Point Beach GL 2004-02 Resolution Update

NextEra Energy Point Beach, LLC (NextEra)

May 18, 2021

Meeting Agenda

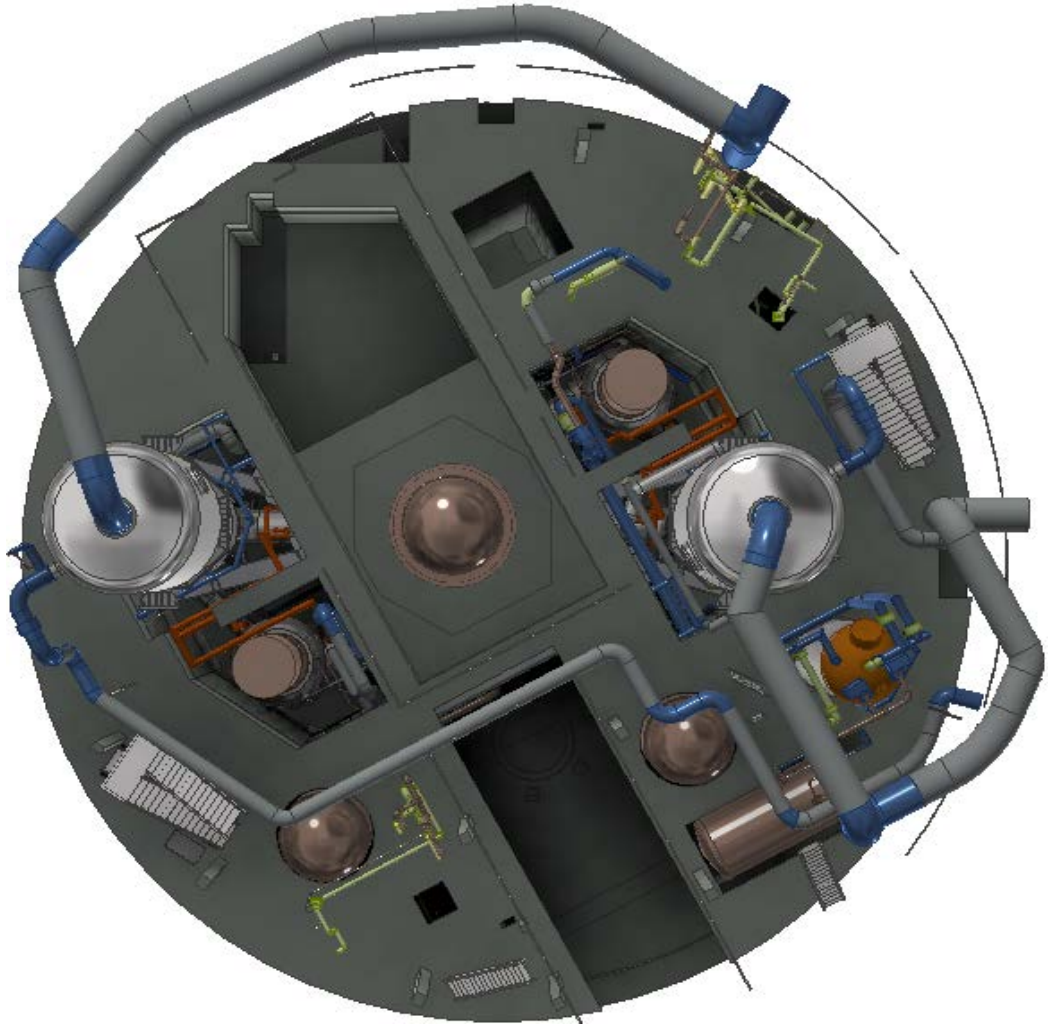
- Overview of plant layout and strainer configuration
- Previous Generic Letter (GL) 2004-02 submittal and NRC audit
- Resolution options evaluation
- Overview of risk-informed resolution approach
- Content of submittal
- Submittal schedule

Meeting Objectives

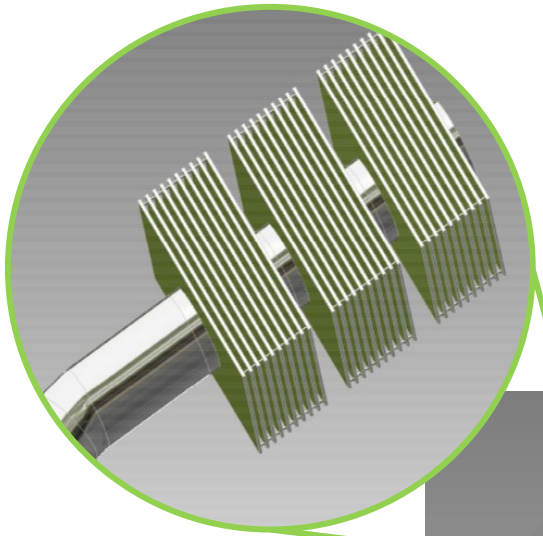
- Communicate current Point Beach plan for GL 2004-02 response
- Obtain staff feedback on the overall risk-informed resolution path for Point Beach
- Identify areas of concern from the NRC on the approach

Point Beach Plant Layout

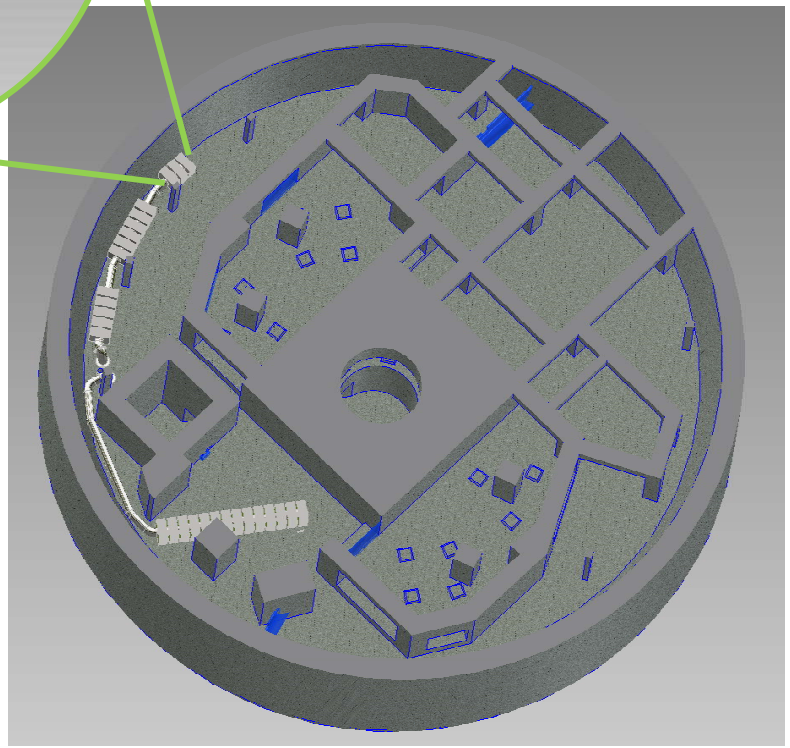
- **Westinghouse 2-loop pressurized water reactor (PWR) with large dry containment**
- **Two redundant emergency core cooling system (ECCS) and containment spray (CS) trains**
  - Each train has a high-head safety injection (SI) pump, residual heat removal (RHR) pump, and CS pump
  - During recirculation, the CS and SI pumps take suction from the RHR pump discharge



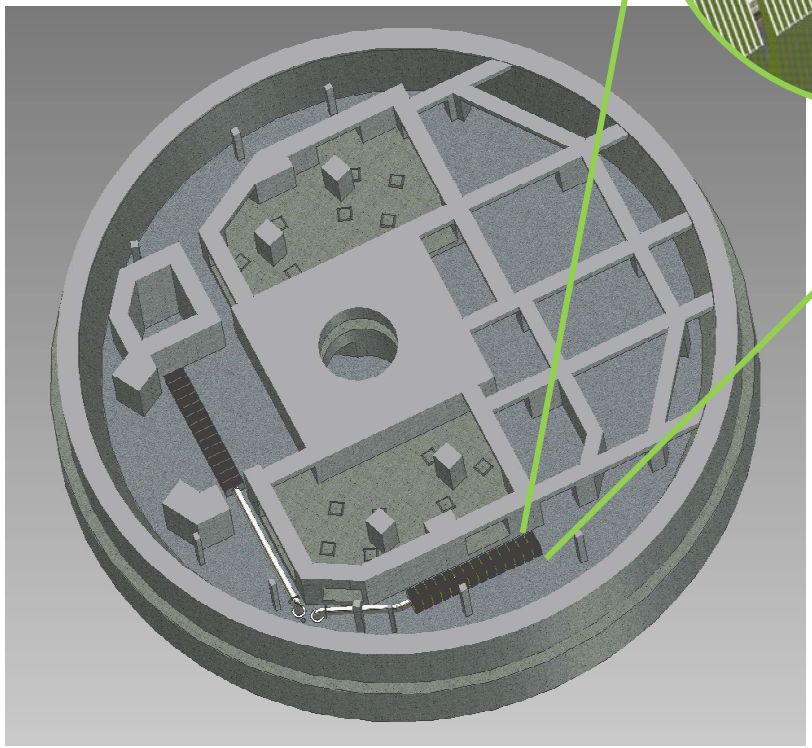
Sump Strainer Arrangement

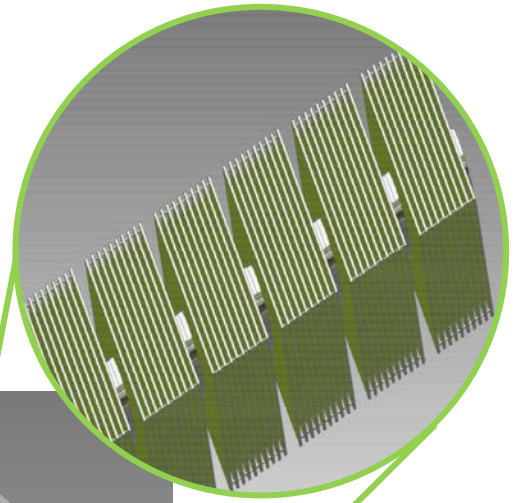


Unit 1



Unit 2





- PCI Sure-Flow strainers
- Vertical disk modules around a core tube
- Surface area of 1904.6 ft^2 per train

Background

- **Previous GL Response submitted to the NRC in 2017 (ML17363A253)**
  - Used NEI 04-07 Section 6 alternate break methodology
  - Required exemption from single failure requirement for Region II breaks
- **NRC performed an audit of the submittal in January 2019**
- **NRC issued an audit report on December 2, 2019 with several questions**
- **Point Beach was able to address all technical questions from the audit report except for Mineral Wool cassettes having a lower destruction pressure than assumed**

Resolution Options Evaluation for GL 2004-02 Closeout

- **NextEra conducted an alternative analysis for Point Beach to determine the best path for closeout of GL 2004-02**
- **Nine options were evaluated, including different levels of modification to the resistance temperature detector (RTD) bypass line piping and/or insulation (e.g., mineral wool and Cal-Sil), use of a different resolution method, and upgrades to sump strainers**
- **The selected option was the use of a risk-informed resolution approach**
  - Accepted resolution methodology with precedence by South Texas Project (STP) and Vogtle
  - The risk-informed approach addresses the NRC concerns in the audit report
  - Overall risk increase due to debris effects is expected to be in Region III of Regulatory Guide (RG) 1.174
  - Minimizes radiation dose associated with physical changes
  - Minimizes outage impacts

Highlights of Changes to Overall Approach

- **NextEra plans to use a risk-informed approach for Point Beach based on conditional failure probability (CFP) similar to Vogtle**
- **Debris generation analysis will be revised to evaluate Mineral Wool debris using a ZOI size of 5.4D**
  - Mineral wool insulation is similar to K-Wool, which is classified as unjacketed mineral wool with wire mesh reinforcement in NEI 04-07
  - K-Wool went through air jet impact testing and was assigned a ZOI size of 5.4D per NEI 04-07 SE
  - Mineral Wool insulation at Point Beach has a more robust casing than K-Wool
    - Tested K-Wool had wire mesh lining and fabric cover
    - Mineral Wool insulation at Point Beach is encapsulated in stainless steel cassettes
- **BADGER models will be rerun to update debris loads for both units**
- **No significant updates to other deterministic analyses (e.g., debris transport, water level, etc.) or testing are anticipated**

Event Selection for Risk Quantification

- **Risk quantification will consider the following events**
  - Small, medium, and large LOCAs due to:
    - -- Pipe breaks
    - -- Failure of non-piping components
    - -- Water hammer
  - Secondary side breaks inside containment that result in a consequential LOCA that requires sump recirculation
  - Fire-induced RCP seal LOCAs
  - Seismically-induced LOCAs
- **Based on preliminary evaluations of these initiating events, it is expected that only large LOCAs and secondary side breaks will contribute to the risk associated with LOCA-generated debris**

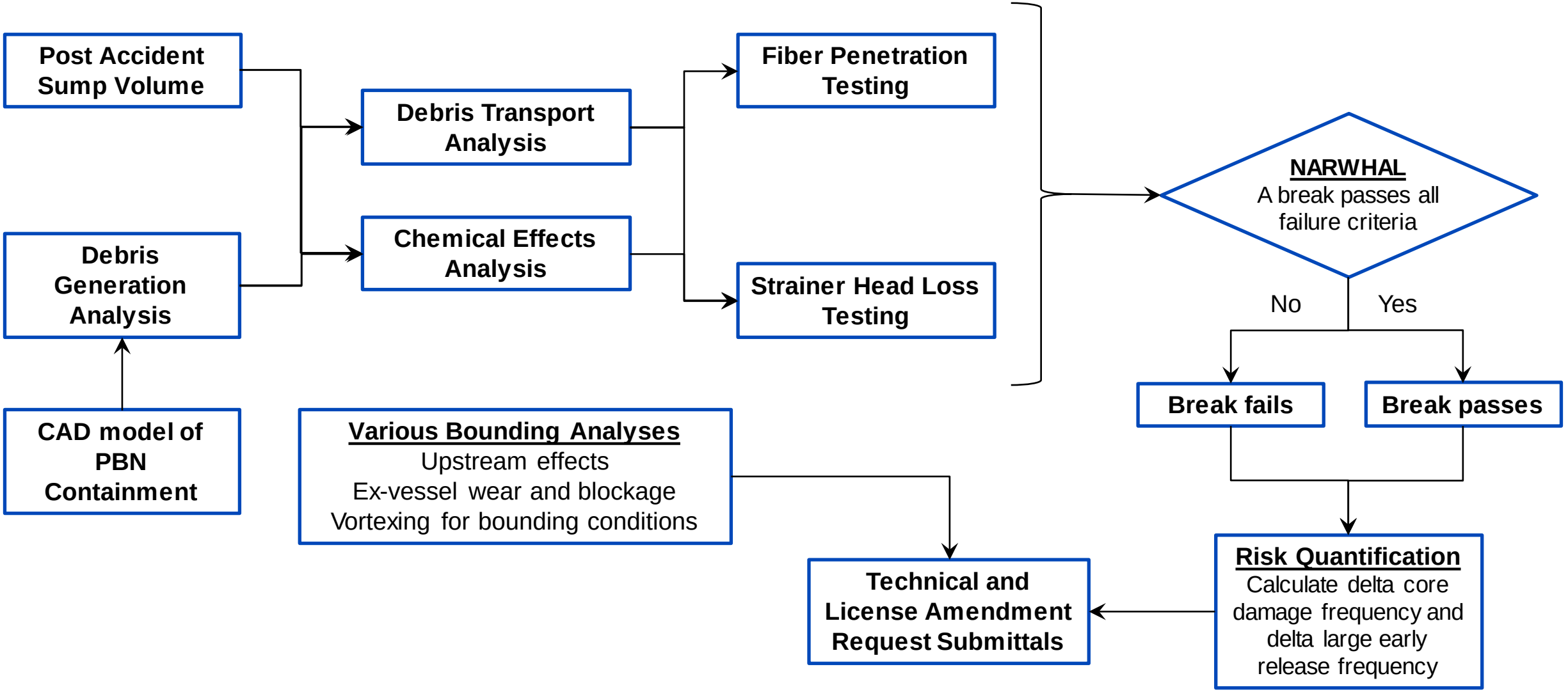
Secondary Side Breaks

- **Secondary side breaks will be addressed using a bounding approach**
  - Secondary side breaks inside containment can generate a significant quantity of debris (although the ZOI would be smaller than an equivalent primary side break)
  - ECCS recirculation may be necessary for secondary side breaks due to a stuck open power operated relief valve (PORV) or a scenario that requires feed and bleed
  - Strainer flow rate limited by capacity of PORVs
  - Internal events PRA model will be used to quantify the change in core damage frequency (ΔCDF) and change in large early release frequency (ΔLERF) by taking the differences in CDF and LERF between the following two scenarios:
    - -- The strainers always fail when required for secondary side breaks
    - -- The strainers never fail when required for secondary side breaks
  - Preliminary results indicate that the risk is within RG 1.174 Region III

Seismically-Induced LOCAs

- **Seismically-induced LOCAs will be addressed using the Point Beach individual plant examination of external events (IPEEE)**
  - Large LOCAs were screened out in the IPEEE at a HCLPF (high confidence of low probability of failure) of 0.3g
  - Small LOCAs were evaluated in the IPEEE and demonstrated not to be a significant risk contributor
  - Because large LOCAs have a lower conditional probability of occurrence, they would also be an insignificant contributor to risk
  - This conclusion is supported for the GSI-191 application because many large LOCAs would not generate enough debris to cause strainer failure
    - -- Only a fraction of seismically-induced large LOCAs would contribute to strainer performance risk
- **Based on this assessment, the risk contribution of seismically-induced LOCAs on strainer performance is judged to be negligible for Point Beach and screened from more detailed evaluation**

Overview of Point Beach Risk-Informed Approach



Failure Criteria

- **NARWHAL software will be used to evaluate each of the postulated breaks against the following failure criteria**
  - Strainer head loss exceeds pump NPSH margin or strainer structural margin
    - -- Breaks that generate and transport more debris of any one type than tested are assumed to fail
  - Gas voids from degasification or flashing exceed pump limits
  - Penetrated debris exceeds in-vessel fuel blockage and boron precipitation limits
    - -- In-vessel evaluation and acceptance criteria will follow latest NRC review guidance
- **Bounding analysis for the following failure criteria have been performed outside of NARWHAL**
  - Upstream blockage prevents water from reaching sump
  - Pumps fail due to air intrusion from vortexing
  - Penetrated debris exceeds ex-vessel wear and blockage limits

Risk Quantification

- **NARWHAL will be used to calculate CFPs based on:**
  - The definition of small (<2”), medium (2”-6”), and large (>6”) LOCAs
  - The fraction of breaks that pass and fail within each size category for various pump configurations
  - The LOCA frequency allocated across welds using the top-down approach
- **PRA model will be used to determine the functional failure probability (FFP) for relevant equipment lineups**
  - All pumps available, single RHR/CS train failure, single RHR train failure, etc.
- **ΔCDF will be calculated outside the PRA model using the initiating event (LOCA) frequency, CFP, and FFP:**

$$\Delta CDF = IEF * \sum_{j=0}^{j=X} CFP_j * FFP_j$$

- **ΔLERF will be calculated outside the PRA model based on:**
  - ΔCDF
  - Conditional large early release probability (CLERP) calculated using relevant LERF sequences from the PRA model

Uncertainty Evaluation

- **Following the guidance in NUREG-1855, uncertainty evaluation will address:**
  - Parametric uncertainty
  - Model uncertainty
  - Completeness uncertainty
- **Parametric uncertainty will quantify uncertainty associated with input parameters that are not conservative or bounding (e.g., mean LOCA frequency values)**
- **Model uncertainty will quantify uncertainty associated with models that are not consensus models (e.g., continuum break model) by running a sensitivity case with an alternative model (e.g., DEGB only model)**
- **Completeness uncertainty will be qualitatively evaluated**

Sensitivity Analysis

- **Sensitivity analysis will be performed for input parameters by varying one parameter at a time to determine its impact on the overall results**
- **Parameters will be varied through a range of values selected based on the value used in base case NARWHAL model**
  - If base case value already skewed in conservative direction, min [max] value will be assumed to be 10% lower [higher]
  - If available, design limits of an input parameter will be used
  - Otherwise, the min [max] value will be assumed to be 25% lower [higher] than the base case value
- **Sensitivity analysis will be used to gain insights on which parameters have the most significant effect on the model**

Submittal Content and Schedule

- **Submittal will address the five principles from RG 1.174**
- **Submittal will include the following enclosures**
  - Enclosure 1: License amendment request (LAR) for implementation of risk-informed approach to address debris effects
  - Enclosure 2: Request for exemption from 10 CFR 50.46(a)(1) for the use of risk-informed approach to address debris effects
  - Enclosure 3: Updated GL 2004-02 responses following the NRC content guide (revision bars will be shown for technical changes from the 2017 GL submittal)
  - Enclosure 4: Risk quantification and sensitivity and uncertainty analyses
  - Enclosure 5: Defense-in-depth measures and safety margin
- **Submittal Schedule**
  - Complete analyses: October 2021
  - Submittal updates: December 2021
  - Submittal to the NRC: Spring 2022

Point Beach PRA Model Status

- **Internal events PRA model developed and maintained in accordance with ASME/ANS PRA standard and RG 1.200, Revision 2**
- **Recent applications**
  - TS Initiative 5.b - SFCP
  - 10 CFR 50.69
  - NFPA-805
- **A preliminary assessment of the open peer review facts and observations (F&Os) indicates they will have no significant impact on the risk-informed resolution of GL 2004-02**
- **A preliminary review of relevant PRA model assumptions indicate that none of the assumptions are key sources of uncertainty with respect to the risk-informed resolution of GL 2004-02**

Questions?