From: [redacted]
To: SizewellC
Subject: Response to Issue Specific meeting ISH 11
Date: 14 September 2021 12:25:00
Attachments: Responses to ExQ2 REP7-052 and REP7-059 Nick Scarr.pdf

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Dear Sizewell C Team

FAO: Mr Neil Humphrey, Miss Wendy McKay, Chief Examiner,

Thank you for raising issues related to my papers.

I was able to hear the comments raised this morning from James Hanson for the Applicant.

He pointed out that the Applicant had responded to my comments in ExQ2.

I will be unable to listen this afternoon. I had prepared the enclosed paper over the weekend.

Kind regards
Nick Scarr

Responses to REP7-052 (EN010012-007054- Responses to ExQ2) and REP7-059 (Comments at Deadline 7 on Submissions from earlier deadlines and subsequent written submissions).

This paper is a response to the Applicant's replies to enquiries made by the Planning Inspectorate relating to my documents.

Author: Nick Scarr

Part 1. Responses to ExQ2 REP7-052

The Applicant's responses listed below in italics are found in REP7-052 - EN010012-007054-Responses to ExQ2 Volume 1 Part 3) pages, pdf pages 104-115.

1. The Applicant states:

"(i) No additional modelling has been undertaken for the flood risk assessment. As discussed in Section 5.3 of Appendix A of the Coastal Modelling Report (Appendix 1 of the MDS FRA [APP-094]), the assessment concluded that the Baseline scenario, i.e. with the Sizewell - Dunwich bank in situ, resulted in more conservative (i.e. worst case) nearshore wave conditions than with their removal. As such, the scenario with the bank in place was adopted in the MDS FRA for all scenarios and epochs as a conservative approach. The latest assessment, summarised in BEEMS Technical Report TR545 [REP3-048], was undertaken to consider beach erosion and viability of the soft coastal defence feature in relation to a specific event, i.e. the Beast from the East storm, and therefore has separate objectives from the MDS FRA."

My response:

The Applicant has now confirmed that its modelling for all scenarios and epochs in the DCO flood risk assessment uses the offshore geomorphological 'breakwaters' comprising the Sizewell-Dunwich banks and the inner and outer longshore bars as permanent immutable wave relief features. Although the Applicant states that this is discussed in Section 5.3 of Appendix A of App-094, in my view the methodology adopted is not made open and clear in the DCO FRA. This methodology is, in my view, inadmissible for the following reasons:

1 The offshore geomorphology is unstable and cannot be regarded as immutable over 'all scenarios and epochs'. Consider the Applicant's own work:

1.1.1 What is the geology of the Dunwich bank?

EDF: DCO Coastal Geomorphology Appendix 20A –Page 135. *"…the Dunwich Bank has no inherited stabilising hard geology (i.e., no headland no underpinning crag).*

1.1.2 The Dunwich bank is not stable:

EDF DCO: Coastal Geomorphology Appendix 20A, Page 21. *"Records over the last decade show…Dunwich Bank exhibited greater variability in both its morphology and position with:*

- *erosion north of 267000N, (that is the Northern half) resulting in bank lowering of -0.5 – -1.5 m,*

- *a decrease in its northern extent of approximately 250 m,*

EDF: BEEMS TR500, Page 32. *"Dunwich Bank exhibited large-scale erosion across its northern third."*
DCO: Marine Management Org. Responses ExQ PINs. The Marine Management Association has stated that the Dunwich bank has dropped 2m in the last 10 years.

1.1.3 The inner and outer longshore bars are not stable:

EDF:TR545: "..*in reality storm conditions will alter the inner and outer longshore bars along the Sizewell frontage over time,*

These points are more fully covered in my document REP2-393.

1.2 The Applicant's claim to 'conservative, worst-case modelling' by regarding the offshore geomorphology as fixed (the Applicant's 'Baseline scenario'), is inadmissible, in my view, for the following reasons:

1.2.1 It is like saying that the wave climate inside Dover harbour is greater than the wave climate outside.

1.2.2 The Applicant in a later modelling exercise, TR545, which is a limited exercise to study the 'cut and fill' response of the soft coastal defence feature, *makes the obverse case strongly that absence of the Sizewell Dunwich banks in the modelling results in precautionary 'conservative' modelling.*

Each of two directly opposing geomorphological scenarios are being suggested by the Applicant as the premise for justifying conservative (precautionary) modelling.

These two modelling scenarios, one from the recent modelling in TR545 and the other from the FRA, appear to me therefore, to be mutually incompatible in their claims.

1.2.3. The Applicant states that BEEMS TR545 was a particular exercise in studying the soft coastal defence feature.

This is agreed. The modelling of more modest, short duration specific storms presented in TR545, is a particular exercise in studying soft defence (SCDF) 'cut and fill' and shingle loss. It cannot be regarded as having any wider remit of studying Sizewell shoreline resilience over the plant lifetime. This is covered in my document, REP7-220.

2. The Applicant states:

"(ii) There is no evidence or mechanism to suggest that the bank would be lost over the life of the station (or indeed over much longer time scales). The assessment of beach erosion and viability of the soft coastal defence feature is summarised in the BEEMS Technical Report TR545 [REP3-048], which focuses on the Beast from the East storm and does not account for the presence of the Sizewell – Dunwich Bank. The offshore model boundary is inshore of the Sizewell-Dunwich bank meaning any variation in bank morphology does not influence the model results, however, wave conditions recorded by the Sizewell Waverider offshore of the bank are still applied to the model boundary. As

such this is considered to be a conservative approach in relation to the feasibility of the soft coastal defence feature."

My Response:

2.1 The Applicant's view '..*that there is no evidence or mechanism that the bank will be lost [until the end of the twenty second century]'* is in my view unsupportable. There is extensive historical evidence to suggest the bank has significantly changed and, indeed, is changing now. The mechanism for change is wave action on *unconsolidated geomorphology* combined with the unknowable effects of climate change. That the Sizewell Dunwich banks can change and have significantly changed is indisputable, the actual future change, unknowable.

2.2 BEEMS TR545,

The Applicant is stating the direct converse in (ii) to its own claim in its point (i) above, namely: in point (i) the Applicant states that *conservative (precautionary) modelling results from the immutable presence of the Sizewell-Dunwich banks* and in point (ii) the Applicant is stating that *the absence of the Sizewell Dunwich banks results in conservative (precautionary) modelling*.

TR545 is still unreasonably relying on the immutable wave relief features of the inner and outer longshore bars, bars that can change, and in the event of loss of the Dunwich bank, significantly. See my document REP7-220.

3. The Applicant states:

"(iii) The CPMMP [REP5-059] includes proposed bathymetric surveys of the Sizewell – Dunwich Bank every 5 years. As the bank is very large and changes slowly, this interval is considered sufficient to track the long-term change of the bank. The Virtual Inshore Wave Buoy (X-band radar) and regular topographic beach surveys will also register changes to inshore storm wave climatology and beach topography/volumes."

My response:

I suggest that the results so far from these techniques would be extremely useful such that we can examine the bathymetric changes that have occurred in the last decade or more to the Sizewell Dunwich banks.

Although there are reasonably detailed bathymetric data of the nearshore, longshore bars in the DCO—see document, "APP-312 Coastal Geomorphology and hydrodynamics, Appendix 20A, Paragraph 7.2.1 Page 45/46", I have not been able to locate any detailed bathymetry of the Sizewell-Dunwich banks in the DCO.

4. The Applicant states (page 106):

(i) The remit of the EGA was to review the potential for future shoreline change that would lead to exposure of the HCDF without secondary mitigation (beach maintenance). BEEMS Technical Report TR403 (summarised in Volume 2 Appendix 20A of the ES [APP-312]) reports the EGA exercise and identified a window (2053-2087) when it was most likely that the initially terrestrial HCDF would be exposed to marine conditions without mitigation (to prevent such an outcome). The EGA identified that HCDF exposure without mitigation was likely to occur under conditions similar to those currently

experienced at the site. BEEMS Technical Report TR403 also identified that uncertainty in the projection of future environmental parameters affecting geomorphic change becomes too great at around this same time for any attempt to project shoreline change any further into the future to be plausible i.e., present conditions are unlikely to hold beyond this window. Having determined that mitigation was required, this work was completed and does not need to be repeated, as the latest modelling and data (BEEMS Technical Reports TR544 and TR545 [REP3-032 and REP3-048]) addresses the performance of the mitigation measures.

My Response:

The Applicant's shoreline change exercise ends in 2070, the plant's lifetime to spent fuel removal being 2160 or beyond. The EGA assumes the permanence and protection of the offshore wave relief geomorphology and therefore, in my view represents a low erosive, non-conservative, non-precautionary modelling exercise over less than half the plant's considered lifetime. For TR545 discussion see my paper REP7-220.

5. The Applicant states:

"(ii) FRA: As noted in the response to CG.2.10, SZC Co. has undertaken an assessment of the impact of the removal of the Sizewell-Dunwich banks on nearshore wave conditions and subsequently the risk of overtopping of the coastal defences. This is discussed in Section 5.3 of Appendix A of the Coastal Modelling Report (Appendix 1 of the MDS FRA [APP-094]). This assessment concluded that the Baseline scenario with the Sizewell – Dunwich bank in place resulted in more conservative (worst case) nearshore wave conditions than with its removal. As such, the scenario with the bank in place was adopted in the MDS FRA for the assessment of overtopping risk to the coastal defences throughout the development lifetime."

My response: See point 1 on pages 1 and 2 above.

The Applicant states:

6. "EGA: The potential nearshore effects of bank change was considered by the EGA and in BEEMS Technical Report TR403 (and synthesized into Volume 2, Appendix 20A of the ES [APP-312]. The EGA did not consider the degradation of the banks over the project lifetime because the scope of the work was limited to defining only the period prior to mitigation being required (and degradation of the banks could not occur within that timeframe)."

My response: The suggestion that 'degradation of the banks could not occur within the stated timeframe' is speculation. The Sizewell Dunwich banks can change year-on-year with major change possible in decadal timescales. The Applicant states in BEEMS TR311 (page 155) that "*Dunwich Bank has been highly variable in its elevation and extent over decadal time periods".* Also see point 2 on pages 2-3 above.

7. The Applicant states:

(iii) SZC Co. has always considered that the Sizewell – Dunwich Bank plays a role in reducing the inshore wave energy. This was demonstrated in various BEEMS reports (also synthesized in Volume 2, Appendix 20A of the ES [APP-312]) on the historical bank variability and in wave modelling. They show that wave energy dissipation is important for larger storms. However, SZC Co.'s view of the linkage between the bank and shoreline response has become more nuanced as data collection and modelling has increased for several reasons:

• The banks crest varies in elevation by over 4 m, which means that some sections will have little effect on waves, even during severe storms.

• As the bank is far from shore (around one kilometre) wave refraction and diffraction processes even-out the wave energy, spreading it more evening along the shore

• Closer to the DCO application, and in particular during the EGA, it became clear that the shoreline behaviour is incoherent and shows no clear linkage to the form of the bank.

Despite these complexities, the uncertainty around the bank and its role in shoreline change is accounted for by excluding it from the BEEMS Technical Report TR545 'Beast from the East' storm modelling [REP3-048] (by virtue of the model boundary being inshore of the bank but with wave conditions offshore of the bank applied to the boundary), to obtain worst-case storm erosion rates.

(iv) Degradation of the Sizewell-Dunwich banks would not have an impact on extreme still water levels and therefore would not increase the risk of inundation to the landward side of the main development platform. Wave overtopping of the existing coastal defences and further wave propagation behind the existing Sizewell A and Sizewell B stations would result in wave energy dissipation, and the wave action at the landward side of the main development platform would therefore not be significant. As discussed in point (ii), the impact of the degradation of the offshore sand banks on the nearshore wave conditions and overtopping of coastal defences has been considered as part of the Coastal Modelling Report (Appendix 1 of the MDS FRA [APP-094]) showing that degradation of the banks would not increase the wave height nearshore, south of the Sizewell C frontage.

On that basis, SZC Co. concludes that degradation of the Sizewell-Dunwich banks would not increase flood risk to the proposed development."

My response:

The Applicant states that *during the DCO application* it 'became clear' that the shoreline behaviour shows no '*clear linkage to the form of the bank'*. This represents a somewhat precipitate change in assessment that, in my view, lacks credible consideration.

Were we, however, to accept the Applicant's recent change in assessment that the shoreline behaviour is 'incoherent' then would this not represent an untenable risk scenario?

The Applicant's claim that TR545 modelling satisfies the '*uncertainty around the bank and its role in shoreline change*' by '*by virtue of the model boundary being inshore of the bank but with wave conditions offshore of the bank applied to the boundary'* is not valid in my opinion, for the following reasons:

TR545 is confined by its defining parameters which also make it unsuitable for wider consideration:

1) The choice of storms modelled (moderate to low wave heights and water levels).

2) The use of mid-range climate change sea level rise.

3) No regard for storm surge in the BofE modelling (and only a very limited consideration in other modelling).

4) Limited scope in not considering the impacts of northern coastline breaches.

5) An unsupportable reliance, in my view, on treating offshore wave attenuating geomorphology such as at least the inner and outer longshore bars as ‘immutable’— i.e., permanently resilient. The alongshore bars will have a marked effect in preventing erosion from more modest storms such as the BofE and, could change or be lost in event of an absent Dunwich bank.

The limited and ‘particular’ nature of TR545 modelling, in and of itself, could be acceptable. However, the meaning of TR545 needs careful consideration; TR545’s claims to conservative (precautionary) modelling are, in my opinion, mainly misplaced as shown in my document REP7-220 *and particularly so if such claims are contextualised to be representative of overall flood and erosion risk modelling of the proposed Sizewell C.* This is more fully covered in my document REP7-220.

The Applicant states *that “Degradation of the Sizewell-Dunwich banks would not have an impact on extreme still water levels and therefore would not increase the risk of inundation to the landward side of the main development platform…and the wave action at the landward side of the main development platform would therefore not be significant.”*

My Response:

That the banks would not have an effect on extreme still water levels is agreed; that wave action on the landward side of the nuclear platform would not be significant assumes a reliance and control of shoreline erosion for the lifetime of the installation. This is not a given.

The more immediate difficulty is erosion of the shoreline north of the proposed Sizewell C in and around the Minsmere levels. The partial loss of Dunwich bank and/or the inner and outer longshore bars could result in increasing water volumes caused by wave action inundating these marshlands that are contiguous with the Sizewell levels on the landward side of the main nuclear platform. This is not accounted for in the FRA that I am aware of. This is covered in my main document REP2-393.

The Applicant concludes with the statement that the ‘*degradation of the Sizewell- Dunwich banks would not increase flood risk to the proposed development*.’ I do not regard this as a supportable premise for reasons given above and, in my papers REP2-393, REP5-253.

Part 2 - Responses to REP7-059 (Comments at Deadline 7 on Submissions from earlier deadlines and subsequent written submissions).

EN010012-007044-Sizewell C Project - 9.73 Comments at Deadline 7 on Submissions from earlier deadlines and subsequent written submissions. Page 12-14

The Applicant states:

“7 STABILITY OF THE SIZEWELL – DUNWICH BANK

7.1.1 For the present: the Suffolk Coast of the Sizewell Bay is acknowledged to be an eroding shore, however, the shoreline in front of the Sizewell power stations including the Sizewell C frontage is by comparison somewhat stable. This is because of the shape of the coastline, sediment movement in the Bay and the coralline crag outcrop at Thorpeness which acts as a 'hard point' and helps to stabilise the southern part of the Bay. Sand movement locally is southerly, it then reaches the crag outcrop and is funnelled offshore to the southern end of the Sizewell Bank. The southern end of the Sizewell Bank is anchored in a stable position at the north-east corner because of the stable tidal circulation and redirection of sand to the bank caused by the rocky coralline crag outcrop. The Sizewell-Dunwich Bank complex is slowly rotating anti-clockwise, owing to shoreward movement at its northern end. The Sizewell Bank (and, to the north the Dunwich Bank) serves to provide some shelter from very large storms and thus helps to mitigate erosion."

My response: The points stated above are in contradiction with those stated earlier—the Applicant states above in [REP7-052] (point 7 on page 4-5 above) the converse argument that, "… *it became clear that the shoreline behaviour is incoherent and shows no clear linkage to the form of the bank."?*

It is also important to note that the Sizewell-Dunwich banks protect the inner and outer longshore bars which do have a marked effect on moderate and low-level storms and hence shoreline erosion.

The Applicant states:

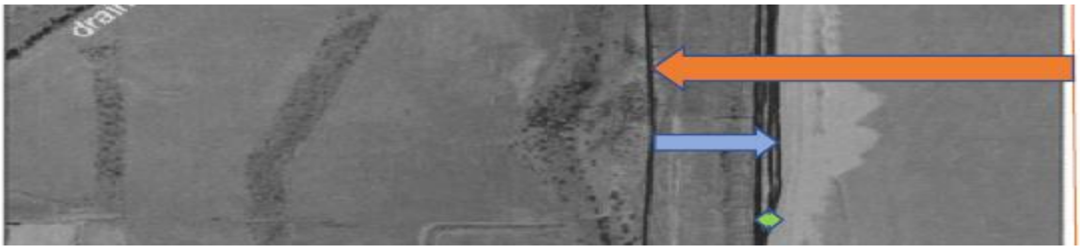
*"7.1.2 However, the assessment has not assumed that this present case is fixed. Up-to-date assessment of bank dynamics over varying timescales up to centuries was presented in considerable detail in BEEMS Technical Report TR500 which contributed to the system conceptual model developed in **Volume 2 Appendix 20A of the ES** [APP-312]. Modelling has been carried out to examine the potential for significant reductions in bank height (reduction in sheltering, including complete removal of the bank for wave modelling and propagation of offshore waves inshore of the bank for **BEEMS Technical Report TR545** [REP3-032]). Modelling illustrates that changes in the bank are just one factor in a complex system and the affect of bank elevation changes on inshore wave energy is not a simple match to erosion or accretion. These changes do not, however, affect the fundamental impact of Sizewell C infrastructure on longshore processes."*

My response: I have not found evidence that the major episodes in coastal change listed below have been fully evaluated in the DCO documentation:

1. Erosion 1736-1836: The Sizewell shoreline between 1736 and 1836 is the ***'most eroded shoreline on record'*** according to EDF in BEEMS TR058. It appears that the 1836 shoreline had eroded approximately 300m in one century to just 20m seaward of the present-day Sizewell B. The orange arrow represents this period. See section 2.

2. Accretion 1836-1920: **The Sizewell-Dunwich bank grew after 1824 and protected the shoreline**; between 1836 and 1920 the Sizewell shoreline accreted 80-90m to roughly its present location. The present shoreline is therefore notably 'soft and erodible'. See section 2. The blue arrow represents this period.

3. Stability 1920-2000: **1920- present day**, relative stability. The green double arrow represents this period. See section 2 for the full chart shown below.



In my opinion, no one episode is more important than another; all must be fully considered.

The Applicant states:

"7.1.2 "…Natural changes in bank influence on inshore wave climate will therefore not alter the scale of the direct impacts in the nearshore."

My Response: This final premise is not coherent with historical precedent and academic research as stated earlier and is contradicted by the Applicant in 7.1.1 where it states that the banks '*help mitigate erosion*'.

The Applicant states:

"7.1.3 Parts, but not all, of the Sizewell-Dunwich Bank will affect inshore wave energy during severe storms; but the bank itself has less energy reducing capability on the more common moderate storms, which make up most of the energy at the coast. This is not to say that large, rare storms are not important – they have particular relevance for other topics, like flood risk assessment and safety case, and over several decades into the future, such events may stimulate erosion and roll-back of the Minsmere Shingle Ridge."

My response: Agreed. However, large storms cannot be regarded as rare during the timescale of the lifetime of the plant and the uncertainties of climate change. Also, the Sizewell-Dunwich banks protect the inner and outer longshore bars that do have a marked effect on more moderate and light storms. The loss of part of the Sizewell-Dunwich banks will very likely cause a breakdown in sections of the inner and outer longshore bars which, in turn, will lead to accelerated shoreline erosion.

The Applicant states:

"7.1.4 The role of the banks would be to increase or decrease inshore wave energy subject to how deep or shallow it is, speeding up or slowing down these processes. The depth of water over banks will vary with sea level rise, sand supply (that originates from cliff erosion along the 20 km frontage north of Sizewell C), and coastal processes that shape the bank."
"7.1.5 Cliff erosion, and therefore supply of sediment, is expected to increase with rising sea levels i.e., the available length of cliff available to be eroded will rise. Sand in the subtidal nearshore moves south under tidal currents and waves, along the subtidal longshore bar sand transport corridor. The sand and the bars are highly mobile, bypassing engineering structures that protrude into the nearshore, namely Southwold Pier, the harbour jetties at the mouth of the Blyth, the Minsmere Sluice outfall pipe and the SZB outfall."
"7.1.6 The Thorpe Ness headland, north of Thorpeness village, represents the southern boundary of the sediment cell (the sediment cell boundaries along this coast are defined by geological or engineered barriers to sediment transport and exchange). Sand transport is deflected offshore on the

north side of the Thorpeness headland by the coralline crag ridges and the persistent tidal flows. Hence the regional longshore sand transport feeds the bank system."

> My response: Sand supply cannot be guaranteed. This is acknowledged in BEEMS TR223: "*The last 2 to 3 decades of strong erosion at Dunwich were not matched by ongoing accretion in the south*." BEEMS TR223 Table 12, shows net erosion of the Sizewell C foreshore since 1993.

The Applicant states:

"7.1.7 Recent changes to Dunwich bank are seemingly creating a wide sand platform which continues to absorb wave energy; merging of banks landward would increase (not reduce) shoreline protection and reduce the potential for Sizewell C to have significant impacts on coastal processes. Alternatively, lowering of the protection afforded by the bank (by some other, unknown mechanism for loss of sediment mass) is likely to be one of the drivers for increased erosion of Dunwich cliffs, leading to a general increase in sediment availability within the regional system feeding sediment southward toward Sizewell. Since transport rates generally decline toward Thorpeness, both pathways to bank lowering would indicate no likely future shortfall in sediment availability within the system which would prompt accelerated erosion within the Sizewell sub-bay. Even so, subject to spatial patterns in longshore transport, any bank reconfiguration leading to shoreline recession adjacent to Sizewell C could increase (or decrease) the maintenance requirement on the SCDF. This has been taken into account through very conservative steps used to model and assess the performance of the SCDF in ***BEEMS Technical Report TR545*** *[REP3-032] and* ***BEEMS Technical Report TR544*** *[REP3-048]."*

> My response: The Applicant states that '*lowering of the protection afforded by the bank (by some other, unknown mechanism for loss of sediment mass) is likely to be one of the drivers for increased erosion of Dunwich cliffs'* is not, in my view coherent. The loss of Dunwich bank would cause accelerated erosion of the Sizewell Minsmere foreshore, not Dunwich cliffs.
> I disagree that TR545 represents 'very conservative' modelling. See point 7, pages 4-5 above and my document REP7-220.

The Applicant states:

"4.1.2 Several IPs suggest that erosion 1736-1836 was considerably faster than any period since (Pye and Bott, 2005). However, on the basis of a systems dynamics approach advocated by the IPs, the application to impact assessment is limited. The system conditions prompting erosion in 1736-1836 do not pertain in the present day. Pye and Blott (2005) describe a large Broad prone to frequent freshwater flooding (prompting installation of the sluice 1810-1830, and drainage such that the Broad identity is effectively lost by 1890). This phase of erosion ended with the sluice and was partially reversed in the 20th Century. Given this, it makes no sense to emphasise data from this period."

> My response: The Applicant's claim that the '*system conditions prompting erosion in 1736-1836 do not pertain in the present day*' needs further detail and explanation. The acute 1736-1836 erosion episode appears to have ended with the development of the Sizewell-Dunwich banks to the north, what is now called the Dunwich bank. Its loss therefore might reasonably return the shoreline erosion to a similar level of erosion.
>
> There is no documentary evidence that the drainage of the Sizewell belts occurred to the south at Sizewell Gap but certainly we know that by 1783 the area drained northwards

(accredited source Pye and Blott, 2005) and therefore the wetlands to the north do not appear to have a clear link with the acute erosion experienced along the shoreline at Sizewell itself.

The phase of severe erosion also appears to have ended *prior to the building of the sluice* in 1810-30 as Hodskinson's map of 1783 indicates. Minsmere sluice may have aided the accretion period after 1836 but in my view the end of the acute erosion period and the start of the accretion period coincides, as stated, with the development of the Sizewell Dunwich banks as is shown in my paper REP2-393.

There is, therefore, in my opinion, much merit and 'sense in emphasising', not just the erosion period but *each of the three main episodes of coastal change* that have occurred at Sizewell from 1736 to the present day. In my view a study that will illustrate the indispensable role of the Sizewell-Dunwich banks to nuclear shoreline stability and security.