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GE-Hitachi Global Laser Enrichment LLC Facility Mandatory Hearing

July 11-13, 2012

NRC Staff Presentation Topic 3:
Safety Impact of External Hazards

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Purpose of Testimony

- Review key aspects of staff's review of GLE's external hazards evaluations:
  - Flooding
  - High winds and tornadoes
  - Earthquakes
- Discuss basis for staff conclusions that GLE evaluations were acceptable

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Regulatory Requirements

- 10 CFR 70.61(a) – integrated safety analysis (ISA)
- 10 CFR 70.61(b) – high-consequence events to be highly unlikely
- 10 CFR 70.61(c) – intermediate consequence events to be unlikely
- 10 CFR 70.62(c)(iv) – ISA to include potential accident sequences caused by credible external events, including natural phenomena events
- 10 CFR 70.64(a)(2) – facility design to provide adequate protection against natural phenomena with consideration of most severe documented historical events for the site
- 10 CFR 70.65(b)(1) – ISA summary to include a general description of the site with emphasis on factors that could affect safety (i.e., seismology, meteorology)

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Applicable Guidance Documents

- NRC guidance
  - NUREG-1520, Rev. 0 (Standard Review Plan), Ch. 1 & 3 (Ex. NRC005)
    - Acceptance criterion 3.4.3.2(1)(c)
  - Interim Staff Guidance (ISG) FCSS-ISG-08, “Natural Phenomena Hazards” (Ex. NRC036)
  - Regulatory Guide (RG)1.59, “Design Basis Floods for Nuclear Power Plants” (Ex. NRC029)
- External codes and standards – DOE, ASCE, AISC, ACI

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GLE Flooding Hazards Assessment

- GLE considered the following:
  - Probable maximum flood due to rainfall in local watersheds
  - Probable maximum precipitation due to locally heavy rainfall
  - Probable maximum hurricane surge
  - Tsunami hazard
  - Appropriate design
- GLE used RG 1.59 to estimate probable max. flood
  - Design basis (DB) flood water level = 28 ft

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Staff Evaluation – Probable Maximum Flood

- Use of probable maximum flood as a basis to categorize highly unlikely events is consistent with FCSS-ISG-08
- Selected DB flood water level (28 ft) is conservative
  - site and surrounding area are relatively flat; gently sloping surfaces, little relief
  - facility is situated at the local high point
  - large flat area surrounding facility → rise of flood water above the probable maximum flood level is highly unlikely
- Ample time for operational personnel to take mitigating actions
- Design conforms with appropriate codes and standards

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Probable Maximum Precipitation

- GLE assessment
  - Probable maximum precipitation estimates corresponding to 24-, 48-, and 72-hour durations were 26, 30, and 32.5 inches, respectively
  - Because facility is at a local high point, rainfall will drain in all directions to lower elevations
- Staff evaluation
  - Use of probable maximum precipitation as a highly unlikely event for local rainfall hazard is consistent with FCSS-ISG-08
  - Flat terrain → probable maximum precipitation will not flood the facility site
  - design basis flood level based on probable maximum flood bounds probable maximum precipitation

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Probable Maximum Hurricane Surge

- GLE assessment
  - Using RG 1.59, the probable maximum hurricane storm surge at open coast shoreline is 21.9 feet above mean low water
- Staff evaluation
  - Even assuming no dissipation, maximum probable hurricane storm surge remains below the design basis flood level
  - use of probable maximum hurricane surge as a basis to categorize highly unlikely events is consistent with FCSS-ISG-08

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GLE Tsunami Hazard Assessment

- Atlantic Ocean is 10 miles east and 26 miles south of the site
- Proposed facility elevation = 25 feet above mean sea level
- The proposed site may be categorized as “inland” – not susceptible to flooding from a tsunami
- A tsunami reaching far enough inland to impact the facility is highly unlikely

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Staff Tsunami Hazard Evaluation

- Plate tectonic conditions along the Atlantic seaboard are not conducive to forming large earthquake-generated tsunamis
  - Atlantic coast of North Carolina is not a subduction zone
  - No large submarine volcanoes offshore
- Inundations even for large tsunami events remain relatively close to the shoreline (*see* Ex. NRC007 at 16)
  - Great Japan Earthquake – 4.9 miles
  - Sumatra (2004) – 3.1 miles
- Highly unlikely for large tsunami to reach site (>10 miles inland)
- Possible landslide-generated tsunami surge bounded by estimated maximum hurricane surge

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GLE Assessment of High Winds and Tornado Hazards

- GLE design basis wind speed is 157.5 miles per hour (3-second gust)
- The tornado wind speed corresponding to a highly unlikely event is 112 miles per hour
- The design basis wind speed is higher than the upper bound wind speed of a Category 3 hurricane

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Staff Evaluation of High Wind and Tornado Hazards

- Estimated tornado wind speed (112 mph) consistent with guidance in NUREG/CR–4461 (Ex. NRC030)
- Design basis wind speed is conservative
  - No hurricane winds of Category 3 or 4 strength reported in the area
  - Wind speed of hurricane decreases as it moves inland
  - “highly unlikely” tornado wind speed << design basis wind speed
- Design for wind loads conforms with appropriate codes and standards

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GLE Earthquake Hazard Assessment and Seismic Design

- GLE defined 10^{-4} as the highly unlikely performance objective for earthquakes
- Basis for seismic design ground motions
  - USGS 2,500-year return period earthquake, modified for site soil conditions
- Design methodologies
  - DOE-STD-1020-2002 (Ex. NRC031) or ASCE 43-05 to develop design spectra
  - AISC N690-06 for steel structures
  - ACI 349-06 for concrete structures
- Combination of hazard level and design ensures highly unlikely performance objective is met

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Staff Earthquake Hazards Evaluation

- GLE's design ground motions are greater than those predicted from historical record or using FCSS-ISG-08 methods
- GLE will use appropriate nuclear grade codes and standards for seismic design
  - provide structures with sufficient capacity to withstand ground motions from earthquakes that are less likely than the design basis ground motions
- GLE's approach will ensure that IROFS are constructed with sufficient capacity to withstand 10^{-4} or smaller probability ground motions, consistent with GLE's highly unlikely definition
- Possible additional capacity beyond highly unlikely failure probability
  - e.g., IROFS may maintain safety function

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