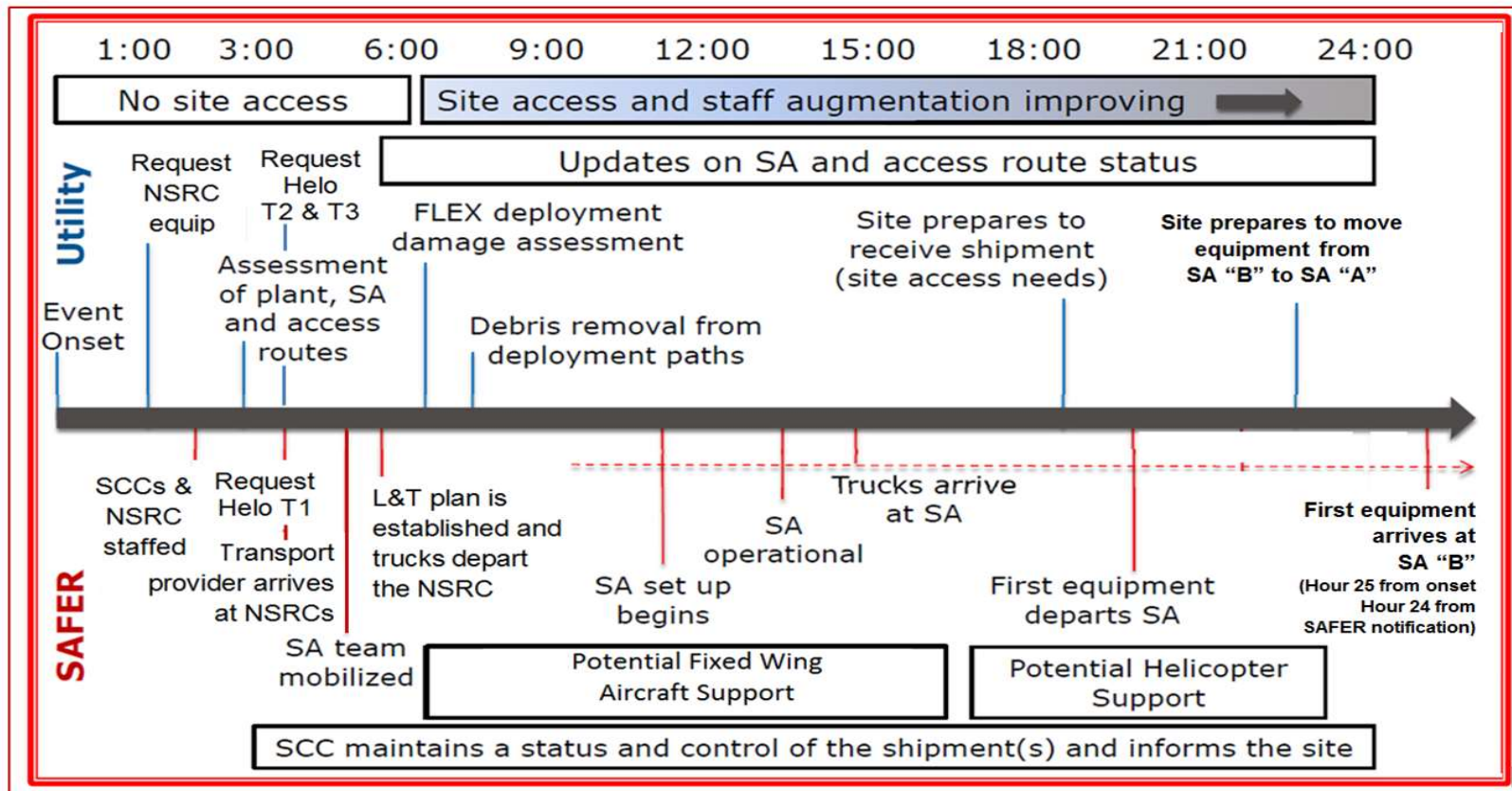


## Staging Areas

- "A" – Site Connection
- "B" – On-Site Holding Area
- "C" – Off-site Holding Location (Primary)
- "D" – Off-site Holding Location (Back-up)



# Deployment Timeline



# SAFER Training

## Deployment Positions

- SAFER Control Center Leads
- Logistics and Transportation Coordinators
- Staging Area Coordinators
- Staging Area Leads
- Equipment Technicians
- Framatome Outage Control

## Training

- Bi-Monthly tests of notification (personnel call-out) system
- Annual training & quarterly tabletops
- Annual hands-on equipment training for deployed personnel
- No actual deployment (equipment movement) exercises are scheduled



# FLEX at Work

[http://www.bigshouldersfriends.com/15-1157 Exelon FLEX/](http://www.bigshouldersfriends.com/15-1157_Exelon_FLEX/)





# Questions