



FENOC – NRC Pre-Submittal Meeting Proposed Request for Licensing Action Perry Flood Hazards June 29, 2017

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#### Introductions

- Meeting Purpose
  - Site Design Basis External Flood Hazard Reconstitution direction and scope of License Amendment Request
- Topics for today's discussion
  - History
  - Flood Hazards
  - Proposed Licensing Action Scope
  - Requested Licensing Action



### **FENOC** Representatives

- Ben Huck, Manager Design Engineering
- **Tom Lentz, Manager Fleet Licensing**
- Phil Lashley, Supervisor Fleet Licensing
- Mark Bensi, Design Engineering
- John Sabo, Design Engineering
- Steve Osting, Project Manager
- Kathy Nevins, Fleet Licensing



### History









### **Flood Hazards**

- Dam Breaches and Failures
  - No traditional dams in Perry watershed
- Storm Surge and Seiche
  - Passively protected by bluff height
- Tsunami N/A
- Ice-Induced Flooding N/A,
  - High bluffs, stream ice blockage bounded by all-season event
- Channel Migration or Diversion N/A
  - No cooling water channels exist
- Flooding in Streams and Rivers
  - New diversion channel installed
  - Railroad embankment removed for major stream
  - Secondary access road raised
- LIP
  - Reevaluation of LIP remains a challenge







### **Proposed Request for Licensing Action Scope**

- All hazards with the exception of LIP have been mitigated.
  - Site drainage
- Items required for Design Basis LIP analyses and mitigation in proposed licensing action scope:
  - Technical Specification for time-based warning protection
  - Incorporated barriers for mitigation of LIP event
  - FLO-2D computer program
  - Credit all building exteriors as flood boundaries
  - Credit plant storm system



### Time-Based Warning Protection (License Amendment Request)

- Provide "Hardened Protection" for all events up to and including the Standard Project Storm/Standard Project Flood (SPF)
  - Standard Project Storm (SPS) for PNPP determined to be 28.4% of PMP
  - SPS determined using the guidance of EM 1110-2-1411
  - SPS process provides an event "reasonably characteristic of the region"
  - SPF results will be developed using process consistent with LIP PMF (FLO-2D)
- Technical Specification to provide limiting condition for operations for potential flood conditions
- Proceduralized response for events in excess of SPS/SPF
  - Advanced warning to be received from FE Meteorology Dept.
  - Warning response to be incorporated into plant procedures
  - Plant personnel to deploy temporary "incorporated barriers"
  - Similar to approach adopted for Beyond Design Basis hazards
- Similar in concept to Regulatory Position 2 of RG 1.59, Rev. 2
  - Warning time will be sufficient to reach cold shutdown, if required
  - SSCs needed for cold shutdown will utilize temporary barriers for PMF effects



## Incorporated Barriers for Mitigation of LIP Event

### (License Amendment Request)

- LIP remains an issue, anticipated flood levels may exceed doors thresholds, installation of flood panels, ramps, thresholds needed to mitigate event
- Incorporated barriers
  - Permanent ramps
  - Permanent door thresholds
  - Permanent/temporary flood panels
- Preventative maintenance



# Flood Barriers for Mitigation of LIP Event ESW Pumphouse Ramp



#### Flood Panel & Threshold





#### **FLEX Bay Ramp**





### FLO-2D Computer Program (License Amendment Request)

- □ FLO-2D program employs an unsteady state modeling technique;
  - Change in analytical methodology
- Utilized in Beyond Design Basis event calculations
- Complex Flooding Simulation
  - Conservation of mass
  - Water storage
  - Site runoff
  - Timing of rainfall event
- Validation
  - Vendor Appendix B Program
  - FEMA
  - Maricopa County, Arizona





### FLO-2D Computer Program (License Amendment Request)

- FLO-2D program employs an unsteady state modeling technique
  - □ Also known as a transient flow technique
  - Unsteady state modeling is described in ANSI N170-1976
- Underlying computational methodology of FLO-2D, the program employs the use of the shallow water equations (also known as Saint Venant's Equations).
  - Numerical solution of these equations are referenced in Section 5.4 of ANSI N170-1976 (Reference 1 of Section 5.4.2.1 is Strelkoff's "Numerical Solution of Saint-Venant Equation" as published in ASCE's Journal of the Hydraulics Division, Jan. 1970)
- One of the key capabilities of the program is the ability to perform storage routing functions
  - Storage routing is referenced in the PNPP USAR in that the USAR credits the topographic storage of six inches of precipitation for LIP domain analyses



### Crediting Building Exteriors (Exemption Request)

- Anticipated flood levels to exceed nuclear island
- Calculations to evaluate forces to building structures
  - Water height
  - Flow velocity
- Building construction standards (safety and non safety)
  - Concrete ACI 318 or ACI 349
  - □ Steel AISC 7<sup>th</sup> Edition
- Periodic maintenance inspections to maintain building conditions
  - Utilize existing Maintenance Rule walkdowns
    - Update to include flood protection criteria
    - Calculations for crediting structures will be established for critical characteristics for periodic inspections



### Credit Plant Storm System (Exemption Request)

#### Storm Sewers

- Minimizes water surface elevation during LIP
- Reduces duration of LIP event
- Corrugated metal with paved invert
- AASHTO M190 Bituminous Coated
- AASHTO M218 Galvanized
- Cleaned and inspected in 2016
- Included in FLO-2D model
- Roof drains
- Conservatively included in FLO-2D model
- Roof drains would result in roof storage if inoperable
- Periodic maintenance inspections to maintain conditions
  - Critical characteristics for periodic inspections will be identified



### **Credit Plant Storm Drain System**





# **Requested Licensing Action**

### Next Step:

- Submittal planned for December 2017
- Nominal 12 month review requested
- Items required for Design Basis LIP analyses and mitigation in proposed licensing action scope:
  - Technical Specification for time-based warning protection
  - Incorporated barriers for mitigation of LIP event
  - FLO-2D computer program
  - Credit all building exteriors as flood boundaries
  - Credit plant storm drain system

