BWXT
BWX Technologies, Inc.

September 18, 2015
15-113

Attn: Document Control Desk
Director, Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington D.C. 20555-0001

References: (1) License No. SNM-42, Docket 70-27

(2) General Letter dated June 22, 2015, M.G. Bailey (NRC) to Fuel Cycle Facilities (BWXT), Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities.

(3) Letter dated February 14, 2014, CA England (B&W) to MN Baker (NRC), B&W NOG-L progress update on URI 70-27/2012-006-001, from Temporary Inspection Report No. 70-27/2012-006

(4) NRC Integrated Inspection Report No. 70-27/2012-002 and Temporary Instruction 2600/15 Inspection Report No. 70-27/2012-006

Subject: Reply to General Letter 2015-01: Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities dated June 22, 2015.

BWXT Nuclear Operations Group, Inc., Lynchburg, (NOG-L) is providing its response to the NRC's General Letter 2015-01, dated June 22, 2015, Treatment of Natural Phenomena Hazards in Fuel Cycle Facilities (Reference 2). The response is provided in Enclosure 1.

Please note that on July 1, 2015, B&W Nuclear Operations Group, Inc. changed its name to BWXT Nuclear Operations Group, Inc. Any references in this letter or associated documents to B&W or BWXT refer to the same company.

If you have questions or require additional information, please contact Tony England, Manager of Licensing and Safety Analysis, at caengland@bwxt.com or 434-522-6405.

Sincerely,

B. Joel Burch
Vice President and General Manager
BWXT Nuclear Operations Group, Inc. – Lynchburg

Enclosure

cc: NRC, Resident Inspector
Region II Regional Administrator

IE07
NMSS01
NMSS33

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ENCLOSURE 1

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BWXT NOG-L Response to NRC Generic Letter 2015-01: Treatment of Natural Phenomena Hazards in the Fuel Cycle Facilities dated June 22, 2015.

The NRC conducted an inspection of the BWXT facility under Temporary Instruction 2600/015. The results were provided to BWXT in inspection report 70-27/2012-006. The inspectors found the BWXT did have adequate documentation and procedures for flooding. The inspectors also determined that an extended loss of power and water would not result in an accident sequences that would exceed the performance requirements of 10 CFR 70.61 threshold for public safety.

The inspectors were not able to verify earthquake and wind design specifications for existing buildings housing SNM in building constructed prior to the adoption of the International Building Code. As such, an unresolved item, URI 70-27/2012-006-01 was opened to further evaluate whether BWXT is in compliance with 10 CFR 70.62(c) and the performance requirement of 10 CFR 70.61 for accident sequences that are a result of natural phenomena.

BWXT responded to the URI in letter dated February 14, 2014, B&W NOG-L progress update on URI 70-27/2012-006-001, from Temporary Inspection Report No. 70-27/2012-006 (Reference 3), providing the basis under which it demonstrated via additional analysis that 10 CFR 70.62(c) and the performance requirement of 10 CFR 70.61 for accident sequences that are a result of natural phenomena were met. BWXT requested closure of the URI.

On June 22, 2015, the NRC issued Generic Letter 2015-01 related to natural phenomena. The generic letter requests

(1) Within 90 days of the date of this letter, all addressees are requested to:

a. Submit the definitions of "unlikely," "highly unlikely," and "credible" in evaluating natural phenomena events in the ISA such as earthquakes, tornadoes, tornado missile impacts, floods, hurricanes, and other wind storms.

b. Submit a description of the licensee's safety assessment for the licensing and design basis natural phenomena events, including the following information:

i. likelihood and severity of the natural phenomena events, such as earthquakes, tornadoes, floods, hurricanes, and other wind storms

ii. accident sequences as a result of natural phenomena event impacts to facility structures and internal components

iii. assessment of the consequences for the accident sequences from item ii that result in intermediate and/or high consequence events

iv. items relied on for safety to prevent or mitigate the consequences of the events from items ii and iii

c. For facilities subject to 10 CFR Part 70, Subpart H requirements, submit a description of the results of the ISA review used to comply with 10 CFR 70.62(c). This requested documentation should have identified the characteristics of the licensing and design basis natural phenomena events applicable to the site.

Additionally, the documentation should have evaluated possible changes in the methodology, likelihood, and severity of natural phenomena events with those used in the original design, evaluation, and licensing of the facility.

d. Submit for staff review a summary of the results of any facility assessments or walk downs, if performed, to identify and address degraded, nonconforming, or unanalyzed conditions that can affect the performance of the facility under natural phenomena and have available for NRC inspection the documentation of the qualifications of the team.

NRC Request

a. Submit the definitions of "unlikely," "highly unlikely," and "credible" in evaluating natural phenomena events in the ISA such as earthquakes, tornadoes, tornado missile impacts, floods, hurricanes, and other wind storms.

BWXT NOG-L's Response

As described in Chapter 3 of SNM-42, BWXT primarily uses a qualitative scoring system, but can use probabilities to assess risk.

The overall likelihood (OAL) of an accident sequence is defined for qualitative scoring as:

OAL = Frequency of Initiating Event Score – Effectiveness of Protection Score

If the OAL is calculated using failure rates, then the equation is:

OAL = Occurrence Rate of Initiating Event Score x Failure Rate of Protection Score(s)

The scoring and probabilities used in the determination of OAL are:

Initiating Event or Prevention		**Protection**		
Score	**Occurrence Rate**	**Score**	**Success Rate**	**Failure Rate**
1	1/month	0	0%	1
0	1/year	1	90%	0.1
-1	1/10 years	2	99%	0.01
-2	1/100 years	3	99.9%	0.001
-3	1/1000 years	4	99.99%	0.0001
-4	1/10,000 years			
-5	-			

The likelihood of the OAL can be qualitatively described as:

Category	OAL (Risk Index)	OAL (Probability)
Unlikely	-2 or -3	1 x 10^{-2}/yr to 1 x 10^{-4}/yr
Highly Unlikely	≤ -4	1 x 10^{-4}/yr to 1 x 10^{-6}/yr
Credible		> 1 x 10^{-6}/yr
Not Credible		≤1 x 10^{-6}/yr

NRC Request

b. Submit a description of the licensee's safety assessment for the licensing and design basis natural phenomena events, including the following information:

i. likelihood and severity of the natural phenomena events, such as earthquakes, tornadoes, floods, hurricanes, and other wind storms

BWXT NOG-L's Response

The likelihood and severity of the natural phenomena events, such as earthquakes, tornadoes, floods, hurricanes, and other wind storms is described in Integrated Safety Analysis Summary in SNM-42 which was most recently submitted in January of 2015. More detailed information was provided in the BWXT letter dated February 14, 2014 (Reference 3). A brief summary is provided below.

The probability of an earthquake with a Richter scale magnitude of 5.0 or greater within 50 km of the facility is no greater than 1 in 10,000 years. A 5.0 magnitude earthquake is approximately a Mercalli Intensity Scale VII. This intensity is consistent with two significant earthquakes in Virginia, Giles County in 1897 and Mineral in 2011. It is also in line with the requirements of International Building Code (IBC) 2009.

The probability of a tornado strike was reassessed by BWXT using the method described in NUREG/CR-4461, Rev. 2. The probability determined for an EF0 tornado (maximum wind speed of 85 mph) striking the Main Bays of the facility to be 1.48 x 10^{-4} per year at the 95% limit which is unlikely and close to being highly unlikely. The probability of an EF1 (minimum wind speed of 86 mph) or stronger tornado striking the Main Bays is 4.00 x 10^{-5} per year at the 95% limit and therefore is highly unlikely.

The facility was built over time and under many different building codes. In order to determine the survivability of the facility when subjected to current code IBC 2009 natural phenomena hazards (NPH), the services of a professional engineering firm was obtained. The firm modeled seismic and wind response of the Main Bays and "A" Bays of the facility built to SBC which house SNM using American Society of Civil Engineers (ASCE) 31-03. The results of these structural calculations and modeling were very positive and demonstrate that all Bays constructed under SBC, even though there were no seismic criteria at that time, will survive an earthquake of the strength specified in 1973 and most would survive the earthquake strength specified in IBC 2009 and allow employees to safely exit the facility. All of the analyzed buildings would survive the IBC 2009 wind load of 90 mph.

For the buildings that contain SNM that were not analyzed by the Engineering firm, a qualitative analysis was performed by BWXT NOG-L. The conclusion was that they would be expected to survive and allow employees to safely exit the facility. It was also concluded that the buildings would survive the IBC 2009 wind load of 90 mph.

The Facility is located on an elevated bend in a shallow gradient portion of the James River. The plant elevation is located substantially above the James River. The main site is approximately 500 feet MSL at its lower (plant north) fence line, with the principal facilities at 568 MSL or above. Most operations are not at risk of flooding. Past flooding events did not impact the NOG plant proper or the LTC. Unencapsulated uranium facilities (active uranium storage and processing portions of the site) are located at 568 MSL or above. The flood levels for the James River are:

- 502 feet MSL for the Standard Project Flood (SPF) level,
- 522 feet MSL for the Probable Maximum Flood (PMF) of 2 X SPF flow rate
- 521 feet MSL for a Probable Maximum Flood ("highly unlikely" or $<10^{-5}$ by NUREG-1520-Rev. 1 page 3-D-1 definition event without dam breaches
- 523 feet MSL for a Probable Maximum Flood with dam breaks and wave action

A history of floods dating from 1771 to present is known (~ 240 years). Four floods affecting site support facilities or the area they presently occupy (floods reaching levels ≥ 488 feet MSL) have occurred, with two reaching up to 494 feet MSL. The 1791 flood and the 1985 flood reached a level of ~494 feet MSL at the site for both.

Two encapsulated material storage building first floors (Rail Yard Storage and Container Storage) are at the Standard Project Flood (SPF) level of ~502 feet MSL which is above the maximum recorded flood level. The PMF flood is projected to flood these two facilities. Nuclear Criticality Analysis has demonstrated criticality control of these materials is not affected by total inundation, let alone partial flooding of these stored materials.

The Waste Treatment facility is located below the SPF crest line in the 100 year flood plain and infrequently experiences minor flooding from the James River with no operational difficulty. Consistent with NUREG 1520, Rev. 1 recommendations, flood warning times are used to prepare facilities and equipment and move materials to minimize the impact for these events (which are rare as per NUREG-1049). The relationship between James River Levels and those at a monitoring station upstream is well known and is used to provide substantial warning and reaction time to adjust operations to reflect local flooding conditions. The reactions, adjustments, flood warning times and relationships to values are proceduralized. During a 100-year or greater flood the Waste Treatment facility is not operational; therefore, nearly all operations at BWXT NOG would temporarily cease. The access road (Route 726) to the facility may become impassable to normal vehicular traffic during flooding events of a lesser magnitude.

NRC Request

b.ii. accident sequences as a result of natural phenomena event impacts to facility structures and internal components

BWXT NOG-L's Response

The likelihood for an earthquake or wind event is less than 1 x 10^{-4}/year which are considered highly unlikely events. The scenario is an earthquake or wind storm (tornadoes, tornado missile impacts, hurricanes and other wind storms) has occurred. To result in a high consequence event (criticality), the initiating event had to rearrange fuel and then result in necessary amount of moderation be mixed with the relocated fuel. It is conservatively judged that the likelihood of rearranging fuel is 1 in 10 and to the have the necessary amount of moderation is conservatively judged as 1 in 10.

(1 x 10^{-4}/yr)	x	(1/10)	x	(1/10)	=	(1x10^{-6}/yr)
Initiator		Optimum Spacing		Optimum Moderation		Overall Likelihood

For a flood, the frequency is <1 x 10^{-5} / year and relocation fuel in the Container Storage Building or Railyard Storage Building is no greater than 1 in 10, a criticality from a flood is less than 1x10^{-6}/yr. This overall likelihood, 1 x 10^{-6}/year, is equivalent to the "once in a million years" cited in NUREG 1520 Section 3, Integrated Safety Analysis, Paragraph (9), as "incredible." As such, there were no accident sequences that were initiated by natural phenomena that resulted in credible high consequence events. The earthquake, wind and flood events are sufficiently infrequent that they are highly unlikely and therefore meet the required risk profile for intermediate consequences which by regulation must be unlikely.

NRC Request

b.iii. assessment of the consequences for the accident sequences from item ii that result in intermediate and/or high consequence events

BWXT NOG-L's Response

There were no accident sequences that were initiated by natural phenomena that resulted in credible intermediate and/or high consequence events. The earthquake, wind and flood events are sufficiently infrequent that they are highly unlikely and therefore meet the required risk profile for intermediate consequences which by regulation must be unlikely.

NRC Request

b.iv. items relied on for safety to prevent or mitigate the consequences of the events from items ii and iii

BWXT NOG-L's Response

Since there were no credible accident sequences initiated by natural phenomena that resulted in intermediate or high consequences, there are no IROFS created to prevent or mitigate the consequences of the event.

NRC Request

c. ***For facilities subject to 10 CFR Part 70, Subpart H requirements, submit a description of the results of the ISA review used to comply with 10 CFR 70.62(c). This requested documentation should have identified the characteristics of the licensing and design basis natural phenomena events applicable to the site. Additionally, the documentation should have evaluated possible changes in the methodology, likelihood, and severity of natural phenomena events with those used in the original design, evaluation, and licensing of the facility.***

BWXT NOG-L's Response

Information has been provided as part of the annual update of the Integrated Safety Analysis summary and additionally in letter dated February 14, 2014 (Reference 3). The detailed records are available on site for NRC review.

NRC Request

d. ***Submit for staff review a summary of the results of any facility assessments or walk downs, if performed, to identify and address degraded, nonconforming, or unanalyzed conditions that can affect the performance of the facility under natural phenomena and have available for NRC inspection the documentation of the qualifications of the team.***

BWXT NOG-L's Response

The contracted engineering firm performed walk downs of the facility to verify the configuration of the structure as part of developing the analytic model used to assess seismic and wind loads on the facility. The results of the structural modeling revealed that all Bays constructed under SBC, even though there were no seismic criteria at that time, will survive an earthquake of the strength specified in 1973 and most would survive the earthquake strength specified in IBC 2009 and allow employees to safely exit the facility. All of the analyzed buildings would survive the IBC 2009 wind load of 90 mph. No degraded, nonconforming, or unanalyzed conditions that can affect the performance of the facility under natural phenomena were identified. The analyses are available for review on site.