Together Against Sizewell C

Sizewell C [SZC] DCO

TASC's [IP no. 20026424] response to Appendix 2 of SZC Co's May 2022 response regarding TASC's observations on fish matters

SZC Co's response: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-010913-SZC%20-%20Appendix%202%20-%20Response%20To%20TASC%20Submission%20in%20relation%20to%20fish.pdf

Role of Cefas

SZC Co in para 1 refer to Cefas's role in the DCO process and that they operate under the guidance of the Civil Service code from which we quote:-

- *'integrity' is putting the obligations of public service above your own personal interests*
- *'honesty' is being truthful and open*
- *'objectivity' is basing your advice and decisions on rigorous analysis of the evidence*
- *'impartiality' is acting solely according to the merits of the case and serving equally well governments of different political persuasions*

Cefas's website includes comments such as *"Our work tackles the serious global problems of climate change, marine litter, over-fishing and pollution to secure a sustainable blue future for all."* And "*Tackling the serious global problems of climate change, biodiversity loss and food security to secure a sustainable blue future for all."*

SZC Co's aim is to obtain maximum return for its investment by maximising profitability from the SZC project.

In TASC's opinion, Cefas's role compromises both the applicability of the Civil service code and the aims that it quotes on its website. We know from a previous FOI request [FOI 566] that during the years 2015-2018 Cefas received over £17.5 million for work carried out for EDF on the Hinkley Point C [HPC] and SZC projects. Cefas subsequently refused TASC's FOI request for equivalent figures for later years which, to TASC, suggests that Cefas may be embarrassed about how reliant its operation has become on income from EDF. TASC do not consider that Cefas, in common with other government agencies, will have been immune from the lack of government funding for its operations, so we suspect that many of the jobs within Cefas have become totally reliant on the income it has received from EDF. TASC consider that this suspected reliance on EDF's income is likely to have unintentionally compromised Cefas's ability to operate objectively and with impartiality. After all, it cannot be said that, in any way, the SZC project is going to enhance the very marine environment that Cefas are charged to protect: SZC will pollute and warm our seas with chemical and radiological wastes as well as through the discharge of an undefined volume of dead/dying

marine biota. There can be no dispute that SZC's cooling water system will cause biodiversity loss, in complete contradiction to Cefas's stated aims.

TASC's lack of confidence in Cefas's involvement in the SZC DCO is highlighted by some examples: (1) TASC prepared the estimated impingement levels for SZC based on Appendix C: *'Predicted Sizewell B Annual Impingement from 2009-2013 data'* of DCO document *'6.3 Revision: 1.0 Applicable Regulation: Regulation 5(2)(a) PINS Reference Number: EN010012 Volume 2 Main Development Site Chapter 22 Marine Ecology and Fisheries Appendix 22D - Sizewell Characterisation Report – Fish'* {APP-321}. [TASC calculations can be found at Annex B to TASC post examination document *'Post D10 comments on Sizewell C DCO submissions in relation to adverse impacts on the marine environment'* (https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-010784-TASC%20-%2018%20March%202022.pdf)]. We are now told in para 2.1.14 of SZC Co's response that the figures shown in the DCO application on which we based our calculations was not properly labelled as effectively a 'worst case scenario'. TASC consider that by applying the precautionary principle it is quite reasonable to consider the maximum damage possible based on previous experience. If the summary we used was not adequately explained, it begs the question of how many other schedules were not properly presented. SZC Co make the point that the impingement of Sea Bass at Sizewell B was particularly high in 2010 so this skewed the numbers to show a higher figure than the mean levels shown over a longer period of time. TASC contend that impingement of Sea Bass in subsequent years may have been lower due to the mortality caused by Sizewell B in earlier years. TASC note the concerns expressed by the Environment Agency (EA) [see their letter of 12th October, reference comments on 'Section 1.2.2 and Figure 1' and 'Table 2'- REP10-187] as to the poor state of Sea Bass stocks at the current time, so this adds weight to taking a precautionary approach. (2) TASC note that the Environment Agency, in their letter to Gareth Leigh dated 14th April 2022, have pointed out (ref. para 5.2) that Cefas had ignored their advice that smelt had been found in the River Blyth. (3) Despite SZC Co's reference to the head shape of certain fish and the implications this has on a fish's propensity for passing through a 10mm square mesh, it is clear that Cefas overlooked the implications for fish passing through the mesh on the diagonal when they looked at the matter of fish entrainment.

TASC remain extremely concerned about Cefas's role as a SZC Co's paid promoter of the SZC development, rather than as a government advisor.

TASC response to Appendix 2 of SZC Co's submission to BEIS

General

TASC do not consider the need to repeat our/Dr Henderson's previous observations about the damage that SZC's cooling water system will have on the marine environment, except to say that we still hold the same opinion despite what SZC Co/CEFAS say i.e. that hundreds of millions of fish and larvae will be killed each and every year of SZC's targeted 60 years of operation. It is clear there is great uncertainty about the scale of the mortality of fish and other marine biota due to entrainment, not least because SZC Co's estimates are largely based on records from SZB, and we know SZB does not fully record entrainment at SZB due to reliance on use of a pump sampler which does not sample small or long thin fish that pass through the mesh screens. TASC also remain of the opinion that reference to EAVs and comparison to ICES stock levels is purely a smokescreen to hide the numbers of fish affected.

TASC note with incredulity, that Appendix 2 makes numerous references that effectively imply that, as lots of the fish will die anyway, those killed by the SZC cooling water system does not present a problem. Such references are in: para 1.1.2 regarding sea bass *"entrainment losses of early life-history stages from the station are dwarfed by very high rates of natural mortality in this species."* : para 1.1.3 *"The majority of these juveniles would never survive to maturity (and reproduce) owing to very high rates of natural mortality."*; para 1.2.3 *"high rates of natural mortality mean these early life stages have a low probability of reaching maturity."* ; para 2.1.3 "*Due to the very high natural mortality of early life stages of sea bass, the relative population effects of any feasible underestimates of losses of these stages is minor."* [TASC Note: as no detailed records of small fish entrained by SZB are available, TASC question SZC Co's assertion that there are low numbers of sea bass, or any other species, vulnerable to entrainment]; para 3.1.1 *"any underestimation of these small size classes would have minor effect on the results, as demonstrated in Section 1.1 due to the low relative EAV."* ; para 3.1.14 *"High natural mortality of juvenile pipefish means in reality, few juveniles would survive to maturity."*; para 3.1.16 re flatfish *"Very high natural mortality of these early life stages means the equivalent adult losses are predicted to be low".* These statements by the Applicant that the death of millions of juvenile, small, and long, thin fish as well as fish larvae, are of no consequence, ignores their importance as a food source for predators and also ignores the fact that natural mortality through circumstances such as starvation, means that an important part of the ecosystem, e.g. dead fish laying on the sea bed, is unnaturally removed, thereby negatively impacting on the natural food chain and biodiversity.

TASC note that the applicant has agreed a deed of covenant with the Environment Agency [REP10-088] which includes the statement *"The construction and operation of the nuclear power station is likely to have an adverse effect on the populations of eels and migratory fish in the locality"* and *"SZC Co will pay a financial contribution towards the carrying out of mitigation measures to reduce any such adverse effect, such contribution will be made pursuant to the Principal Deed".* The deed then advises that the contribution is £500,000. It is TASC's opinion that the size of financial compensation supports our contention that there will be substantial damage to the marine environment (eels and migratory fish being just a part of this) and that this damage has implications for protections under the Water Framework Directive (WFD).

<u>Discharge of biota</u>

With reference to the WFD and the shadow HRA, the Applicant has stated in section 1.4 of this response 'Discharge of biota', that there are not expected to be any impacts from the discharge of biota. TASC do not consider this position adequately considers the impact of biofouling of the intake tunnels, particularly resulting from outages. TASC have asked marine ecologist, Dr Peter Henderson, to consider this aspect and he has prepared a short report *'Estimation of the weight of fouling organisms in the intake system at the proposed Sizewell C nuclear power station'* which is included at Annex A to this document. The conclusion states ***"In conclusion, when the culverts become heavily fouled, the total biomass of fouling organisms present could reach 4,000 tonnes by the time of the 18-month planned shutdown. This huge mass of dead organisms will generate an appreciable biological oxygen demand as they decay. This upper limit should not be viewed an extreme upper estimate as large culverts have in the past been fouled with far higher biomass of mussels and other molluscs per unit area than has been assumed here."*** TASC do not consider the environmental implications of this toxic outfall at each outage has been adequately addressed or taken into consideration when considering the alternative use of cooling towers instead of a direct/once-through cooling water system.

Cooling Towers

Para 1.5.3 of the Applicant's response is quite telling with its comments relating to consideration of cooling towers as an alternative cooling system. Firstly, the Applicant refers to their 'Alternatives' document APP-190, specifically paras 6.6.21-6.6.27, mentioning the Environment Agency criteria relating to cooling systems. TASC assume the Applicant is actually referring to paras 6.2.21-6.2.27 and will continue on that assumption. Para 6.2.24 is worth quoting: *"The Environment Agency (Ref. 6.5) states that direct cooling can be acceptable in coastal locations if three conditions are met:*

- *extension of heat plume in the surface water leaves passage for fish migration;*
- *cooling water intake is designed aiming at reduced fish entrainment; and*
- *heat load does not interfere with other users of receiving surface water."*

With regard to the second bullet point, para 6.2.25 then includes this statement *"The Sizewell C cooling water system has been designed to minimise environmental impacts on fish and other marine biota by means of the siting of the intake and outfalls, the specially designed Low Velocity Side-Entry intake head and the Fish Recovery and Return system."* This statement is clearly incorrect, as the cooling water system design proposed for SZC does nothing to reduce fish **entrainment** as the measures quoted are all designed to reduce fish 'impingement'. As stated by TASC on many occasions, the Applicant does not have a clear picture of the number of fish that SZC will entrain anyway.

Secondly, TASC wish to advise the Secretary of State that the EA criteria is set out in the EA's document *'Cooling Water Options for the New Generation of Nuclear Power Stations in the UK'* published in 2010 (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291077/scho0610bsot-e-e.pdf). In para 1.2 it states, as part of the background, *"The Government is committed to allowing the construction of new nuclear power stations provided they are subject to the normal planning process for major projects (under a new national planning statement) and* ***provided also that they receive no public subsidy*** [emphasis added]" and *"A Strategic Siting Assessment of potential sites for nuclear new build has been carried out using exclusionary and discretionary criteria which were consulted upon publicly. This included a criterion on access to suitable sources of cooling."* The first sentence quoted, highlights the change in circumstances since the EA document was published, as SZC is slated to receive public support via the RAB funding model and direct public ownership. The second sentence then highlights SZC's lack of potable water supplies that will be needed for cooling during the proposed 60 years of operation, a clear failure of any 'Strategic Siting Assessment'. This EA guidance is clearly out of date, and this was recognised by the government, when in 2018 the EA launched a scoping document *'Protection of biota from cooling water intakes at nuclear power stations: scoping study".* This document clearly identified changes that had ensued since 2010 including the increasing awareness of the impact of cooling water systems on the marine environment, the increased awareness of the impacts of climate change and changes in technology. TASC consider it is worth acknowledging that the U.S.A. banned the use of direct cooling water systems in new nuclear plants due to their impact on the marine environment- see https://www.epa.gov/cooling-water-intakes?csModule=security/getfile&PageID=693859 which refers to section 316(b) of the Clean Water Act. TASC also point to the implication of the above matters to reinforce our previous comments that NPS EN6 is out of date, including its references to cooling water systems.

One of the predicted consequences of climate change is rising sea temperatures and it is recognised that this can have implications for the efficiency and effectiveness of a nuclear plant such as Sizewell C that will rely on sea water cooling. TASC do not consider this has been adequately addressed in the Applicant's consideration of the alternative of using cooling towers. TASC attempted to obtain information about the predicted impact that sea water and air temperatures may have on the operation of SZC from the Office for Nuclear Regulation (ONR) who held this in documents supplied by the Applicant as part of their application for a nuclear site licence. It is telling that this information was withheld by the ONR on the grounds of a supposed commercial sensitivity, suggesting that rising sea temperatures will have a negative impact on SZC's operations. This information should be available for public scrutiny.

In APP-190, the Applicant, in para 6.2.26, dismisses the use of cooling towers demonstrating an apparent lack of serious consideration of these as an alternative. The Applicant's comments demonstrate, more than anything else, that the proposed site for SZC is too small, also that it is in the wrong location because of its potential impact on the Suffolk Coast and Heaths AONB.

Conclusion

TASC's review of the impact of SZC's proposed cooling water system has highlighted that there are unknown and unquantifiable negative impacts that it will have on the marine environment. EDF have recently announced that it is planning on applying to extend the life of Sizewell B by up to 20 years. SZC's operation alone is an unsustainable burden on the marine environment so the cumulative impact of 3 nuclear power reactors~~s~~ operating alongside each other for a likely period of 20 years needs far greater assessment than that already considered. The lack of a local source for potable water for SZC's build, 60 years of operation and decommissioning also highlights that SZC is not sustainable, and that the site is not suitable for SZC Co's proposals.

Finally, we refer to the submission made by the Blue Marine Foundation [AS-325] where they highlight the importance of the decision to be made in connection with the Hinkley Point C, Acoustic Fish Deterrent case, including the implications for the Water Framework Directive. They suggested that the SZC examination should not commence until that case has been decided. TASC believe that the Secretary of State is not in a position to make a fully informed decision on the SZC DCO application until the result of the HPC case is published. TASC are concerned that the results of the HPC case are being deliberately withheld because of the bearing it could have on aspects of the SZC DCO application.

ANNEX A

DR PETER HENDERSON REPORT FOR TASC:

Estimation of the weight of fouling organisms in the intake system at the proposed Sizewell C nuclear power station

Estimation of the weight of fouling organisms in the intake system at the proposed Sizewell C Nuclear Power Station

P. A Henderson

Thursday, 09 June 2022

The Risk of Biofouling without chlorination

The protection of the intake structure and the pipework of a plant from fouling by mussels and other organisms often requires the use of anti-fouling agents.

Bivalve animals, especially mussels, can and do settle and grow in cooling systems; their larvae and juvenile stages pass through intake filter screens. Within the system the animals can cause blockages, while detached mussel shells can cause erosion-corrosion in condenser tubes, thereby threatening plant integrity. Historically mussels had to be cleared by hand from culverts on a regular basis. Many coastal power stations control fouling by chlorination. Chlorination products are frequently released into the receiving waters at low levels with the discharge water. Chlorination is important as it will reduce entrainment survival and will kill a high proportion of the bacteria and other micro-organisms present in the intake water.

The Applicant's ES states the following: "**Sizewell is categorised to be a high-risk site in respect of potential fouling by marine organisms (e.g. mussels, tube worm, anemones etc) and low velocities act to enable settlement of the planktonic larvae of these organisms (which then grow into adults and their presence can restrict water flow and potentially block the cooling water system). Consequently, very low flow velocities are not suitable for the Sizewell C intake design. However, a design that is side entry and placed orthogonal to the tidal flow does not affect biofouling risk and so these elements have been retained to mitigate entrapment of marine animals."**

It is clear that the inevitability of biofouling build-up on solid surfaces is accepted and one of the consequences is that a low velocity intake head which would have helped to reduce fish and invertebrate capture is not proposed.

The ES notes that: "**In contrast to the Sizewell B strategy, chlorine would not be added to the system upstream of the Sizewell C drum and band screens.**"

The result is that it is inevitable that the walls of the intake culverts, the fish return system and the drum and band screens will become fouled, and this will have potentially major impacts on both the operation of the plant and also the local environment.

The threat to the power station from biofouling has been dismissed with the simple statement " **the intake tunnels for Sizewell C are very large (6m internal diameter)and are assessed to be capable**

of incurring some fouling without having a significant effect on flow rates (fouling occurs on the walls of cooling water systems but the depth of material that can attach and survive there is finite; the large diameter of the intakes can accommodate a degree of fouling);•in addition to the large diameter, flow rates in the intake tunnels are in excess of 2m/s and at such speeds settlement of fouling organisms is very unlikely; at the drum and band screens, .."

The problem is that it is not the reduction in flow rates that will first impact the power station but the shedding of lumps of biofouling comprising sea squirts, mussels, oyster, barnacles, anemones, tube worms and starfish amongst other organisms. This material will both block and penetrate the 10 mm mesh screens and has the potential to block and cause erosion of condensers and other bits of the plant. The assertion that a velocity in excess of 2 m/s will make fouling unlikely is incorrect. The velocity close to the culvert wall will be less than 2m/s because of boundary effects and once fouling organisms have settled, possibly during periods when pumping rates are low, they will increase the boundary effect and rapidly colonise.

A further problem is that fouling organisms will die when the pumps are turned off. This will generate a large volume of anoxic water which will be discharged to sea.

It is claimed that fouling of the screens will not occur because of high pressure washing. A system of low- and high-pressure washers are used at Marchwood Power Station filter screens in conjunction with the fish return system. The system was found to foul, and they have been forced to install chlorination at the intake in front of the screens. I believe this will also be found to be the case at Sizewell C. A particular area of concern relates to starfish. These are rarely a biofouling problem with short intake tunnels. However, the 3 km intake tunnels create a huge area for starfish to colonise. When they are washed onto screens they attach tenaciously and are hard to wash off. A large starfish ingress occurred when Sizewell B first started operation. The potential for a far more serious problem at Sizewell C exists.

Fouling within the unchlorinated fish return system is inevitable and this will inevitably impact upon its utility and ability to return fish alive to the environment.

Quantification of the problem

1. The 3000 m long 6 m diameter intake culverts will each have a fouled surface area of 84,950 m^2. The total unchlorinated hard surface available to fouling organisms, including the intake head works, screens and fish return system will be around 200,000 m^2.

2. In the ES we are informed that, "**During the 60-year operational life, each reactor unit would undergo refuelling and maintenance shutdowns ('outages') at approximately 18-month intervals. The duration of these outages would vary but would typically be for up to two months.**"

3. Over an 18 month fouling period the typical biomass of attached biofouling (biofilms of microorganisms, mussels, barnacles, limpets, bryozoans, tube worms and ascidians) observed in culverts ranges would be expected to range from 100 g to 1 kg/m^2 depending upon conditions. In addition, the surface will be colonised by starfish and other mobile organisms such as crabs, amphipods and shrimps, the biomass of these motile forms is difficult to estimate, but starfish biomass could become appreciable as this has been

observed to be the case in the past at Sizewell and other power plants situated along the English Channel coast. There have been cases of filter screens becoming fouled when large numbers of starfish detach from culverts and reattach themselves to the rotating drum screens. Their sucker feet hold so strongly that the screen wash fails to remove them. Reasonable assumptions for mobile biomass would be 50g to 1 kg/m^2 depending upon the level of starfish colonisation.

4. The lower estimate of attached fouling organisms is 0.01 x 200,000 kg = 2000 Kg

5. The upper estimate of attached fouling organisms is 1 x 200,000 kg = 200,000 kg or 2000 tonnes

6. The lower estimate of mobile fouling organisms is 0.005 x 200,000 kg = 1000 Kg
7. The upper estimate of mobile fouling organisms is 1 x 200,000 kg = 200,000 Kg

In conclusion, when the culverts become heavily fouled, the total biomass of fouling organisms present could reach 4,000 tonnes by the time of the 18-month planned shutdown. This huge mass of dead organisms will generate an appreciable biological oxygen demand as they decay. This upper limit should not be viewed an extreme upper estimate as large culverts have in the past been fouled with far higher biomass of mussels and other molluscs per unit area than has been assumed here.