



Mitigating Strategies for Loss of a Large Area of the Plant

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Background

On September 11, 2001, terrorists attacked targets using large aircraft as weapons. In response, the NRC issued advisories to strengthen licensees capabilities and readiness to respond to a potential attack.

Principles for Mitigating Strategies

The potential effects of an aircraft impact on a nuclear power plant motivated the NRC to require the development and implementation of mitigating strategies. However, the NRC did not limit the scope of the requirement to aircraft. Instead, the scope is generalized to an event that causes the loss of a large area of the plant.

While the threat is undefined, it is implicitly not a regional threat, but a localized one that allows offsite response and is of limited extent.

Order EA-02-026, Section B.5.b

February 25, 2002

This order required licensees to “Develop specific guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities using existing or readily available resources (equipment and personnel) that can be effectively implemented under the circumstances associated with loss of large areas of the plant due to explosions or fire.”

License Conditions

Develop and maintain strategies for addressing large fires and explosions and that include the following key areas:

- (1) Fire fighting response strategy with the following elements:
 1. Pre-defined coordinated fire response strategy and guidance
 2. Assessment of mutual aid fire fighting assets
 3. Designated staging areas for equipment and materials
 4. Command and control
 5. Training of response personnel
- (2) Operations to mitigate fuel damage considering the following:
 1. Protection and use of personnel assets
 2. Communications
 3. Minimizing fire spread
 4. Procedures for implementing integrated fire response strategy
 5. Identification of readily-available pre-staged equipment
 6. Training on integrated fire response strategy
 7. Spent fuel pool mitigation measures
- (3) Actions to minimize release to include consideration of:
 1. Water spray scrubbing
 2. Dose to onsite responders

10 CFR 50.54(hh)(2)

March 28, 2009

Each licensee shall develop and implement guidance and strategies intended to maintain or restore core cooling containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire, to include strategies in the following areas:

- (i) Fire fighting;
- (ii) Operations to mitigate fuel damage; and
- (iii) Actions to minimize radiological release.

B.5.b Phase I Guidance

February 25, 2005

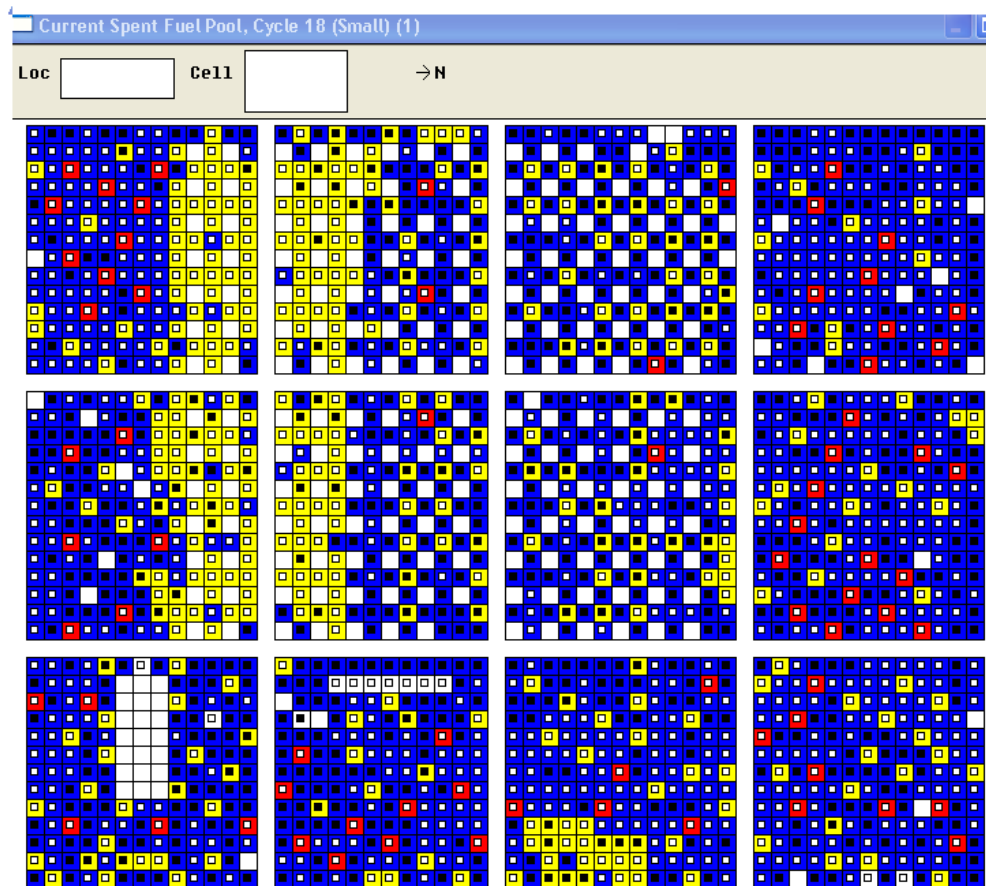
- Originally designated Safeguards Information
- Contents re-designated subsequently in Safety Evaluations
- Publicly Available in NUREG-0800, Section 19.4, Draft Revision 0

B.5.b Phase I Guidance

February 25, 2005

- Fire-fighting Response Strategies and Guidance
- Operations to Mitigate Fuel Damage
 - Use of portable equipment
 - Spent fuel pool mitigation measures
 - Dispersal
 - Hot fuel not over rack feet
 - Downcomer
- Actions to Minimize Release

1 x 4 Dispersal Example



Licensee example of dispersal.
(NRC only considers recently discharged fuel.)

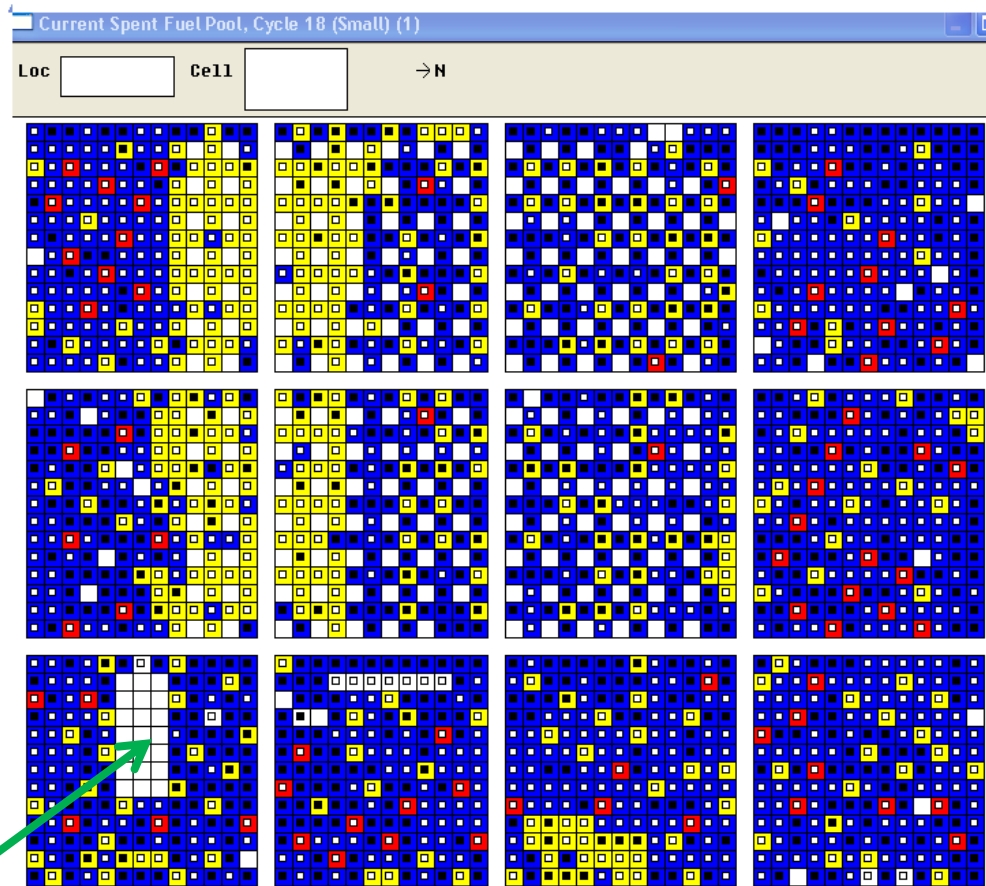
Red = Recently discharged fuel

Yellow = Discharged prior cycle

Blue = Older fuel

White = Empty

Downcomer Area Example



Purpose is to promote natural circulation of air in a drained pool.

“Downcomer” is made up of the empty block of cells in the lower left.

Cooler air can flow down this area, beneath the fuel assemblies and become heated as it rises through fuel assemblies.

NEI 06-12, Revision 2

Spent Fuel Pool Strategies

Diverse SFP Makeup Source (500 gpm)

Flexible, Power-Independent Makeup Source

SFP Makeup Capability (500 gpm)

SFP Spray Capability (200 gpm/unit to pool)

Local Spray

Elevated Spray

Site-Specific Makeup Strategies

Leakage Control Strategies





NEI 06-12, Revision 2

Command and Control Enhancements

Communications

Notifications/ERO Activation

Initial Operator Response Actions

Initial Damage Assessment

NEI 06-12, Revision 2

Core and Containment Strategies

- Generic strategies were acceptable rather than plant specific analyses due to speculative state following an initiating event
- Many strategies are based on loss of internal power distribution, but some assume power is available
- Separate groups of strategies for PWRs and BWRs

NEI 06-12, Revision 2

Core and Containment - PWR

Makeup to Refueling Water Storage Tank (300 gpm)

Manually Depressurize Steam Generators

Manually Operate Turbine-Driven Auxiliary Feedwater

Manually Depressurize Steam Generators and Feed
with Portable Pump (200 gpm)

Makeup to Condensate Storage Tank (200 gpm)

Containment Flooding with Portable Pump (300 gpm)

Portable Sprays

NEI 06-12, Revision 2

Core and Containment - BWR

Manual Operation of Reactor Core Isolation
Cooling/Isolation Condenser

DC Power to Depressurize Reactor Pressure Vessel
and Inject with Portable Pump (300 gpm)

Feed Reactor Pressure Vessel with Feed and
Condensate

Makeup to Hotwell (300 gpm)

Makeup to Condensate Storage Tank (300 gpm)

NEI 06-12, Revision 2

Core and Containment – BWR, continued

Maximize Control Rod Drive Flow

Isolate Reactor Water Cleanup

Manual Open Containment Vent Lines

Inject Water into Drywell (300 gpm)

Portable Sprays

10 CFR Part 50, Appendix E

Section IV.F.2.j. – Emergency Preparedness Exercises must provide the opportunity to demonstrate key skills necessary to respond to implementation of strategies, procedures and guidance developed under § 50.54(hh)(2).

MBDBE Rulemaking

- Moves requirement for mitigating strategies to 10 CFR 50.155(b)(3)
- Moves exercise requirement to a drill or exercise requirement in § 50.155(e)
- Modifies sunset provisions

Bibliography

| Document | Accession No. |
|-----------------------------------|--------------------|
| Order EA-02-026 | ML020510635 |
| NEI 06-12, Rev. 2 | ML070090060 |
| NEI 06-12, Rev. 3 | ML092890400 |
| Power Reactor Security Rulemaking | 74 Fed. Reg. 13926 |
| NUREG 0800, Section 19.4 | ML13316B202 |
| MBDBE Rulemaking | SECY-16-0142 |