Environment Agency
c/o The Joint Programme Office
New Reactor Programme
4S.2 Redgrave Court
Merton Road
Bootle
L20 7HS

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For the attention of the [redacted] Sizewell C Lead Regulator, Environment Agency

Dear [redacted]

FOR INFORMATION: UPDATE ON THE TAISHAN NUCLEAR POWER PLANT

In July 2021, the Taishan Nuclear Power Plant (Taishan NPP) had to shut down Unit 1 of its two EPR™ reactors as a precautionary measure due to a detected increase in radioactivity in the primary coolant, believed to be associated with failed fuel. It is noted that at no point did Taishan NPP exceed its operational radioactivity limits within the reactor circuit.

Given the large number of fuel rods within a nuclear reactor, and the environment they operate in, minor damage to fuel cladding is not unusual. The EPR™ reactor and auxiliary systems are designed to operate safely, whilst protecting the environment, even in the event that such damage occurs; which includes deployment of diverse and effective treatment and containment systems.

Following investigations by Taishan NPP and Framatome (the fuel manufacturer) the root cause of this issue was identified, a summary of which has been provided in the attached (Letter from Framatome to Sizewell C Date 28th April 2022 subject to further review and technical exchanges).

As a learning organisation NNB Generation Company (SZC) Ltd is committed to learning from the experience of the wider EPR™ fleet. We will ensure that communication remains open between us and other EPR™ or Pressurised Water Reactor (PWR) reactor operators, in the UK and abroad e.g. through membership within the EPR Owners and Operators Group (EPROOG), so that lessons learnt from the Taishan issue can be shared across the international nuclear generation community. Worldwide fuel performance, as reported by the World Association of Nuclear Operators (WANO), will be continually monitored so that measures are put in place to ensure satisfactory fuel performance at both HPC and SZC.

Yours sincerely,

[redacted]

Head of Environment, Decommissioning and Radiation Safety
NNB Generation Company (SZC) Limited

NNB GenCo Review	Name	Signature
Peer Check	[redacted]	[redacted]
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Enclosures

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1	SZC Framatome letter – 28042022 – Regarding lessons learnt from TSN1	101000385	001	UK PROTECT	Teamcenter

framatome

[redacted]
Sales & Business Development Director
Projects & Components
Framatome SAS
Tour CB1 – 1 place Jean Millier
92400 Courbevoie- France

[redacted]
Engineering and Delivery Director
NNB Sizewell C
90 Whitfield Street
London
W1T 4EZ

28 April 2022

Dear [redacted]

By your email dated 22 March 2022, you asked Framatome to provide information summarising the position on the lessons learned from Taishan 1 (TSN1) fuel issues, explaining why, as the technology supplier, Framatome is confident that the Sizewell C (SZC) nuclear reactor will operate safely. Please find below the requested information already shared with you by email dated 31 March 2022.

The events observed on TSN1 unit are of two types:

- Leakage of some fuel rods,
- Localized Fuel Assemblies (FA) Grid wear.

It is important to note that, notwithstanding these events, according to the information communicated by the operator (TNPJVC), Taishan plants did at no point in time leave their operating technical specifications and regulation limits.

After the shutdown of TSN1 reactor, the fuel was unloaded and an extensive inspection program was performed on the FAs and their close environment (reactor pressure vessel and internals, primary coolant water chemistry etc.).

The analysis of the results led to an in-depth understanding of the root causes and of the definition of mitigation measures to be applied:

- firstly, to resume operation of TSN1.
- and, secondly, to evolve the fuel product configuration to address each of the events observed. With that respect, it can be emphasized that some of the foreseen improvements are already implemented in the design of HPC FAs.

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Concerning the Leakage of some fuel rods:

The root cause of the rods leakages is associated to fretting against broken grid springs in the bottom part of the FAs. The failure of the springs is due to Irradiation Assisted Stress Corrosion Cracking (IASCC) phenomenon. This is a localized phenomenon, which only concerns a limited number of assemblies. This phenomenon is well-known since it has already occurred and has been observed on PWRs including some of the French fleet.

In order to remedy IASCC of the springs, Framatome has developed a specific heat treatment encompassing a low temperature final annealing. This enhanced heat treatment is already implemented in the design and manufacturing process of the FA for HPC.

Framatome recommends also using High Mechanical Performance (HMP) end grids and Robust Fuel Guard (RFG) bottom nozzle to further decrease the risk; these components are largely used on PWRs including Sizewell B and the associated operational experience is very satisfactory.

Therefore, it is considered there is no more risk of IASCC or springs failure. No further recommendation is to be considered for HPC and SZC

Concerning the Localized FA Grid wear:

Inspections carried out on the unloaded FAs have revealed a localized phenomenon of wear of a very limited number of FA grids outer straps against the heavy reflector (metal envelope surrounding the core). No damage was observed on the fuel rods, and it has been demonstrated that the structural integrity on the FAs in all conditions was not impaired

This wear phenomenon is linked to the combination of a relative movement of the FAs against the heavy reflector associated with a contact between the grids and the heavy reflector. To limit the grid wear, Framatome propose to increase the lateral stiffness of the FA (for instance, by using thickened guide tubes – modification which is already considered for HPC fuel) and to specify an appropriate management of the fuel assemblies. With these preventive measures, the risk for a similar abnormal grid wear on HPC FA is expected to be very low. And a safety risk can be discarded.

In addition, and as already observed on some PWR under specific conditions, enhanced corrosion has been observed on the uppermost span of some fuel assemblies. The French fleet OPEX has been recently shared with NNB and the ONR, apart from the TSN issue. This phenomenon is linked to the combination of susceptibility of the cladding material to corrosion, specific operating conditions at the top of the fuel rods and primary coolant chemistry. A reliable remedy is to increase the iron content of the cladding above 450 ppm. It is already considered in the HPC FA specification.

Therefore, it is considered there is no more risk of enhanced corrosion. No further recommendation is to be considered for HPC and SZC.

As a conclusion, the root causes of the events met on some fuel elements on TSN1 reactor are understood and mitigation measures have been defined for each.

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Some of them are already considered in the design of HPC FA; most of them being proven solutions.

SZC will benefit of all these measures and satisfy the replication principle.

Yours sincerely