Together Against Sizewell C

TOGETHER AGAINST SIZEWELL C (TASC) WRITTEN REPRESENTATION

SIZEWELL C PLANNING APPLICATION INQUIRY (IP no. 20026424)

REVIEW OF POLICY AND NEED

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Contents

Executive summary

TASC conclude that:-

a) Current policy as set out in National Policy Statements (NPSs) EN1 and EN6 is now out of date due to, amongst other things, changes in predictions relating to the impacts of climate change as well as advances and cost reductions in renewables and novel electricity generation technologies,
b) Even if EN1 and EN6 are applied to the SZC project, there are sufficient grounds within these policies for its rejection,
c) There is a need for new sources of low-carbon electricity production, but there are alternatives to new nuclear which do not have the intractable problems of legacy radioactive waste as well as the risks of accidents and malicious attacks. There are also questions over the carbon footprint of new nuclear,
d) As identified in TASC's critical reviews of EN6 volume 1 and the Sizewell Site Assessment at Annex C EN6 volume 2, Sizewell is not an appropriate site for a new nuclear development, therefore the 'need' to build at Sizewell is not established,
e) In respect of claims made by the Applicant that SZC meets the urgent need for new electricity generation, TASC contend that alternatives can be deployed faster and at less cost. Recent government inaction/advice has not provided evidence of any urgency to move new nuclear forward,
f) The IROPI claim for Sizewell C is not made as there is not an imperative need for new nuclear, certainly not a need to build at Sizewell and the public interest claims are undermined by SZC not being able to contribute significantly to the goals of decarbonizing the electricity grid by 2035 nor the 'zero carbon goal' by 2050. The economic case is weak in that SZC will damage Suffolk's existing tourism industry, both short and long term, and local economic activity from the build will be short-lived and disruptive to many other businesses and services. The impact on European sites (as well as other designated sites) and all that entails would not be justified.

Introduction

1. In September 2020, TASC submitted its Relevant Representations to the Planning Inspectorate (PINS) which included the following paragraph relating to Policy and Need which we will build on further in this document: " *(1)* ***The insufficient justification for the proposal****. Whilst SZC is noted within EN-6 as a potentially suitable site, that only applies to reactors deployable before 2025 (EN-6 para.2.2.2). Pursuant to that framework, a DCO was granted for Hinkley Point C in 2013. A new nuclear policy statement (for post 2025 deployment) has yet to be published, following consultation on siting criteria in 2017-2018. It follows that there is no NPS which establishes the "need" for a new nuclear power station post 2025, or the appropriateness of SZC for that purpose, when judged against the reasonable alternatives. To this end TASC will draw attention to the Government's siting criteria in the December 2017 consultation ("Draft Siting Criteria"), as a material consideration pursuant to s.105(2)(c) Planning Act 2008."*

2. In April 2021, the government announced that it was reviewing all energy NPSs including EN1 and EN6. TASC believes this confirms that EN1 and EN6 are no longer fit for purpose and should be revoked until replaced after a thorough public consultation including the review of the need for new nuclear promised by BEIS- see appendix A. TASC lawyer's letter dated 5th May 2021 addressed to the Secretaries of State for BEIS

and Housing, Communities and Local Government refers to TASC's request for revocation of EN1 and EN6.

3. The Applicant's Planning Statement: DCO Doc 8.4 Planning Statement (PS) [APP-590]

TASC's assessment of section 1.7 of the Applicant's PS is that they accept that NPS's EN1 and EN6 do not have legal force as SZC cannot be deployed by 2025 so the DCO application will be considered under s.105 Planning Act. However, they rely on the Written Ministerial Statement (WMS) of 7th December 2017 using the Secretary of state's statements that (i) "*Government is confident that both EN-1 and EN-6 incorporate information, assessments and statements which will continue to be important and relevant for projects which will deploy after 2025*", (ii) "*the Secretary of State would be required, under section 105(2)(c) of the Act, to have regard to the content of EN-1 and EN-6, unless they have been suspended or revoked. In respect of matters* ***where there is no relevant change of circumstances*** *it is likely that significant weight would be given to the policy in EN-1 and EN-6" (emphasis added)",* and (iii) "*The new NPS, once designated, will "have effect" for the purposes of section 104 of the Act for development which forms parts of a project able to demonstrate expected deployment after 2025 and before the end of 2035. The Government also considers that a published new NPS in draft form would be considered as relevant to a decision on whether or not to grant development consent under section 105 of the Act."*

TASC's position

4. TASC agrees that EN1 and EN6 no longer have legal force for considering the SZC DCO application as SZC cannot be deployed by 2025. However, if PINS are minded to be guided by EN6, TASC have completed critical reviews of EN6 Volume I (appendix B) and EN6 Volume II Annex C Sizewell Site Assessment (appendix C) and these highlight policies where we question SZC's ability to meet the requirements set out, as well as identifying policies that should now be considered out of date. With regard to the WMS we comment on the three quotes as follows:-
5. "*Government is confident that both EN-1 and EN-6 incorporate information, assessments and statements which will continue to be important and relevant for projects which will deploy after 2025*"
    a. TASC consider that this statement ignores the fact that many of the assessments and statements referred to in EN1 and EN6 are over a decade old, outdated and no longer relevant, as identified in appendices B and C attached, with the main reasons identified being: material changes in climate change forecasts resulting in the predictions of accelerated sea level rise, increased storm surges and more extreme weather events; the scale of the development changing significantly since the Sizewell Site Assessment was carried out; significant reductions in the cost of alternatives; greater availability of low carbon alternatives.
6. "*the Secretary of State would be required, under section 105(2c) of the Act, to have regard to the content of EN-1 and EN-6, unless they have been suspended or revoked. In respect of matters* ***where there is no relevant change of circumstances*** *it is likely that significant weight would be given to the policy in EN-1 and EN-6" (emphasis added)."* TASC are of the view that there has been 'a relevant change in circumstances' for reasons that include the matters referred to in (i) above, but which are explored further in the paragraph headed 'Relevant change of circumstances' below. Therefore, TASC contend that little, if any, weight should be given to EN1 and EN6.

7. "*The new NPS, once designated, will "have effect" for the purposes of section 104 of the Act for development which forms parts of a project able to demonstrate expected deployment after 2025 and before the end of 2035. The Government also considers that a published new NPS in draft form would be considered as relevant to a decision on whether or not to grant development consent under section 105 of the Act."*
8. TASC make two critical comments regarding this extract from the WMS regarding the relevance of any draft EN6:-
   The reference to the new NPS says it will relate to projects deployable by 2035. As the 2020 energy white paper referred to the possibility of a Final Investment Decision by the end of this parliament, i.e. 2024, and nuclear projects have a history of time slippage, it is quite possible that, even if it were decided to approve the SZC project, the 2035 deadline will not be met. It is relevant here to mention that the Olkiluoto and Flamanville EPR construction projects are both running more than a decade late and are still not operational despite building work starting in 2005 and 2007 respectively. The Hinkley Point C EPR project has already announced delays and with over 300 Assessment Findings from the EPR GDA review by the ONR, further delays cannot be discounted.

   We also note that in the Local Impact Report submitted by Suffolk CC and East Suffolk Council, the AECOM Rail Proposals report of September 2020 says, "*SCC has commissioned AECOM to provide an independent view on whether the strategy proposed by Network Rail is appropriate and deliverable within <u>EDF's timescales to begin construction in 2025</u>."* (Emphasis added)

9. Given the nature of changes TASC refer to in (i) above, any draft NPS that still needs parliamentary approval should not have legal force, as parliamentary scrutiny may well result in the draft policies being amended.

   For these reasons, TASC believe that a new EN6 that relates to deployment by 2035, whether in draft or final form, would not support the SZC project. Additionally, many of the provisions in the government's consultation response document leave criteria that TASC consider should be treated as 'Exclusionary', rather than 'Discretionary'- see TASC's response to the consultation at appendix D, which concludes that, in our opinion, Sizewell should be excluded from the list of potential sites.

<u>Relevant change of circumstances</u>

10. As mentioned in paragraph (i) above, there have been significant changes in matters affecting the assessment of the SZC project, some of which are explored here:-

    <u>Material changes in climate change forecasts resulting in the predictions of accelerated sea level rise, increased storm surges and more extreme weather events</u>.

    EN1 and EN6 were developed at a time when the UK's governing climate forecasts were included in UKCP09, but these have now been replaced by UKCP18 which contain worsening predictions of the impacts from climate change. There are also a growing number of subsequent announcements of more warnings regarding rising sea levels. EN6 policies affected by climate change have been identified in Appendices B and C.

The scale of the development changing significantly since the Sizewell Site Assessment (SSA) was carried out.

TASC note the Appraisal of Sustainability(AoS) for the Sizewell site carried out 2008 to 2010 when EN6 was first introduced, says in The Summary of Key Findings on page 5, that "*This site report for Sizewell has helped to inform the decision-making for the SSA*" :-

Table 1.2, 'Table of Base Case Assumptions and Variations Considered for Sizewell', contains the following data (in black) after which we have shown (in blue print and in brackets) corresponding data from the SZC DCO application:-

a. No. of reactors: at least one (two)
b. Construction period: 5-6 years (10-12 years, but 12-14 years including relocation of Sizewell B facilities)
c. No. of construction workers: approx. 4,000 (max 8,500)
d. of which local: 50% (38%)

11. According to Table 6.1 'Summary of Significance of Potential Strategic Sustainability Effects' on page 55 of the AoS, the review identified that there were significant sustainability issues with a potential SZC project. As can be seen from the paragraph above, the project now proposed would be far bigger than that assessed so it is reasonable to assume the potential adverse impacts would increase proportionately. Indeed, the site assessed in EN6 was 117 hectares whereas the SZC main development site shown in the DCO documents is 371.7 hectares. However, based on the smaller site size and smaller development originally assessed, the AoS still highlighted these potential issues:-
    a. Para 5.10 *"There is the potential that activities may lead to detrimental effects on, and displacement of, important bird populations associated with the Minsmere-Walberswick SPA and Ramsar sites and Sizewell Marshes SSSI. This may include visual and noise disturbance from general construction and operation site activities, plus potential impacts from construction traffic and site lighting."*
    b. Para 5.65 *"There is potential for some long lasting adverse direct and indirect effects on landscape character and visual impacts on the Suffolk Coast and Heaths AONB, a nationally recognized landscape, with limited potential for mitigation."*
    c. Para 6.6 "*There are also potential adverse effects on at least five nature conservation sites of UK and European importance, including Minsmere to Walberswick Heaths and Marshes, Sizewell Marshes, Leiston-Aldeburgh SSSI, the Outer Thames Estuary, and the Alde-Ore Estuary; and effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling. There are existing sand and shingle flood defences in place, which may require upgrading to protect the site for the full lifetime of a new power station, which may have potential effects on erosion and visual appearance of the coastline. These effects could be significant."*
    d. The only major positive contribution anticipated in Table 6.1 was in respect of helping the UK meet its carbon reduction targets, but we now know that by the time SZC is deployed and has paid back the 6.2 million tonnes carbon debt from construction (if it ever does), it will make very little contribution towards carbon zero by 2050- see Stop Sizewell C report, 'How much carbon would Sizewell C save?', April 2021.

12. Significant reductions in the cost of alternatives

a. When EN1 and EN6 were introduced and government energy policy decided over a decade ago, the cost of renewable sources of electricity generation were seen as prohibitive. However, costs have dropped significantly over the last 10 years and are predicted to continue falling as is illustrated by the following extract taken from Paragraph B.1, page 3 of Jonathon Porritt's report, 'Net Zero without Nuclear' (attached at appendix E):

b. *"Every year, the investment bank Lazard produces a comparison of generation costs on what is known as a 'LCOE' methodology – Levelized Cost of Energy. Its 2020 estimates for relative costs per megawatt hour (MWh) of electricity produced were as follows:*

c. *Large-scale solar £27*

d. *Onshore wind £30*

e. *Combined cycle gas turbines £44*

f. *Offshore wind £63*

g. *Coal £83*

h. *Nuclear £121*

i. *All such comparisons are controversial, but there is no-one out there today making the case for nuclear on the basis either of its advantageous economics or on its CO2 abatement potential (as in cost per tonne of CO2e abated) – an equally critical comparison."* And the same paragraph in appendix E refers to the reduction in renewables costs taken from a 2020 BEIS report, as follows:

j. *"On a more historical basis, 'LCOE analysis shows that between 2009 and 2019, utility-scale solar costs came down 89%, and wind power by 70%, while new nuclear costs increased by 26%. The gap has continued to widen between 2018 and 2019.' Nuclear continues to get more expensive, while renewables continue to get cheaper. For instance, that Lazard figure for offshore wind quoted above looks very high in comparison to the UK Government's latest assessment of £47/MWh when one projects through to 2030, and it's certain that this year's auction for offshore wind will see bids at no more than £40/MWh. Just five years ago, the Government's projection was £103/MWh."*

13. <u>Greater availability of low carbon alternatives</u>

a. Government energy policy leading to the production of EN1 and EN6 over a decade ago was predicated on the inability of renewables to effectively be utilized at scale. This view has now changed, as evidenced by the 2020 energy white paper setting out a target of 40GW of offshore wind by 2030. TASC's view is that the decarbonization of the electricity grid is best affected through the fields of renewable sources of electricity generation and conservation of energy in the domestic, industrial and commercial sectors but as is set out in TASC WR "Non-nuclear means of generating 3.2GW of 'reliable electricity' when needed" even using BEIS's own modelling, there are cheaper low carbon alternatives available that do not include nuclear with all its attendant problems such as radioactive waste, risk of accident or malicious attack, high cost, lengthy deployment.

b. The independent Centre for Research into Energy Demand Solutions carried out a review looking at contributions to UK CO2 emissions reductions 1988 to 2019 and the following table has been taken from this report, *'Summary: thirty years of climate mitigation',* which clearly demonstrates that nuclear has made zero contribution to decarbonization over the 30 years assessed. The UK's success at reducing demand for electrical energy has largely been the result of energy efficiency measures and renewable electricity.

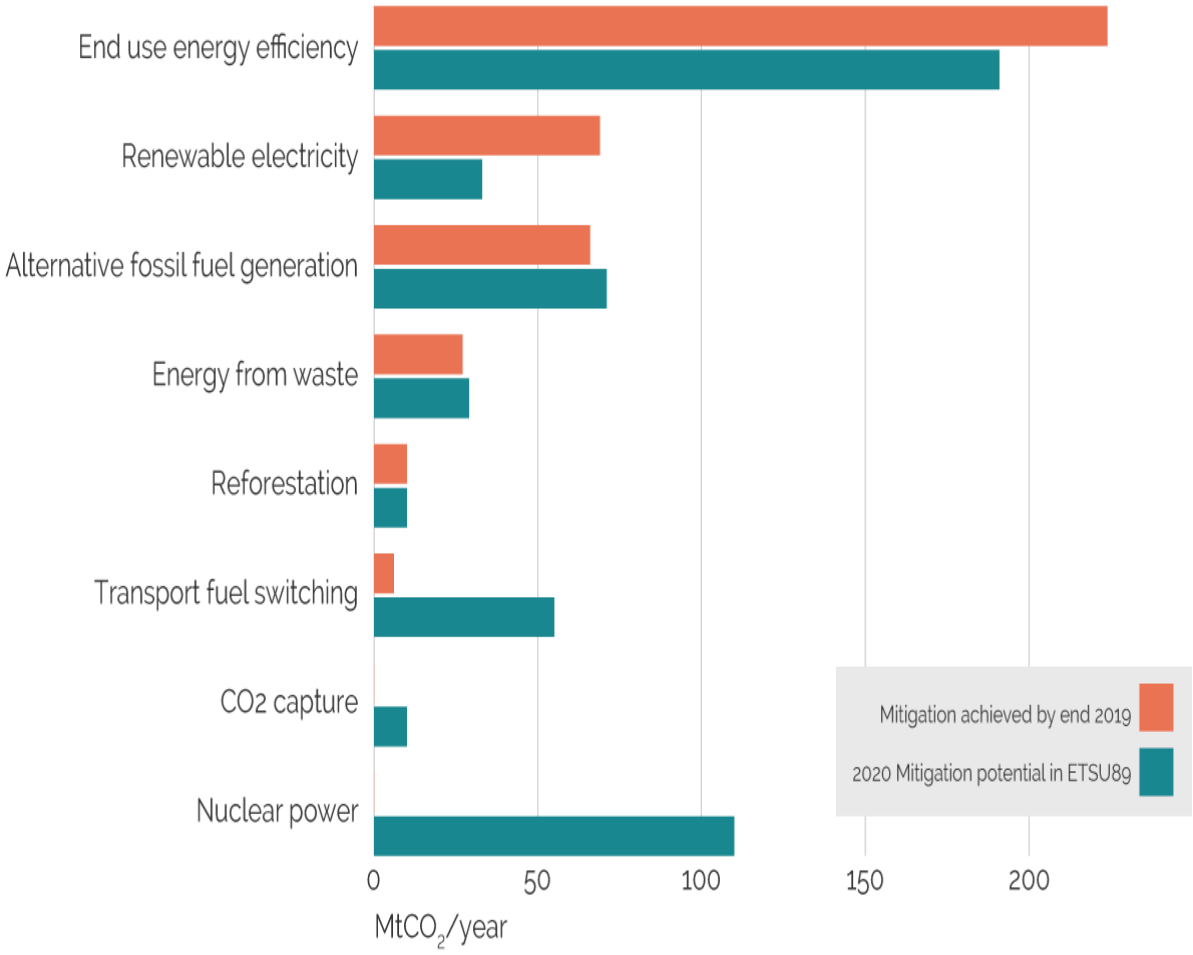

Figure 4: Contributions to UK CO2 emissions reductions, 1988-2019: expectations versus outcome[1].

14. Other government policies/statements/advice increasingly point to the SZC project being out of place in a sustainable future for future generations, including:-
15. The 25-year plan for the environment (see our report 'TASC review of DEFRA summary of targets in their 25 year environment plan in relation to the proposed Sizewell C' at appendix F).
16. The DesGupta Review commissioned by the Treasury which recommended that protection and enhancement of the UK's natural capital should be a prime consideration in all government policy.
17. The government's 'Ten Point Plan for a Green Industrial Revolution', published November 2020, which included these commitments: "*We will safeguard our cherished landscapes, restore habitats for wildlife in order to combat biodiversity loss and adapt to climate change, all whilst creating green jobs*" and "*We will start the process for designating more of England's beautiful and iconic landscapes as National Parks and AONBs, safeguarding these areas for future generations and bringing more people within closer reach of nature. These new National Landscapes will play a key role in meeting the Government's commitment to protect and improve 30% of UK land*

[1] Summary: thirty years of climate mitigation Centre for Research into Energy Demand Solutions https://www.creds.ac.uk/wp-content/uploads/CREDS-Thirty-years-mitigation.pdf

by 2030." This commitment makes no sense if we degrade Suffolk Coast and Heaths AONB with the SZC project.

18. In May 2019 Environment Agency Chair, Emma Howard-Boyd, said *"We need to move away from talking about flood "defence". We cannot win a war against water. We cannot expect to build our way out of future climate risks with infinitely high walls and barriers".*
19. On 23rd February 2021 James Bevan, Chief Executive of the Environment Agency (EA) said *"The reasonable worst case scenario for climate sounds like this:*
    Much higher sea levels will take out most of the world's cities, displace millions, and make much of the rest of our land surface uninhabitable or unusable.
    Much more extreme weather will kill more people through drought, flooding, wildfires and heatwaves than most wars have.
    The net effects will collapse ecosystems, slash crop yields, take out the infrastructure that our civilisation depends on, and destroy the basis of the modern economy and modern society."
        i. Surely, these warnings from the EA should not be ignored by building on the vulnerable Suffolk Coast.

<u>The Need for New Nuclear at Sizewell</u>

a. The government has to be commended for setting a legal 'net zero emissions' target by 2050. As already mentioned above, new nuclear has not contributed to any of the UK's decarbonisation to date, indeed new nuclear has not generated a single watt of electricity since the so called nuclear renaissance was first mooted in 2006, nor have 'the lights gone out' as was the fear promulgated by the nuclear industry and government at the time. So, just as history shows that the urgent need for new nuclear was not justified over a decade ago, there is not an urgent need today. To explain the situation in more detail, we turn again to Jonathon Porritt's recent article (appendix E) which, in this lengthy extract, he addresses two statements often made by the nuclear industry:-

    *"**C1. 'Yes, but it's impossible for the UK to achieve Net Zero without new nuclear power.'***

b. *I'm putting the emphasis on new nuclear power simply because there will already be a significant contribution to UK electricity supply from nuclear power through to at least 2050. The PWR at Sizewell B (which provides 3% of the UK's electricity) is scheduled to continue generating until 2035, but there's a strong likelihood that its lifetime may be extended through to 2050, assuming it meets rigorous safety checks. If and when Hinkley Point C is finished (providing 7% of UK electricity), it will still be generating low-carbon electricity well into the second half of the century – all being well. So we can assume a combined contribution from 2030 to 2050 of around 10% from those two nuclear plants.*
c. *What Net Zero means is that all emissions of greenhouse gases (across the entire economy) must be either eliminated or brought down as close to zero as possible, with all residual emissions compensated for by an equivalent removal of CO2 from the atmosphere. Net Zero includes all emissions from transport, heating, manufacturing and refining, farming and land use, as well as from shipping and aviation (which are currently not included in the UK Government's Carbon Budgets). In effect, that means we first have to electrify pretty much everything we can, and then ensure that all that electricity is itself low or zero carbon.*
d. *This is indeed a massive challenge. Advocates for nuclear power argue that it cannot be achieved without a significant percentage of that total electricity demand being met by new nuclear power – in effect, countering the argument that a combination of energy efficiency, renewables, storage and grid redesign is all that is required. Tom Greatrex,*

Chief Executive of the Nuclear Industry Association, continues to argue that nobody in the industry has 'ever heard anybody, serious or credible, suggesting that there is any way you're going to get to Net Zero without nuclear being part of it.' This is the nub of the 'Net Zero needs nuclear' case.

e. *Having once argued that nuclear power should be the <u>principal</u> source of generating low-carbon electricity, constantly disparaging and misrepresenting the potential contribution from renewables, the industry has had to fall back a long way from that aggressive positioning, relying instead on the somewhat less ambitious claim that 'we need every low-carbon tool in the toolkit' in order to address the Climate Emergency. And though it is never spelled out as such, there is an implicit assumption behind this 'all of the above' argument that all of the different options are somehow equal in terms of their low-carbon credentials.*

f. ***The first thing to be said is that it is very misleading to make out that renewables and nuclear are equivalently low-carbon – and even more misleading to describe nuclear energy as zero-carbon, as a regrettably significant number of politicians (including BEIS Ministers) and industry representatives (including EDF's egregiously saccharine TV ads claiming that it is 'the biggest producer of carbon-free electricity' in the UK) continue to do. Many of them in the full knowledge that they are lying.***

g. *In 2008, the journal Energy Policy published an article by Benjamin Sovacool (now Professor of Energy Policy at the Science Policy and Research Unit at Sussex University) analysing 103 lifecycle studies of greenhouse gas-equivalent emissions for nuclear power plants. It calculated that the mean value is 66g of CO2e/KWh. This compares to 9g of CO2e/KWh for offshore wind and 32g of CO2e/KWh for solar PV.*

h. *According to Mark Jacobson, Professor of Civil and Environmental Engineering at Stanford University, when the full life cycle of nuclear is taken into account – from mining, milling and enriching the uranium that provides the fuel, through to fabricating and transporting that fuel, and then on to managing and eventually disposing of the radioactive waste and decommissioning the reactors – emissions from nuclear power are between 10 to 18 times greater than emissions from renewable energy technologies. And all those emissions are over and above the huge embodied carbon costs of construction that I've already referred to.*

i. *Having dismissed that myth, let's examine the case for a 100% 'nuclear-free Net Zero' ambition.*

<u>C1.1 Efficiency</u>

j. *I've put this first because it's so often (and so frustratingly!) left out of the discussion about Net Zero, or relegated to some also-ran status. Whether nuclear is in the mix or not, it is absolutely critical that we should put efficiency at the heart of our Net Zero ambition: the lower the total amount of energy required, the easier it becomes to meet that demand. And the fact that some environmental organisations, climate campaigners, anti-poverty campaigners and trade unionists continue to treat energy efficiency (and fuel poverty in particular) as a secondary concern tells me they haven't begun to understand the true nature of our Net Zero challenge.*

k. *Indeed, if there's one thing that keeps the nuclear industry alive today apart from the continuing interdependencies between nuclear weapons and nuclear power (which I'll address later), it's the continuing complacency of so many campaigning organisations as to the preconditional importance of energy efficiency. It's not just Dominic Cummings, Boris Johnson's former Svengali, who finds energy efficiency 'boring' – despite the fact that the energy efficiency sector was responsible for 114,000 fulltime equivalent jobs in 2018, according to the Office for National Statistics, compared with around 50,000 in renewables and a paltry 12,400 in nuclear. (That figure does not include all the jobs involved in decommissioning.)*

l. *It's knee-jerk nonsense from the likes of Dominic Cummings that continues to undermine the case for energy efficiency – and not just here in the UK. The*

International Energy Agency's 'Energy Efficiency 2020' report in August last year predicted that overall investment in energy efficiency improvements would be down by around 9% in 2020, the slowest rate in a decade. But the UK has been particularly badly affected by this institutional bias against prioritising energy efficiency – a pattern compounded by the Conservative Party's deep-seated antipathy to using regulation to drive behaviour change. A report from the Energy and Climate Intelligence Unit in February last year demonstrated how the Conservative Government's axing of the Zero Carbon Homes initiative in 2016 (together with the Code for Sustainable Homes) will drive up energy bills in the UK by around £200 a year for all new homes purchased since 2019.

m. *And without the EU's focus on efficiency and appliances (through the Ecodesign Directive and other measures), it's doubtful that we would have seen anything like the same efficiency gains here in the UK. The latest ecodesign laws, which come into force in April this year, will require manufacturers of fridges, freezers, washing machines, dryers, dishwashers, TVs, monitors and lighting products not only to make their appliances easier to repair or recycle – but even more energy efficient. The UK will still be bound by these new standards (which were agreed back in January 2019), but one wonders what will happen in future now that we're out of the EU? It's critical that Ministers continue to drive down energy demand through further initiatives of this kind, ensuring that 'demand management' is as high a priority in policy terms as new generation.*
n. *Beyond that, it's the built environment where the biggest efficiency gains are to be made – not just in terms of new-build but existing buildings. And in particular, existing housing. Household emissions from heating and hot water (roughly 20% of the UK's emissions) must reduce by a massive 95% if the UK is to achieve its Net Zero target by 2050. According to the Committee on Climate Change, that will require up to 20,000 homes and other buildings to be retrofitted <u>every week</u>. For the next 30 years. The Committee has also pointed out that the number of homes being insulated today has dropped by over 90% since 2012, owing mostly to the Government's axing of Labour's tried and tested retrofit initiatives.*
o. *Relative to the cost of gas, electricity is very expensive, making the imperative of 'decarbonising heating systems' (by massively reducing the use of gas) all the more problematic. But the Government's response to this is nothing short of pathetic. Despite endless calls from business and NGOs to put a homes retrofit programme at the heart of its 'Build Back Better' strategy, even the patently inadequate Green Homes Scheme promising grants to individual homeowners was terminated in March after failing to meet any of its targets. This represents a colossal policy failure.*
p. *What we've ended up with is the usual 'targetry without delivery': 600,000 heat pumps a year by 2028; 2.2 million homes in the social housing sector to be improved, with a promise in the 2019 Election Manifesto of £6.3bn to help make this happen; no more gas boilers to be installed in new homes from 2025 onwards; a new Low-Carbon Heat Support Scheme from April 2022, etc etc. This on/off approach, with a drib here and a drab there, shows this Government's contempt for addressing fuel poverty strategically – as they're now doing so effectively in Scotland through the 'Warmer Homes Scotland' initiative.*
q. *What's needed is a multi-year programme for the whole UK, taking us through to 2030, 2040 and then 2050, focused both on the 'willing and able to pay' and on the social housing sector, as originally called for by the Green New Deal group – and now supported by the Lib Dems and by Labour.*
r. *This will indeed cost billions of pounds. But as a general rule of thumb, 'buying efficiency' costs a lot less than 'buying new electrons', wherever they come from. And a retrofit programme of this kind will cost so much less than the utterly nonsensical ideas about a new hydrogen-based gas grid, apparently entailing the installation of millions*

of new hydrogen-ready boilers, with that notionally 'green hydrogen' being produced from nuclear-generated electricity. This is just the latest in a long line of the nuclear industry opportunistically jumping on a temporarily over-hyped bandwagon in order to strengthen its rapidly diminishing credentials (see page 25).

s. <u>C1.2 Renewables</u> *Let's assume we get smart in putting energy efficiency first in policy terms. And that we drive that energy efficiency programme hard throughout the next 30 years. In such circumstances, it's reasonable to assume that we could then halve total energy consumption in the UK from around 1,700 TWh/year today to around 850 TWh/year by 2050. Decarbonising total energy use in the UK means all but eliminating the use of oil in transportation, and massively reducing the use of gas for providing heat and hot water. Most scenarios assume this will mean a doubling in the amount of electricity we need to generate by 2050: the Committee on Climate Change's so-called 'Balanced Pathway' scenario suggests electricity could rise to around 677 TWh/year by 2050.*

t. *As much as possible of that remaining 677 TWh/year will need to come from a combination of renewables backed by storage. According to Government figures, 42% of our electricity in 2019 came from renewables – that's the equivalent of about 120 TWh/year. So we have to get from 120 TWh (from current electricity) to 677 TWh over the next 30 years. And that's the gap that Tom Greatrex does not believe can be filled without new nuclear-generated electricity, carefully curating his own reading list to avoid various authoritative '100% renewable energy scenarios' from the Centre for Alternative Technology and other international NGOs, from independent experts like Keith Barnham, or even from the International Energy Agency itself. An IEA report in 2019 demonstrated that offshore wind could theoretically provide enough electricity to meet total global electricity demand, predicting that offshore wind will grow 15-fold to become a $1tn industry over the next 20 years. (To be fair, the IEA is not actually recommending this scenario!)*

u. *Suffice it to say that those who believe the gap can be filled are getting more and more bullish by the year, with continuing improvements in technology, continuing reductions in costs, year on year, and continuing confidence in reconfiguring distribution systems.*

v. *Just a couple of additional points here: for once, Boris Johnson's resort to hyperbole was justified when he laid out his ambition for the UK to become 'the Saudi Arabia of windpower':*

- *In July last year, analysts at Imperial College crunched the numbers to demonstrate that when the latest offshore wind farms come on stream over the next few years (at a contracted price of £40/MWh), this is likely to be below wholesale prices at that point. Their report suggested that wind farm operators would then have to pay back the difference between the contracted price and wholesale price, with those savings passed on in the form of lower energy bills for businesses and households. This raises the very real possibility that all future offshore wind contracts will be completely subsidy-free from the middle of the decade. A full ten years before the first (and still massively subsidised) electrons are due to be generated at Sizewell C.*

w. *These figures relate to turbines limited to relatively shallow water with a depth of less than 60 metres. Floating wind turbines have already been deployed in a number of demonstration projects, and as the size of each individual turbine increases, there's no doubt that cost curves will start coming down at the same rate as happened with conventional offshore turbines. And turbines will continue to get bigger: in January, GE secured a contract to build a 14MW turbine at the Dogger Bank Wind Farm; Vestas has just started work on a 15MW offshore turbine – enough to power 20,000 households on its own!*

According to the Government's own figures, large-scale solar will be the cheapest generating technology by 2025 (at half the cost of combined-cycle gas turbines), and will get cheaper still through to 2040 where costs could fall as low as £28/MWh. Which

may explain why BEIS called for new evidence at the end of last year as to the potential contribution of large-scale solar to our Net Zero target, and why even the Solar Trade Association's call for a tripling of existing solar by 2030 seems modest.

x. *The simple and most important point is this: the Government itself recognises that renewables can be scaled quickly and cost effectively. We've seen the impact of that over the last five years, even before a recognition of the full extent of the Climate Emergency in which we now find ourselves. So imagine that we started to do that scaling with that Emergency in mind.*

y. *And all this (in my opinion) before the Government eventually bites the bullet and commits to significant investment in tidal energy on the Severn Estuary, either through tidal lagoons or a full-blown barrage, generating totally predictable, near-zero-carbon electricity for up to 100 years – and simultaneously protecting the whole Severn Estuary from the extreme disruption which will inevitably be caused by rising sea levels.*

z. *It's true that the UK is particularly well endowed with renewable energy resources, but similar '100% renewable' scenarios are becoming more robust every year. Mark Jacobson and his team at Stanford University have argued that 100% of all global energy can come from renewable sources (with biomass excluded) by 2050.*

aa. *<u>C1.3 Storage</u>*

bb. *The astonishing potential of renewables can only be realised if massive new investment in batteries and other storage technologies can compensate for 'the intermittency challenge' – those times where 'the sun isn't shining and the wind isn't blowing', a phrase which is ritually trotted out by nuclear advocates in order to disparage the case for renewables. It will require significant breakthroughs in storage to ensure cost-effective integration of variable renewable electricity on to the grid, with the UK remaining dependent on fast-ramping natural gas plants for peak power generation until then.*

cc. *Like many environmentalists, I'm deeply concerned about the impact of this huge growth in demand for batteries on the environment – particularly in terms of the extraction of raw materials (lithium, cobalt and nickel) required, often sourced from countries such as the Democratic Republic of Congo which have a terrible record on human rights and environmental safeguards. It's imperative that governments act now both to address the supply chain challenges, and to mandate the strictest 'circular economy' conditions to ensure that batteries can easily be disassembled and recycled to limit demand for virgin raw materials.*

dd. *The cost of lithium-ion batteries has also been plummeting over the last few years as a consequence of growth in EV markets, down from $1,183/KWh in 2010 to $156/KWh in 2019, according to data from Bloomberg New Energy Finance. And BNEF is predicting $100/KWh by 2024 (the price point at which EVs reach cost parity with petrol and diesel vehicles) and an astonishing $60/KWh by 2030. These improvements will come through further incremental innovation in battery chemistry and significant economies of scale.*

ee. *These reductions in the cost of batteries will ensure that the so-called 'balancing cost' entailed in integrating much larger amounts of variable renewable electricity onto the grid will also reduce – adding somewhere between £10/MWh and £15/MWh to the overall cost of the renewables + storage option. Here in the UK, there's growing recognition of the importance of large-scale storage through the Government's Capacity Market, and the inclusion of storage schemes within the new Contracts for Difference auctions. In February, RenewableUK published its analysis of just how quickly the UK's battery storage pipeline is growing – up 50% over the last year or so – with bigger schemes able to get planning permission much more easily. 'There is now more than 16GW of battery storage projects operating, under construction, or being planned here in the UK.'*

ff. *Unfortunately, this is something which BEIS currently can't get its head around, with its archaic belief in centralised dispatch based on large power stations – including nuclear. According to Michael Liebreich of Bloomberg New Energy Finance:*

gg. *'There are plenty of ways of managing intermittency in renewables without resorting to expensive back-up power. First, you improve your resource forecasting. Second, by interconnecting the grid over larger areas, much of the variability of renewable energy can be evened out. Third, just when an increased proportion of renewable energy means you start losing control over supply, the introduction of digitally controlled smart grids gives you better control of demand. Finally, there is power storage, currently mainly in the form of pumped hydroelectric power, but, in the future, most likely in the form of batteries for electric vehicles. The cost of each of these techniques is coming down just as rapidly as the cost of renewable energy.'*

hh. *Beyond that, we shouldn't underestimate the potential for pumped storage from hydroelectric schemes. When renewable electricity is plentiful and cheap, it can be used to pump water uphill from a lower reservoir to a higher one. When power is needed, the water is released and passes through turbines to generate electricity. The UK has four such schemes at the moment, but Scotland is now actively exploring proposals from both SSE and Drax that would significantly increase overall capacity. SSE's scheme at Coire Glas in the Highlands would be the UK's largest pumped storage scheme with a capacity of 1,500MW at a cost of around £1.5bn.*

ii. *And there are now plans for smaller, high-intensity hydro projects across the UK. It's estimated that there could be as many as 700 sites with no more than a 200m 'lift' between two small-scale reservoirs, possibly providing as much as 7GW of storage. These are early days, but if we unleash the power of innovation here as much as on mechanical, battery-powered storage, we could see a far more environment-friendly solution emerge.*

jj. *This all relates to <u>short-term storage</u>, where a combination of improved storage technologies and effective demand management (both for industry and households) shows great promise. What's more, as the number of EVs starts ramping up (reinforced by the Government's very welcome decision to ban the sale of new petrol and diesel vehicles by 2030), even more cost-effective storage and trading opportunities will kick in with 'V2G' (Vehicle-to-Grid) systems. According to the Committee on Climate Change, there could be as many as 25 million electric vehicles on our streets by 2035. V2G technology will enable plug-in vehicles to act as a form of distributed energy storage by providing demand response services to the power grid, with electricity flowing from cars to grid, and vice versa, based on demand needs at any given time.*

kk. *<u>Long-term storage</u> (ie taking account of the big variations in renewable electricity from season to season) will require different approaches, especially when it's a question of needing to store surplus electricity from wind and solar power. Green hydrogen may have an important role to play here.*

ll. The storage challenge is very much one of those areas where steep learning curves yield rapid and substantial efficiency and financial benefits – exactly the opposite of what has happened with nuclear power over the last few decades. It's also the key to freeing ourselves of our current dependency on baseload thinking.

mm. C2. 'Yes, but only nuclear can provide the low-carbon baseload on which the grid depends'

<u>C2.1 Baseload: time to move on</u>

nn. *This is the second of the two 'yes, but' arguments used by the nuclear industry. Indeed, as all other arguments in favour of nuclear power fall away under properly rigorous scrutiny, this is now the last redoubt in defence of the case for nuclear power. And it would indeed be a very compelling argument were it not for the fact that the very idea*

of baseload generation is itself seen as increasingly redundant. Back in 2015, the then Chief Executive of National Grid, Steve Holliday, spelled out the writing on the wall for those still looking backwards rather than forwards in terms of energy systems: 'The idea of large power stations for baseload is outdated.'

oo. This has become increasingly apparent since then as the costs of highly inflexible baseload become more apparent. As more and more variable renewable electricity becomes available, there are inevitably more instances where there is much more electricity available than is needed – meaning that operators of those wind farms and solar installations have to be paid to switch them off. Because nuclear power can't be switched on and off, the National Grid's historical distribution systems is based on an 'always on' assumption for nuclear – when it's available, which is a lot less than people imagine with so many of our ageing reactors closed for long periods of time for maintenance or repair, or for weeks at a time for refuelling. In 2019, the so-called 'plant load factor' for nuclear power stations in the UK was just 63% of their theoretical generating capacity. Some offshore wind farms are already achieving plant load factors of 55%, and floating wind farms further out at sea will be able to achieve significantly higher yields than that. So much for nuclear's 'always on' comparative advantage.

pp. As is increasingly argued by the International Energy Agency, power system flexibility is now an absolute priority if we are to reap the full benefits of more decentralised generation and demand management technologies. It's been convincingly demonstrated by the National Infrastructure Commission that largescale nuclear power plants entrench more costly, inflexible distribution systems.

qq. I see this as a classic case of incumbent technology standing in the way of more innovative solutions to the challenge of achieving a Net Zero economy, locking in consumers and businesses to increasingly outmoded ways of providing energy services. Prospective innovations in the UK are indeed 'revolutionary', as we see three disconnected energy systems (electricity, gas for heat, and oil for transport) merging into one. One can only hope that BEIS gets its head around this with its emerging 'Smart Systems Plan' promised for Spring 2021.

rr. C2.2 Nuclear and renewables don't mix

ss. There's one final problem about the 'let's have all of the above, with nuclear as baseload' rationale: nuclear and renewables don't mix.

tt. A study in November last year from the University of Sussex Business School and International School of Management, published in Nature Energy, found that nuclear and renewable energy programmes do not coexist at all well in low-carbon energy systems. Instead, they tend to crowd each other out.

uu. Drawing on World Bank and IEA data from 123 countries over the last 20 years, researchers found that grid systems optimised for large-scale centralised power production (such as from nuclear power) make it much harder in terms of both money and time to introduce small-scale, distributed renewable electricity. Those systems where both financial markets and regulatory institutions are structured around centralised, large-scale power plants, with long lead times, are simply not agile enough to facilitate a much more diverse set of short-term, distributed initiatives. Especially where 'rapid, positive learning' can (and should) result in lower costs and improved performance. This is one further indication of the highly significant opportunity costs entailed in any long-term strategy that continues to favour nuclear power.

vv. This was confirmed by an interesting report from Wärtsilä Energy in November last year, looking at ways of optimising the transition to 100% renewable energy for the UK by 2050:

ww. 'Renewables plus Nuclear would add £660 million per year to the cost of energy by 2030. As nuclear must run 24/7 to recoup its investment and its lack of flexibility means it continues generating during periods of high renewable output and low demand. It

creates further potential costs to export power or curtailment charges to stop renewable generation. With a multi-decade lifecycle, this would significantly affect the UK's ability to achieve 100% renewable energy before 2050.'

xx. *All of which means, for <u>any</u> Net Zero scenario by 2050, that the 'full renewables package' (renewables + energy efficiency + storage + new grids) will make a far more significant contribution than any amount of (realistically deliverable) nuclear energy. How ironic for pro-nuclear environmentalists that the principal consequence of hanging on in there for that relatively small nuclear element will be to jeopardise a wholly deliverable, non-nuclear Net Zero outcome."*

yy. Other considerations with regard to the need for new nuclear are:-

a) EN1 was predicated on an increase in demand for electricity consumption but, as advised by the CCC on page 7 of the Sixth Carbon Budget- Electricity: "Lower electricity demand. In 2018, electricity demand was around 300 TWh. This represents a decline of 12% compared to 2008 levels, and has led to lower generation and hence lower emissions. There was a reduction in both residential and industrial electricity consumption.

b) Page 29 of the CCC 6th Carbon Budget- Electricity Generation sets out 5 possible scenarios for the future electricity generation mix by 2050, none of which show more than 10GW from nuclear and 3 out of the 5 only show 5GW (rough equivalent of Hinkley Point C (HPC) and Sizewell B combined or HPC plus 2 SMRs) of nuclear generation. The CCC are clearly anticipating that large scale nuclear power stations are not going to be a major factor on the future electricity grid.

c) The National Infrastructure Commission (NIC) report 'Net Zero Opportunities for the power sector' published in March 2020 says on page 8 *"In the National Infrastructure Assessment the Commission recommended that government: not agree support for more than one nuclear power station beyond Hinkley Point C, before 2025."* Note, the NIC do not actually recommend one more reactor. While TASC believe the need for any new nuclear is not justified, if government are minded to support one more gigawatt reactor, TASC contend that it would make sense to choose a site that is not in an AONB, not on an already eroding coast, not in flood zones 2/3, that will not build a causeway through, or fragment, a pristine SSSI wildlife habitat, risk damaging Natura 2000 sites, Ramsar, SPA, SAC and other SSSI designated areas, all of which conditions must surely remove the Sizewell site from the 'potential' list.

<u>URGENCY</u>

zz. The urgency claims for the SZC project that the Applicant repeatedly makes in their DCO application, flies in the face of the recent evidence both from the government's approach as well as from other considerations. We comment as follows:-

The 2020 energy white paper sets a target (subject to caveats) of making a final investment decision 3 years hence i.e. by 2024.

aaa. Electricity demand is continuing to fall, although there is an expectation for greater demand sometime in the future which can be mitigated by greater efficiencies, demand response, Vehicle2Grid, smart grids, storage, green fuels etc.

bbb. Despite a promise from BEIS in April 2019 (see paragraph 4 in appendix A), there has been no public consultation on the ongoing need for new nuclear. This intention was a repeat of the BEIS document, 'RESPONSE: CONSULTATION ON THE SITING CRITERIA AND PROCESS FOR A NEW NATIONAL POLICY STATEMENT FOR NUCLEAR POWER WITH SINGLE REACTOR CAPACITY OVER 1 GIGAWATT BEYOND 2025', published in July 2018, where paragraph 2.131 states "The public will have an opportunity to comment on the ongoing need for nuclear as part of the forthcoming consultation on the draft NPS." This statement also appears in paragraph 3.9 of the same document.

ccc. The consultation on the revised EN6 started back in 2017, with a second consultation scheduled for spring/summer 2019. Even allowing for the distractions from the pandemic, the lack of further consultation or publishing the draft AoS, demonstrates no urgency at all. Indeed, we are aware from communications with the ONR, that BEIS requested the ONR to indefinitely pause their response to the revised EN6 consultation.

ddd. If the need for new nuclear is so urgent, why have the government not made any effort to identify any new potentially suitable sites since EN6 was first introduced over a decade ago?

eee. Continuing to pursue the EPR design for the Sizewell site knowing the historic delays associated with all previous EPR projects, particularly those built to European regulations i.e. Olkiluoto, Flamanville and HPC, does not sit comfortably with any real urgency requirement.

IROPI

fff. The government established an IROPI case for Sizewell C over a decade ago when it was listed as a potentially suitable site for a nuclear power station of over 1GW. However, as set out above, EN6 currently has no legal force and is outdated, as is EN1, due to changing circumstances in the intervening period.

ggg. In the circumstances, the meaning of Imperative Reasons of Overriding Public Interest need to be explored.

hhh. Looking at the dictionary meaning of Imperative, the words 'commanding', 'urgent' and 'obligatory' can be seen. TASC have already set out above that, in their opinion, there is no need for new nuclear power stations and more especially in this instance, there is no need for one at Sizewell. The need for new nuclear by 2025 will not be met, and 'the lights will not go out'. The 'lights will not go out' if Sizewell C is not built, nor if no new nuclear is deployed or even if Hinkley C is cancelled. SZC's imperative label was justified by the last Labour government as being essential for energy security and decarbonisation: both arguments have long been demonstrated as incorrect, disingenuous and divisive.

iii. TASC has set out above the argument that there are alternatives means to producing electricity that do not include new nuclear. TASC would make the observation that the UK is blessed with sufficient availability of renewable sources of electricity generation in the form of, mainly, offshore wind, onshore wind and solar PV to meet ANY electricity demands going forward. These can all be deployed at scale far quicker and at a lower cost than nuclear and be combined with different storage and green fuel production technologies to provide dispatchable power.

jjj. Regarding 'overriding public interest', TASC have already advised above that the contribution that SZC could make to helping the UK meet its carbon goals is, at best, negligible but at worst it could add to the carbon debt, particularly because of the fuel lifecycle while operational. The short-term economic benefits from construction need to be balanced against the negative impact the SZC project will have on existing businesses, especially in the tourism industry.

kkk. TASC have demonstrated there is no IROPI case to answer. However, even if a case for IROPI was made, the cumulative impact on European designated sites in Suffolk and the species that rely on them, the devastation it would bring to the Suffolk heritage Coast, the disruption to the lives and livelihoods of thousands in the area and the long-term damage it would do to the thriving Suffolk tourism industry, would outweigh any perceived benefits.

Appendix A

Policy & Need
Appendix A BEIS EN6

Appendix B

TASC: Critical review of EN6 volume 1 in relation to the Sizewell C (SZC) project	
Relevant abstracts from EN6	TASC comments
1.1.1 *The Government believes that energy companies should have the option of investing in new nuclear power stations.*	The Applicant has admitted in their Funding Statement that they do not have the funds to build Sizewell C so are expecting UK electricity consumers and taxpayers to pay upfront for the construction and take on the project risk so **reference to energy companies investing in new nuclear no longer applies in the case of SZC. See TASC Written Representation (WR) "Review of Applicant's Funding Statement"**
1.2.1 *This NPS, taken together with the Overarching National Policy Statement for Energy (EN-1), provides the primary basis for decisions taken by the Infrastructure Planning Commission (IPC) on applications it receives for nuclear power stations (as specified at Section 1.9 of this NPS). The way in which NPSs guide IPC decision making, and the matters which the IPC is required by the Planning Act 2008 to take into account when considering applications, are set out in Sections 1.1 and 4.1 of EN-1.*	EN1 para 1.1.2 says that the application should be considered in accordance with the NPS unless a project will "*result in adverse impacts from the development outweighing the benefits*". As set out in our Written submission 'Cumulative Impacts' and from the comments in this document **TASC are of the view that the disbenefits of SZC clearly outweigh the benefits**.
1.2.4 *Further information on the relationship between NPSs and the town and country planning system, as well as information on the*	According to the CLG letter, para 10 says '*NPSs will continue in force until such time as they are withdrawn or replaced. There is no set period for*

role of NPSs, is set out in paragraphs 13 to 19 of Annex A of the letter to Chief Planning Officers issued by the Department for Communities and Local Government (CLG) on 9 November 2009.	*NPSs although each individual NPS may suggest a time-frame, for example, up to 2025 or 2030. While it is important that NPSs have a long shelf-life it is also important that they remain up to date and reflect changing circumstances. The Act [*section 6 of the Planning Act 2008*] therefore places a duty on the Secretary of State to review each NPS whenever the Secretary of State thinks it appropriate to do so.*' As evidenced by the update from UKCP09 to UKCP18, **TASC consider** major changes have occurred in respect of climate change predictions, and there have also been many changes in renewables and novel energy technologies yet no such review have yet been concluded.
1.3.1 says '*This NPS is part of a suite of energy NPSs. It should be read in conjunction with EN-1, which covers*:' [the relevant sub-paragraphs we wish to refer to are listed] ● *the need and urgency for new energy infrastructure to be consented and built with the objective of contributing to a secure, diverse and affordable energy supply and supporting the Government's policies on sustainable development, in particular by mitigating and adapting to climate change;* ● *the role of the Appraisals of Sustainability (see Section 1.7 below) in relation to the suite of energy NPSs;* ● *policy on good design, climate change adaptation and other matters relevant to more than one technology-specific NPS*	The energy market has changed dramatically since EN6 was drafted and then passed into law, and in TASC's opinion the need and urgency for new nuclear power stations of over 1GW can no longer be justified, nor can the 'affordable' label or description as 'sustainable development' be applied to SZC. **These issues are covered in TASC WR 'Policy and Need'**. With regard to 'mitigating and adapting to climate change' TASC draw your attention to our endorsement of: the Stop Sizewell C WR 'How Much Carbon would Sizewell C save?' which shows that SZC will likely add to the UK's carbon footprint and therefore make no contribution to the UK's Net Zero by 2050 target, and N Scarr's report 'Sizewell C - Coastal Morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments -May 2021' which highlights the risk to the site from the impacts of climate change. An example of why SZC cannot be regarded as sustainable relates to the requirement for potable water in one of the driest regions of the country: up to 3.5 million litres per day during construction and 2 million litres per day during operation-after 5 consultations over 9 years the Applicant has still not identified the source of potable water supply see TASC's WR 'Potable Water Supply for Sizewell C'. According to DCO document 6.3 Vol 2 Chapter 26 Climate Change para 26.5.2 the Applicant says '*The CCR assessment scenarios considers climate change impacts during the construction and operation of Sizewell C on the main development site and the associated developments through to 2099, the last year for*

	which UKCP18 climate projections are provided. The scenario took into account the resilience of construction and operation of the Sizewell C Project to climate change, resulting from projected increases in temperature, high winds, flooding (associated with increases in precipitation and sea level change).' **TASC consider this period of assessment is inadequate as it does not cover decommissioning and spent fuel storage.**
	DCO doc (APP-159) 6.1 ES Non-technical summary (page 8) says "*This reactor design has been assessed and approved by the Office for Nuclear Regulation and the Environment Agency through the UK Generic Design Assessment process. The UK EPR™ reactor is the same reactor design as is being constructed at Hinkley Point C. Therefore, no alternative locations for the Sizewell C power station and reactor design have been considered*." HPC was designed for a different type of location and is not in an AONB. As SZC is proposed as a replica of HPC, it cannot be considered as a good design specific to its location towering over the Heritage Coast path, in an AONB designated for its scenic beauty, extensive views and relative wildness – see TASC's WR 'Landscape and AONB issues' for more information .
1.6.1 This NPS will remain in force in its entirety unless withdrawn or suspended in whole or in part by the Secretary of State. It will be subject to review by the Secretary of State to ensure that it remains appropriate. Information on the review process is set out in paragraphs 10 to 12 of Annex A of CLG's letter of 9 November 2009 (see also paragraph 1.2.4 above)	According to the CLG letter, para 10 says '*NPSs will continue in force until such time as they are withdrawn or replaced. There is no set period for NPSs although each individual NPS may suggest a time-frame, for example, up to 2025 or 2030. While it is important that NPSs have a long shelf-life it is also important that they remain up to date and reflect changing circumstances. The Act* [section 6 of the Planning Act 2008] *therefore places a duty on the Secretary of State to review each NPS whenever the Secretary of State thinks it appropriate to do so.'* As set out in TASC WR 'Policy and Need', major changes have occurred in respect of climate change predictions and in the energy sector and no such review has been concluded.
1.7.4 A summary of the main findings of the Nuclear AoS is set out below. *● EN-6 could bring significant benefits in meeting the Government's climate change and energy security objectives.*	TASC endorse the Stop Sizewell C paper 'How Much Carbon would Sizewell C save?' which shows that **SZC will make little or no contribution to the UK's Net Zero by 2050 target and more likely add to the UK's carbon footprint.**

● *Possible adverse effects on nature conservation sites of European Importance were identified by the Nuclear Habitats Regulations Assessment (HRA). Further studies will need to be carried out, as part of the project HRA and environmental impact assessment (EIA) processes for individual development consent applications, to determine the significance of the effects and the effectiveness of any mitigation measures.*

● *Possible significant adverse effects on nationally important nature conservation sites and designated landscapes were identified by the Nuclear AoS. Further studies will need to be carried out, as part of the project EIA process for individual development consent applications, to determine the significance of the effects and the effectiveness of any mitigation measures.*

● *Key inter-relationships between biodiversity and other sustainability effects were identified. These were most notably in relation to flood risk management, water quality and sustainable communities.*

● *There is the potential for interactions and cumulative adverse effects on wider biodiversity in relation to water quality and resources, habitat loss and "coastal squeeze" where there is more than one potentially suitable site for new nuclear power in the locality or as a result of other major development in the area. Such interactions and adverse effects are possible in European Sites in the Severn Estuary and River Wye and the Outer Thames Estuary where there are two potentially suitable nuclear sites These issues will need to be considered in project level HRAs and EIAs.*

● *Effects associated with the management and disposal of hazardous wastes, including radioactive wastes, can affect other sustainability topics. The significance of these effects can only be determined through studies as part of the project level EIA and HRA.*

● *There is the potential for positive effects on local employment opportunities. A development consent application should therefore include an assessment of the considerations given to socio-economic as well as environmental issues (see Section 4.2 of EN-1 for further details regarding the EIA and Environmental Statement). This might be especially relevant where there is the potential for cumulative positive effects for economic development at the*

TASC agree with the grave concerns expressed by the representations of the RSPB, Suffolk Wildlife Trust (SWT), and Friends of the Earth Suffolk Coastal (FOE) about **the impact SZC will have on European sites.**

TASC agree with the grave concerns expressed in the representations of RSPB, SWT, and FOE about the impact SZC will have on nationally important nature conservation sites and believe the impact on Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB), the Heritage Coast and County Wildlife Sites renders the SZC project untenable.

TASC endorse FOE's representation that rejects the Applicant's claim that there is a net biodiversity gain. We also endorse the concerns expressed by RSPB, SWT, FOE and Minsmere Levels Stakeholder Group (MLSG) about the negative impact SZC will have on water quality, water levels, flood risk management and the unsustainable use of potable water.

As set out in TASC's WR 'Ecological impact of Sizewell C on marine life' **there are untenable, unsustainable impacts on the marine environment**, especially in combination with Sizewell B and these would also need to be considered in relation to the plans to build Bradwell B which has the same partners as SZC.

TASC draw PINS attention to the AONB's 'Management Plan 2018-23' which, on page 34 says *'A widely accepted definition of sustainable development, taken from the Brundtland Report, is: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. An AONB is not about preserving the landscape or having no development, but as an area that is designated for its outstanding landscape development should contribute to its natural beauty. Part of this involves adhering to the concept of sustainable development.'* **TASC urge PINS to reflect this definition of sustainable development in their assessment of the SZC development** with particular consideration of the adverse impact on the AONB's landscape and biodiversity, the inevitable damage to the tourism industry and the legacy of radioactive waste left on a coastline vulnerable to flooding.

The Applicant has applied to build 2 EPR reactors on a site that is too small. EN6 guidance (D9 page

regional level, for example in the southwest and north-west of England. ● *Significant trans-boundary effects arising from the construction of new nuclear power stations are not considered likely. Due to the robustness of the regulatory regime there is a very low probability of an unintended release of radiation, and routine radioactive discharges will be within legally authorised limits.*	278 EN6 Volume II) is for 30-50 hectares per reactor. This development will result in coastal squeeze. The Soft Sea Defences are currently proposed to be 40 metres further east than they are now sited. As with the hard sea defences, they are further development in the AONB which sit outside of the licenced site. TASC contend that there are major issues relating to the emitted and residual radioactive and chemical wastes from SZC- these are set out in TASC's 'Ecological impact of Sizewell C on marine life', 'Health wellbeing and low level radiation' and 'Nuclear waste' WRs. TASC draw PINS attention to Stop Sizewell C's "Sizewell C project: Economic Statement Response" dated September 2020, which TASC endorse, noting its **conclusion "*the assessment of the potential economic impact of Sizewell C on the local tourism economy provided in the Economic Statement is incomplete and inadequate.*"**
1.8.2 The Government has assessed this NPS (by conducting an HRA) and has concluded that it cannot rule out the potential for adverse effects on the integrity of European Sites adjacent to or at a distance from each site listed in this NPS. In line with the requirements set out in Article 6(4) of the Habitats Directive the Government considered potential alternatives to the plan and nominated sites, and concluded that there were no alternatives that would better respect the integrity of European Sites and deliver the objectives of this plan. Accordingly the Government has presented a case for Imperative Reasons of Overriding Public Interest (IROPI) which sets out the rationale for why the plan should proceed given the uncertain conclusions identified by the Nuclear HRA. This can be found at Annex A of this NPS	Circumstances have changed since EN6 came into effect, not least the recommendation by the National Infrastructure Commission (NIC) that the UK should support no more than one further nuclear power station of over 1GW after HPC. TASC does not believe that there is a need for any new nuclear build at any site, including Hinkley. Identifying Sizewell as a potential site, which is in an AONB, on a rapidly eroding coast in flood zones 2/3, requiring the construction of a causeway through a pristine SSSI wildlife habitat, risking damage to Natura 2000 sites, Ramsar, SPA, SAC and other SSSI designated areas is perverse and stretches credulity. It is incumbent on the developer to identify other sites which do not compromise such characteristics as are found at Sizewell. **As set out in TASC's 'Policy and Need' WR, TASC contend that the IROPI designation is not justified for SZC.**
2.2.1 *This section should be read in conjunction with Part 3 of EN-1, within which the Government has set out the need for all types of energy NSIPs, including new nuclear power stations. The IPC should therefore assess applications for new nuclear power stations on the basis that the need for such infrastructure has been demonstrated. Section 3.5 of EN-1 provides detail regarding the specific need for new nuclear power stations.*	TASC's highlight how outdated the NPS EN1 has become e.g. EN1 para 3.5.1 refers to 'urgent need by 2025' and nuclear being a 'proven technology'. The so-called nuclear renaissance was first mooted in 2006 based on fears over energy security if new nuclear power stations of over 1GW were not deployed by 2025. Deployment of SZC by 2025 is impossible and it is not anticipated that there will now be an electricity shortfall by 2025. Nor can the European EPR reactor be termed 'proven' by reference to the Olkiluoto,

	Flamanville and Hinkley Point C projects see comments on EN6 paras 2.6.1 to 2.6.3 below. Indeed, since 2006 when new nuclear was first mooted, it has produced no electricity whatsoever.
2.2.2 In order to be considered potentially suitable and therefore be listed in this NPS, sites had to be shown to be capable of deployment by the end of 2025 (see Section 2.3 below). However, given the urgent need to decarbonise our electricity supply and enhance the UK's energy security and diversity of supply, the Government believes that new nuclear power stations need to be developed significantly earlier than the end of 2025.	TASC wish to highlight how outdated NPS EN1 is in relation to new nuclear's ability to assist with decarbonisation and refer PINS to Stop Sizewell C's report dated April 2021 'How Much Carbon would Sizewell C save?' in relation to SZC's inability to help the UK decarbonise urgently.
2.2.5 Paragraph 1.1.2 of EN-1 sets out that the IPC must decide an application for energy infrastructure in accordance with the relevant NPSs except to the extent it is satisfied that to do so would result in adverse impacts from the development outweighing the benefits. <u>The fact that a site is identified as potentially suitable within this NPS does not prevent the impacts being considered greater than the benefits.</u>	TASC's view is that the disbenefits of SZC clearly outweigh any benefits – see TASC's written submission 'Cumulative Impact'.
2.3.1 The Strategic Siting Assessment (SSA) was designed to identify sites in England and Wales that are potentially suitable for the deployment of new nuclear power stations by the end of 2025. 2.3.2 Having considered all of the sites nominated as well as those identified by the Alternative Sites Study (see Section 2.4 below) the Government believes that only those sites listed in Part 4 of this NPS are potentially suitable for the deployment of new nuclear power stations in England and Wales by the end of 2025. This NPS has therefore been designated for the purposes of the Planning Act 2008 in relation to applications for development consent at those sites listed in Part 4. The boundaries of each listed site are shown on a series of maps (at 1:10,000 scale) at Annex C of this NPS. 2.3.3 To reduce the likelihood of further land being needed, and to increase the usability of sites, nominators were encouraged to ensure that the area nominated into the SSA included within it all likely site plans, and all reasonable variations to those plans. The boundary of the nominated area may, however, vary from the site boundary that is proposed for development consent. It was not considered reasonable to expect nominators to have established, at the time of requesting nominations, detailed lay-outs for the whole of their proposed developments, including for example any additional land needed for construction or decommissioning	There is no way SZC could be deployed by 2025. The Alternative Site Study was obviously flawed as the only site that has proved capable of deployment by 2025 is Hinkley Point C and even that must now be in doubt. The original site boundaries have significantly changed between EN6 and the SZC DCO application calling into question the legitimacy of the DCO application being the same project as originally envisaged. Note 18 in this section of EN6 states *"To be considered potentially suitable the sites had to meet the SSA criteria (see "The SSA criteria and how sites are assessed" in Volume II of this NPS) and be shown to be capable of deployment before the end of 2025. The SSA also included an assessment of the ability of the site to store spent fuel and intermediate level waste (see Section 2.11 and Annex B of this NPS)."* **TASC draw the ExA's attention to the Applicant's Climate Change Resilience only covering up to the end of operation so not covering decommissioning and waste storage** – see DCO document APP-342 6.3 Vol 2 Chapter 26 Climate Change para 26.5.2. Waste storage could be for an indefinite period as availability of a GDF is not guaranteed.

2.4.5 In addition to the consideration of alternative sites, an assessment was undertaken as part of the Nuclear AoS to consider whether or not the objectives of this NPS could be delivered using alternative options	Given that it is acknowledged that Sizewell C cannot be deployed by 2025, **the AoS and site assessment need to be updated in light of the many changes that have occurred in electricity generation, storage and management systems** – see TASC's 'Policy and Need' WR above and TASC's WR 'Non-nuclear means of generating 3.2 GW of 'reliable electricity' when needed', as well as changes in climate change predictions, the government's revised carbon targets and the awareness that all alternatives considered for the project's transport strategy are unsustainable and too impactful on the people, businesses and environment in east Suffolk (as evidenced by the recent knee-jerk reaction by the Applicant to try to change the transport strategy as set out in their January 2021 revised proposals) see TASC's WR 'Transport implication of Sizewell C' .
2.5.1 Section 4.4 of EN-1 sets out the circumstances in which the IPC may be required to consider alternative sites or proposals to an application for development consent. In doing so the IPC should act in accordance with Section 4.4 of EN-1 as well as the additional policy set out in this Section 2.5.	EN1 para 4.4.2 says that alternatives need to be considered in the Environmental Statement and TASC consider this has not happened with the SZC DCO application. DCO document 6.1 Environmental Statement non-technical summary (APP-159) page 8 para 3.2(b) says "therefore no alternative locations for the SZC power station and reactor design have been considered"
2.5.2 In view of the urgent need for new nuclear power stations as set out in Part 3 of EN-1, the IPC should be guided by whether there is a realistic prospect of the proposed alternative being able to generate a comparable amount of low carbon electricity on a comparable timescale.	There are now cheaper and quicker to deploy low carbon alternatives to SZC- see TASC WR ''Non-nuclear means of generating 3.2 GW of 'reliable electricity' when needed' New nuclear was first mooted by the UK government in 2006 and to date it has generated no electricity. The time and money invested into the promotion of new nuclear has hindered the development and implementation of cheaper, greener and quicker to deploy alternatives.
2.6.1 The Basic Safety Standards Directive requires European Member States to ensure that all new classes or types of practice resulting in exposure to ionising radiation are "justified" (by their economic, social or other benefits in relation to the health detriment they may cause) in advance of being first adopted or first approved. 2.6.2 This process has been implemented in UK law by the Justification of Practices Involving Ionising	In July 2020 the French public auditors, the Cour des Comptes, published their review of the EPR reactor project (see link below)[2], the same design proposed by the Applicant to be built at Sizewell. This followed the failure of all EPR projects to keep to time and finance budgets. There are 3 EPR projects being built to European standards: Olkiluoto, Finland where construction started in 2005 and is still not operational and about four times its original budget; Flamanville, France (EDF's supposed flagship EPR project) where construction started 2007 and is still not operational and the budget has increased from circa €4 billion to €12.4 billion (although the total cost was assessed by

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Radiation Regulations 2004 (the Justification Regulations) and is known as Regulatory Justification. In relation to nuclear power in the UK, the Justifying Authority for the implementation of the Regulatory Justification aspects of the Basic Safety Standards Directive is the Secretary of State for Energy and Climate Change. 2.6.3 In October 2010 the Secretary of State published his decisions that two nuclear reactor designs, Westinghouse's AP1000 and Areva's EPR, are justified.	the Cour des Comptes as in excess of €19 billion); Hinkley Point C (HPC) which was budgeted at £16 billion in 2016 when the Final Investment Decision was taken, but was revised to as much as £23.2 billion in 2019, with completion put back from 2025 to possibly as late as 2027. The Cour des Comptes report on Flamanville exposed the flaws in EDF's management of the project with many technical changes made during construction, as well as lack of quality control which resulted in faulty parts and inferior workmanship. When the HPC build started there were still nearly 700 outstanding Assessment Findings (AFs) identified by the ONR in respect of the EPR's GDA design that needed to be resolved. At December 2020 there were still nearly 400 AF's outstanding, providing plenty of scope for further time and cost overruns at HPC. Given that the Regulatory Justification (RJ) was completed over a decade ago and all the European EPR projects have experienced serious problems and the design remains unproven in Europe, TASC believe that an up to date RJ should be completed by the Secretary of State.
2.11.3 In reaching its view on the management and disposal of waste from new nuclear power stations the Government has in particular satisfied itself that: ● geological disposal of higher activity radioactive waste, including waste from new nuclear power stations, is technically achievable; ● a suitable site can be identified for the geological disposal of higher activity radioactive waste; and ● safe, secure and environmentally acceptable interim storage arrangements will be available until a geological disposal facility can accept the waste.	See TASC's WR 'Nuclear waste'. Due to the threat of climate change impacts and the length of time that spent fuel will need to be kept on site at SZC, the safe and secure storage arrangements cannot be guaranteed-see N. Scarr's report 'Sizewell C – Coastal morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments.' May 2021 **TASC draw PINS attention to the BEIS's document '**Government's response to the consultation on the siting criteria and process for a new national policy statement for nuclear power with single reactor capacity over 1GW beyond 2025' dated July 2018, which states at I.5 page 45 *"All assessments against the strategic criteria, both for the new NPS and in a future nominations window, will cover the lifetime of the site. That is the operation and decommissioning and the safe and secure storage of all the spent fuel and intermediate level waste produced from operation and decommissioning until it can be sent for final disposal in a geological disposal facility ("GDF")."* **In TASC's opinion, the Applicant's DCO documents do not demonstrate adequate Climate Change Resilience as TASC consider the above requirement is not met.**

3.6.8 Where possible, safety and operational critical installations should be sited in the areas of the site at least risk of flooding.	It is not possible to site SZC critical installations in areas at least risk of flooding as all of the SZC platform is at risk of flooding over its lifetime when considering decommissioning and storage of spent fuel- see N. Scarr's report 'Sizewell C - Coastal Morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments -May 2021'. The inadequate size available for the SZC licensed site does not provide scope for locating all critical infrastructure outside flood zones 2 and 3.
3.6.9 The Sequential Test (see Section 5.7 of EN-1) has been undertaken by the Government as part of the SSA. As a result, the IPC should not conduct the Sequential Test for any of the listed sites – this requirement of EN-1 does not apply to applications for development consent for new nuclear development on any of the sites listed in this NPS. The Government has taken a sequential approach to the SSA by assessing all sites at a strategic level, including in relation to flooding, and by using the results of the Alternative Sites Assessment (see Section 2.4 of this NPS). The Government has considered whether or not the objectives of this NPS can be met through reasonably available alternative sites in lower flood risk zones.	The Strategic Site Assessment was undertaken over 10 years ago and predictions of the impacts in respect of climate change have altered materially since then. The National Infrastructure Commission now recommends that, after HPC, no more than one further nuclear power station of over 1GW should be supported by government before 2025. TASC does not believe that there is a need for any new nuclear build at any site, including Hinkley. Identifying Sizewell as a potential site, which is in an AONB, on a rapidly eroding coast in flood zones 2/3, requiring the construction of a causeway through a pristine SSSI wildlife habitat, risking damage to Natura 2000 sites, Ramsar, SPA, SAC and other SSSI designated areas is perverse and stretches credulity. It is incumbent on the developer to identify other sites which do not compromise such characteristics as are found at Sizewell and which do not pose a threat to the community. Without undertaking such work, TASC consider the developer is in contravention of the NPS and the National Planning Policy Framework regulations which require the developer to demonstrate that they have looked at alternatives to justify the IROPI status of the planned development.
3.6.10 In conducting the Sequential Test the Government concluded that sites within this NPS in lower flood risk zones were not reasonably available alternatives to those in higher flood risk zones. This is because, as set out in paragraphs 2.4.3 and 2.4.4 of this NPS, the Government determined that the only potentially suitable sites for the deployment of new nuclear power stations in England and Wales before the end of 2025 are those listed in this NPS; and that all of the sites listed in this NPS are required to be listed to allow sufficient flexibility to meet the urgent need for new nuclear power stations whilst enabling the IPC to refuse consent should it consider it appropriate to do so. The Government also notes the advice of the independent regulators that all the sites have the	EN1 para 5.7.4 requires an adequate Flood Risk Assessment (FRA) covering the lifetime of the site. TASC believe this means covering the decommissioning and period until the last spent fuel leaves the site decades after 2100. DCO document APP-342 6.3 Vol 2 Main Development Site Chapter 26 para 26.5.2 says '*The CCR assessment scenarios considers climate change impacts during the construction and operation of Sizewell C on the main development site and the associated developments through to 2099, the last year for which UKCP18*

potential to be protected from flood risk throughout their lifetime.

climate projections are provided.' TASC consider this period is inadequate and doesn't demonstrate that the SZC licensed site can be protected from the impacts of climate change for its full lifetime, or indefinitely if a GDF is not constructed.

3.6.11 Applicants will still need to submit a flood risk assessment in accordance with Section 5.7 of EN-1. The IPC will need to be satisfied that a sequential approach has been applied at the site level to ensure that, where possible, critical infrastructure is located in the lowest flood risk areas within the site.

EN1 para 5.7.5 requires an assessment of '*the risk of flooding arising from the project'*. TASC cannot find anything in the DCO documents that confirms this has been adequately assessed.

With reference to the 'CEFAS, 2014. BEEMS TECHNICAL REPORT TR322, UPDATE ON ESTIMATION OF EXTREME SEA LEVELS AT SIZEWELL' that can be found on pages 68-86 in DCO document AS-020 6.12 'Reports Referenced in the Environmental Statement', the conclusion on page 12 says *'It should be noted that these statistical assessments are based only on data for the period 1964– 2014 and do not include the high magnitude 1953 event. Modelling has shown that the inclusion of this and other high magnitude events earlier in the 20th century leads to even higher estimates for the 1in 10000 year water level.'* TASC considers this comment means that calculations of the 1 in 10,000 year water levels is understated thereby underestimating the SZC flood risk.

The whole of the SZC site is in flood zones, the majority in flood zone 2/3, and because of the constraints on the size of the site it is impossible to site critical infrastructure in the lowest flood risk areas within the site.

For reasons set out in this document, TASC considers the SZC project should not be consented as it fails both arms of the sequential test.

3.6.14 It is the Government's view, based on the Nuclear AoS and the SSA, that all sites listed in this NPS have the potential to be adequately protected from flood risk (including the potential effects of climate change, taking into account the UK Climate Impacts Programme 2009).

The government's view was formed over a decade ago and since then the predictions of climate change impacts have worsened leading TASC to conclude that these assessments can no longer be relied upon. Given the length of time that the site needs to demonstrate that it can be kept safe and the unpredictability of the level of sea level rise, increased storm surges and more extreme weather events into the next century, the application of the precautionary principle will result in a decision that flood protection of SZC cannot be guaranteed for its lifetime - see N. Scarr's WR 'Sizewell C - Coastal Morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments -May 2021'.

3.6.15 Based on the advice of the relevant Nuclear Regulators, the IPC should be satisfied that the applicant is able to demonstrate suitable flood risk mitigation measures. These mitigation measures should take account of the potential effects of the credible maximum scenario in the most recent marine and coastal flood projections. Applicants should demonstrate that future adaptation/flood mitigation would be achievable at

the site, after any power station is built, to allow for any future credible predictions that might arise during the life of the station and the interim spent fuel stores	According to DCO document APP-342 6.3 Vol 2 Chapter 26 Climate Change para 26.5.2, which says its Climate Change Resilience assessment only considers up to 2099 (so does not include post operational decommissioning and waste fuel storage), TASC consider the Applicant has not allowed *'for any future credible predictions that might arise during the life of the station and the interim spent fuel stores'*. With regard to PINS receiving further advice from the ONR relating to flood-risk, TASC are extremely concerned that the ONR have advised in FOI 20212068 (see appendix A to TASC report 'DEFRA's 25 year environmental plan') that '*it is important to note that the detailed design of SZC, including its civil engineering design, will continue past the point of any potential nuclear site licence grant'*. TASC consider that the Applicant is attempting to avoid public and PINS examination/scrutiny of major aspects of the SZC project e.g. design of the Hard Coastal Sea Defences (HCSD), by attempting to leave these until after the Examination and after the ONR licensing decisions have been made. TASC trust that both PINS and the statutory regulators will not allow major safety critical matters such as the HCSD or for important sustainability matters such as the source of potable water for SZC to be cast into the 'Rochdale Envelope'.
3.7.2 The Nuclear AoS identified potential adverse effects on water resources including effects on coastal processes, hydrodynamics and sediment transport. Adverse effects on water resources could occur through increased demand, particularly during construction. The Nuclear AoS also identified indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges.This Section should therefore be read in conjunction with Section 3.9 of this NPS and Section 5.3 of EN-1, which set out policy in respect of biodiversity and geological conservation. The significance of these effects depends on the location of the site, proximity to water bodies and the existing water surplus/ deficit status within the region	Since the AoS was carried out over a decade ago, it must be considered out of date due to the greater risk of more severe droughts arising from the impacts of climate change affecting an area that already suffers from potable water shortages. Potable water usage during construction (up to 3.5 million litres per day) and operation (2 million litres per day) are unsustainable. After 5 consultations over 9 years, it is telling that the Applicant is still not able to confirm the source of the potable water SZC will consume- see TASC WR 'DEFRA's 25 year environmental plan'. As set out in representations from RSPB, SWT, FOE, and MLSG, SZC will impact water levels in many designated areas and the Sizewell Marshes SSSI will be lost and fragmented by the project. EN1 para 5.3.11 says '*Where a proposed development on land within or outside an SSSI is likely to have an adverse effect on an SSSI (either individually or in combination with other developments), development consent should not normally be granted.'*

3.7.6 In the design of any direct cooling system the locations of the intake and outfall should be sited to avoid or minimise adverse impacts on legitimate commercial and recreational uses of the receiving waters, including their ecology. There should also be specific measures to minimise impact to fish and aquatic biota by entrainment or by excessive heat or biocidal chemicals from discharges to receiving waters 3.7.7 Discharges into water sources will be controlled in accordance with permits issued by the EA. Applicants will be expected to demonstrate Best Available Techniques to minimise the impacts of cooling water discharges.	Best Available Technique is for the use of an acoustic fish deterrent, but the Applicant has not proposed one for SZC, TASC considers demonstrates that the Applicant is not minimising adverse impacts on marine biota. As set out in TASC's WR 'Ecological impact of Sizewell C on marine life' the loss of fish stocks and other marine biota through the cooling water system has been underestimated by the Applicant and is unacceptable and unsustainable, especially when considering the effect with Sizewell B. The dead/dying biota returned to the sea with chemical effluent could have a serious adverse impact when returned to the marine environment.
3.8.1 Generic coastal change impacts of new energy NSIPs are covered in Section 5.5 of EN-1. This policy applies to applications for new nuclear development and, in addition, policy specific to new nuclear power stations is set out below. 3.8.2 The Nuclear AoS identified that the construction of new coastal and fluvial defences and possible marine landing jetties/docks necessary to support the nuclear power station could affect coastal processes, hydrodynamics and sediment transport processes at coastal and estuarine sites. These impacts could lead to coastal erosion or accretion. There could also be changes to offshore features such as submerged banks and ridges and marine ecology 3.8.5 In applying the policy on mitigation set out in Section 5.5 of EN-1, and having taken account of the effects of climate change over the lifetime of the project (including any decommissioning period), the IPC should be satisfied that the application will include measures where necessary to mitigate the effects of, and on, coastal change.	EN1 para 5.5.1 says planning should '● *ensure that policies and decisions in coastal areas are based on an understanding of coastal change over time;* ● *prevent new development from being put at risk from coastal change by (i) avoiding inappropriate development in areas that are vulnerable to coastal change or any development that adds to the impacts of physical changes to the coast, and (ii) directing development away from areas vulnerable to coastal change;* ● *ensure that the risk to development which is, exceptionally, necessary in coastal change areas because it requires a coastal location and provides substantial economic and social benefits to communities, is managed over its planned lifetime; and* ● *ensure that plans are in place to secure the long term sustainability of coastal areas'* Sizewell C would be built on an eroding coastline vulnerable to the impacts of climate change, likely to impact on neighbouring areas with its sea defences and beach landing facilities including designated SPA, SAC and Ramsar conservation sites. As explained in N Scarr's WR the Applicant has placed an over reliance on the protection the coast at Sizewell is afforded by the Dunwich-Sizewell Bank. TASC consider the Applicant has not demonstrated that SZC's coastal structures will not have an adverse impact on coastal processes or on neighbouring areas. The Applicant's Climate Change Resilience covering up to 2099, does not include the period of decommissioning, nor, just as importantly, the period during which spent fuel will remain stored on site until, or if, a GDF is built.

3.9.2 The Nuclear AoS has identified potential cumulative ecological effects at sites in the east, south-west and north-west of England. It also identified some common implications for biodiversity resulting from: ● water discharge, abstraction and quality issues; ● habitat and species loss and fragmentation/coastal squeeze; ● disturbance events (noise, light and visual); and ● air quality. 3.9.3 In carrying out an assessment in accordance with Section 5.3 of EN-1, applicants should also consider the effects of the construction of a new nuclear power station on the groundwater regime and its effects on terrestrial/coastal habitats.	The Sizewell C site has major issues with regard to all the matters identified in EN6 para 3.9.2 as well as impacts on water quality and levels and terrestrial/coastal habitats, particularly in relation Sizewell Marshes SSSI and the interconnected groundwater reliant habitats-TASC endorse the concerns of RSPB/SWT/FOE/MLSG in this respect. Para 5.3.4 EN1 says that a project should take advantage of opportunities to conserve biodiversity. In TASC's opinion the Applicant has clearly failed to do this with regard to the destruction of Coronation Wood (see attached article in War on Wildlife[3]) as part of the Sizewell B facilities relocation when facilities could have been installed elsewhere outside the AONB. The permanent loss of 7 hectares of the SSSI (including some rare fen meadow habitat) and the fragmentation of the SSSI will likely result in irreplaceable biodiversity loss.
3.10.3 There is the potential for long-term effects on visual amenity, especially at Sellafield because of the proximity to the Lake District National Park, and at Sizewell, given the Suffolk Coast and Heaths Area of Outstanding Natural Beauty. 3.10.7 In assessing the landscape and visual effects resulting from the electricity transmission network associated with the proposal for a new nuclear power station, the IPC should act in accordance with Section 4.9 of EN-1 and with EN-5 (in particular Section 2.8 of EN-5).	Sizewell C, as the only nominated site in a designated landscape, should be excluded from consideration. TASC's concerns are set out in the TASC report 'DEFRA's 25 year environmental plan' and TASC endorse the concerns of the AONB Partnership as set out in their representations. The scarring of the landscape with four new pylons in such a visually sensitive area shows that the Applicant has not minimised the visual impact on the AONB and SSSI. Referring to EN5 para 2.8.2 the visual impact of the pylons will make such proposals '*unacceptable in planning terms*.' **TASC draw PINS attention to the Holford rules, particularly rules 1 and 2, set out EN5 paras 2.8.1 2.8.9**
3.11.2 EN-1 sets out that the construction, operation and decommissioning of energy infrastructure may have socio-economic impacts. It is noted that nuclear power stations involve large scale construction projects at the beginning of their life. The Nuclear AoS identified that there are likely to be positive effects of local economic significance, although these are less significant at the regional scale except where there are clusters of potentially suitable sites for new nuclear power stations, particularly in the south-west and north-west of England. There may also be negative effects	TASC endorse the Stop Sizewell C WR 'Sizewell C project: Economic Statement Response' dated September 2020 as we agree that **the Applicant appears to have overstated local benefits from the project and underestimated the harm to local businesses,** residents and the environment so important for physical and mental health and well-being. TASC considers that the prosperity promised to Leiston as a result of Sizewell B never materialised.
3.12.2 The Nuclear AoS noted that the sites listed in the NPS are on coastal or estuarine locations in	**EN1 para 4.13.2 refers to the cumulative impacts of different projects on human health and well-being**

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rural areas and that there is therefore the potential for impact on land that has recreational and amenity value. As a result, this Section should also be read in conjunction with Section 5.10 of EN-1 (Land Use including Open Space, Green Infrastructure & Green Belt).	**and TASC feel this has not been considered adequately.** Health and well-being covers mental as well as physical health and TASC feel there appears to be a lack of appreciation of the stress the communities of east Suffolk are experiencing with two SPR windfarm DCOs and plans for Interconnectors overlapping with the SZC project. This mental stress is a precursor to the impacts of these projects if they are all constructed at the same time.
3.12.3 The operation of a new nuclear power station is unlikely to be associated with significant noise, vibration or air quality impacts (although there may be local impacts from transport and associated activities during construction; and if cooling towers are required, particularly forced draught towers, the potential noise impact may be greater). With appropriate mitigation, the subsequent effect of these potential impacts on human health is unlikely to be significant.	Negative impacts during construction were under-assessed when EN6 was drafted as it was based on a SZC construction period of 5-7 years, whereas the Applicant now suggests 10-12 years, plus 2 years for the Sizewell B facilities relocation works. Based on other European EPR projects and the anticipated problems of getting materials to site in such a rural area, the timeline is quite likely to be longer than that now anticipated.
3.12.8 The IPC should consider the positive effect of employment and other socioeconomic impacts (see Section 3.11 above) on human health and wellbeing.	EN1 para 5.10.14 says that with regard to open spaces, PINS need to consider whether any benefits, including need, justify the green space lost. The 'urgent need' for new nuclear was based on fears over energy security if new nuclear power stations of over 1GW were not deployed by 2025. Deployment of SZC by 2025 is impossible and it is not anticipated that there will now be an electricity shortfall by 2025. Current circumstances show that the claim was not justified and still has no relevance today. Therefore, there is no justification to sanction SZC due to the significant adverse impacts it would have on the Heritage Coast/the AONB/designated wildlife sites and public rights of way that are enjoyed by so many and which support a vibrant tourism industry. So, **in TASC's opinion there is clearly a balance in favour of refusing this application**. As set out in Stop Sizewell C's report 'Sizewell C project: Economic Statement Response' dated September 2020 local hospitality businesses are likely to suffer if the SZC project goes ahead. They may never recover due to the industrialisation of the most spectacular part of the AONB.
3.12.4 Radiation from nuclear power stations requires careful management during and beyond the operational life of the power station. However, safety systems in place in the designs of new nuclear power stations and compliance with the UK's robust legislative and regulatory regime mean that the risk of radiological health detriment posed by nuclear power stations (both during normal	As set out in TASC's WR 'Health wellbeing and low level radiation' TASC consider comments in EN6 para 3.12.4 show a complacency in respect of likely health issues from solid and gaseous emissions from SZC. In TASC's opinion, the Applicant has not demonstrated that the SZC site can be kept safe for the entire period that radioactive waste will be stored on site, so there is

operation and as a result of an unplanned release) is very small	a potential threat to the health and well-being of future generations.
3.14.2 When considering a development consent application pursuant to this NPS, the IPC should refer to Section 4.9 of EN-1 in respect of the grid connection. Applications for above ground electricity lines of 132 kilovolts (kV) and above, and other infrastructure for electricity networks that is associated with a Nationally Significant Infrastructure Project, such as substations and converter stations, will be considered by the IPC using EN-5	**TASC consider that there has been a lack of consideration of:** imposing the new pylons in an AONB landscape adjacent to a SSSI-in accordance with best practice, they should be underground; and the other infrastructure that may be required to accomodate 3.2GW of additional power supplies from SZC, such as additional spinning reserves.
3.15.2 Applications should demonstrate that the proposed development would not have an unacceptable adverse impact on significant infrastructure. The IPC should take into account any local authority impact report, advice from the relevant Nuclear Regulators and relevant policy in NPSs in assessing impacts on significant infrastructure and resources. 3.15.3 In particular, the Nuclear AoS identified that there may be adverse effects during the construction and decommissioning phases on regional transport networks that may already be under stress, particularly where there are clusters of potentially suitable sites for new nuclear power stations. In considering this issue the policy set out in Section 5.13 of EN-1 (Transport and Traffic impacts) applies.	**As set out in TASC WRs, we contend that there are major cumulative implications** for potable water supplies, mainline rail passenger services, the safe operation of Sizewell B, the electricity transmission network, the local rural roads and the A12 (from the junction with the M25 to Lowestoft) resulting from the SZC project. The cumulative impact of the construction activities from SZC, the two SPR windfarm projects, the new Interconnectors, A12 road works/'improvements and Felixstowe Freeport would be an unfair burden on the communities between Ipswich and Lowestoft. EN1 para 5.13.6 talks of compensation for impacts from a development but it should be acknowledged that any financial settlement from the Applicant, who admit they do not have the funds to build SZC so will be reliant on external monies, will be largely borne by UK electricity consumers and taxpayers. This means any compensation received by local communities will be financed out of our own pockets.
3.16.1 Some activities associated with the proposed development may take place outside of the boundaries of the listed site (for example construction and decommissioning activities – see Section 2.3 of this NPS). In considering an application for development consent IPC should assess all impacts of the proposed development that it considers relevant and important to the application in accordance with the Planning Act 2008, the policy set out in EN-1 and this NPS	The Applicant has failed to demonstrate that the site can be safely decommissioned. The compact nature of the proposed site means it is constrained by the Sizewell B site, Sizewell Marshes SSSI, RSPB Minsmere and the Heritage Coast. TASC consider the lack of detail provided, as to how the site will be kept safe from flooding beyond the period of operation, creates doubt that the site could be safely accessed for decommissioning and spent fuel removal. TASC draw PINS attention to APP-094 page 41 para 6.1.4 which states *'Considering the credible maximum climate change scenarios, the predicted overtopping rates are significant'*

Appendix C

Relevant abstracts from EN6 Vol 2 Annex C 'Site Assessments'	TASC comments
C.8.4 The Strategic Siting Assessment (SSA) considered whether sites are credible for deployment by the end of 2025. This is because it is important to focus on sites which can come on stream in good time to contribute to the Government's objectives on climate change and energy security.	TASC consider this a totally incorrect assessment as SZC, nor any other potential sites listed in EN6 with the possible exception of Hinkley Point C (although even this now seems unlikely), will be deployed by 2025. Indeed, SZC is unlikely to be deployed by 2035 (the end date set in the Government's July 2018 response to the consultation on the revised siting criteria for new nuclear power stations over 1GW), especially when considering the experiences at Olkiluoto and Flamanville which are already 16 years and 14 years respectively into their construction, neither yet operational. TASC also add that government have said a funding decision on SZC could be made by the end of this Parliament ie 2024, which if made in 2024 would mean even further delays in deployment of the project. **In terms of energy security, TASC believe that more than a decade after the SSA, the matter needs to be readdressed**. EDF, the 80% partner in this development, is under the control of the French government and now the UK has left the European Union, we can no longer expect our relations with France to maintain the political stability we have enjoyed over the last 40 years- as evidenced by the threat in May 2021 that electricity supply from France to the Channel Islands might be cut off because of a fishing dispute. There are also potential problems of having the 20% partner, CGN, which is reportedly under the control of the Chinese government, involved in a strategically important infrastructure project such as SZC. **In TASC's opinion** SZC could have an adverse impact on the UK's energy security because:- (1) SZC would significantly add to the heavy reliance that the UK has for the supply of energy from East Anglia with regard to windfarms, interconnectors, Sizewell B's nuclear power, solar and gas plant (in 2020 Bacton was responsible for supply of gas generating 40% of the UK's electricity). This makes the possibility of an accident or

	malicious attack in East Anglia a major risk to the security of UK's energy supplies. (2) The UK has no indigenous source of uranium so is reliant on ores mined in other countries, weakening our energy security (3) SZC's generation of 3.2GW from 2 reactors of 1.6GW places greater pressure on the national grid as that level of power dropping out creates a costly requirement for a larger fossil-fuelled spinning reserve (4) Generation of 1.6GW per reactor places an inflexible pressure on the grid as nuclear needs to run at full power when not in outage to maximise its commercial potential. This means that other, cheaper and more flexible supplies eg that from wind, are curtailed making the mix less efficient and more expensive. As set out in Stop Sizewell C's report 'How much carbon would Sizewell C save?' SZC will not help meet the Government's target of fully decarbonising the electricity grid by 2035, nor help meet the UK's net zero by 2050 goal. Indeed, due to the carbon footprint of the nuclear fuel cycle, SZC would likely hinder the UK's carbon goals. As the deployment of SZC is a minimum of 12-15 years away the time and money invested in its development hinders the installation of cheaper and quicker to deploy alternatives.
C.8.7 The Office for Nuclear Regulation has advised that the site does not exceed the semi-urban criterion. The furthest western edge of the boundary is adjacent to an area which exceeds the semi-urban criterion. The nomination says that land in the Goose and Kenton Hills is to provide for an access road and other facilities which may be located outside the nuclear power station boundary. It does not have sufficient defence-in depth to house facilities which have potential to directly cause a radiological hazard	This assessment needs revising in the light of all the additional accommodation built/ proposed to be built in the area surrounding the SZC site. The methodology appears flawed as it does not take into account the considerable number of temporary residents ie tourists that stay in the area. The access route into the site has changed since nomination and is now proposed to involve building an elevated (7.3-10.5 metres AOD, plus 3 metre barriers) causeway over and through Sizewell Marshes SSSI.
C.8.8 Some responses were concerned over the effect that a new nuclear power station could have on limiting future development of housing in the Leiston area through restrictions in place on acceptable limits of population density around nuclear power stations. The Office for Nuclear Regulation has advised that the extent of the Emergency Planning Zone and the concomitant constraints on population growth in the	**TASC refer PINS to our WR 'Emergency Planning' to understand our concerns about the implications of having many more houses in the vicinity of Sizewell, more accommodation planned and the implications of having 3 operating nuclear power reactors in a confined area and the intention to store their spent fuel cells for**

nuclear safeguarding zones of the Sizewell site are determined principally by the radiological hazards that remain on the Sizewell A Magnox reactor site, which still holds spent fuel and radioactive waste.	**an indefinite period when the SZC coastal location is already suffering erosion and is extremely vulnerable to the risk of flooding from sea level rise, greater storm surges and more extreme weather events.**
C.8.9 This site passes the demographics criterion. C.8.11 Given the proximity of the site boundary to an area which exceeds the semi-urban criterion, the applicant should demonstrate that it has taken the advice of the Office for Nuclear Regulation on demographic risk, and that subject to that advice, the Office for Nuclear Regulation is satisfied that the proposals do not result in a direct radiological hazard being sited in an area which exceeds the semi-urban criterion.	Please refer to comments re sections C.8.7 and C8.8 above. Due to the small proposed SZC licenced site size (too small in TASC's opinion), **TASC are concerned that the Spent Fuel Store poses a risk to the population of Leiston.**
C.8.19 The Government believes that the fact that a site, or in this case, part of a site is in Flood Zone 3 should not necessarily preclude it from the NPS if the independent regulator has advised that the site can be potentially protected. At Sizewell the Environment Agency and the Office for Nuclear Regulation have advised that the site can potentially be protected from flood risk, including the effects of climate change, throughout its lifetime. C.8.20 In addition to considering the availability of other sites in lower flood zones, the Government has taken a sequential approach which involves giving priority to areas at lower risk of flooding. C.8.21 As well as submitting a flood risk assessment in accordance with Section 5.7 of EN-1, this NPS also sets out that the Infrastructure Planning Commission (IPC) will still need to be satisfied that a sequential approach has been applied at the site level to ensure that, where possible, critical infrastructure is located in the lowest flood risk areas within the site.	Since the site assessment was carried out the predictions of the impacts from climate change have worsened. The lifetime of the site will involve storing highly radioactive spent fuel cells on site well into the next century. In DCO document APP-342 6.3 Vol 2 Chapter 26 Climate Change para 26.5.2 the Applicant says '*The CCR assessment scenarios considers climate change impacts during the construction and operation of Sizewell C on the main development site and the associated developments through to 2099, the last year for which UKCP18 climate projections are provided. The scenario took into account the resilience of construction and operation of the Sizewell C Project to climate change, resulting from projected increases in temperature, high winds, flooding (associated with increases in precipitation and sea level change).*' **TASC consider the above period of assessment inadequate as it does not cover decommissioning and the storage of spent fuel on site until 2150, or later if a GDF is not built**. The statement by the EA and ONR referred to in para C.8.19, was very weak in 2010 referring to 'potentially' being able to keep the site safe from flooding. **TASC believe the EA and ONR need to advise, supported by evidence of their analysis, whether they are confident the site can be kept safe for the entire period until the spent fuel leaves the site, without creating problems elsewhere eg**

C.8.22 Responses expressed concern regarding the potential impacts of climate change and the ability of the site to withstand these. There was particular concern regarding the length of time that waste may be on site. A report entitled Climate Change - Adapting to the Inevitable? produced by the Institute of Mechanical Engineers was referred to. Responses stated that sea level rise may necessitate the abandonment of the site. The Appraisal of Sustainability identified potential adverse effects relating to flood risk arising from predicted rising sea levels caused by climate change, especially during the later stages of operation and decommissioning of any new nuclear power station.	**from coastal processes resulting from the SZC flood defences.** Circumstances have changed since the site was assessed, not least the recommendation in July 2018 by the National Infrastructure Commission (NIC) Chair, John Armitt, that after HPC the UK *'should agree support for no more than one nuclear power station before 2025'*. **TASC consider** that SZC will have adverse effects on the integrity of European sites. While TASC believe the need for any new nuclear is not justified, if government are minded to support one more gigawatt reactor, TASC contend that choosing a site that is in an AONB on an already eroding coast, in flood zones 2/3, that will require the building of a causeway through, or fragment, a pristine SSSI wildlife habitat, risk damaging Natura 2000 sites, Ramsar, SPA, SAC and other SSSI designated areas stretches credulity and is an act of recklessness. **As set out in TASC's 'Policy and Need' WR above, TASC contend that IROPI is not justified for SZC.** The AoS identified potential adverse impacts relating to flood risk back in 2010, so the updated predictions in respect of impacts arising from climate change highlight the increased vulnerability of the SZC site to flooding. With reference to C.8.21, **TASC do not consider that the Applicant is able to demonstrate a satisfactory sequential approach to move critical infrastructure to lower flood risk areas due to the small, confined nature of the site.**
C.8.23 Waste will be stored in safe and secure interim storage facilities until a geological disposal facility becomes available. It is currently anticipated that disposal of new build wastes would begin once disposal of legacy wastes is completed. Geological disposal of higher activity waste from new nuclear power stations is currently expected to be available for new build waste from around 2130.	TASC refer PINS to TASC's WR 'Nuclear waste'. There are doubts that a GDF will ever be built and further doubts that the technical issues relating to a proven safe method of storage in a GDF over such a long time is possible e.g. design and durability of storage containers that will need to last for thousands of years (Many consider Sweden to be the world leaders in such storage containers and the Swedes have identified safety issues with the copper containers currently proposed to be used in a Swedish GDF). **TASC consider the precautionary principle should apply. To continue with a new nuclear programme**

	with these unresolved issues is quite frankly immoral.
C.8.24 The Environment Agency has advised that it is reasonable to conclude that a nuclear power station within the site could potentially be protected against flood risks throughout its lifetime, including the potential effects of climate change, storm surge and tsunami, taking into account possible countermeasures. This assessment includes a consideration of sea level rise based on UKCP09 UK climate projections. It is based on a consideration of the capacity of nominated sites to withstand flood risk and coastal erosion including the potential effects of climate change using modelling data that looks ahead to 2100. Predictions of potential climate change effects become increasingly less certain the further into the future that they extend. However, climate change projections will continue to be refined and, as time passes, will project further into the future. As such, should greater future impact be predicted, this should be identified well in advance, giving time for appropriate actions to be taken to address those impacts. [Note: TASC's comments on section C.8.24 above also apply to section C.8.31]	It is telling that the EA say the site could 'potentially' be protected from flood risks. TASC believe the risk attached to an operational nuclear power station and storage of spent fuel on site well into the next century needs a greater certainty than that. **TASC believe that, due to the uncertainties of the impacts from climate change, the precautionary principle should apply, and PINS recommend the SZC project be refused**. TASC refer PINS to N Scarr's WR 'Sizewell C - Coastal Morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments -May 2021' which highlights the unfounded confidence the Applicant has displayed, and still maintains, in stating that the site can be kept safe from flooding relying on the protection of offshore sandbanks and coralline crag. While engineers can build sea defences higher, flooding can equally affect access routes and, as in the case of SZC, the landward boundary of the site. As advised in DCO document AS-181 para 2.2.134, the SSSI crossing, which is vulnerable to overtopping, will need managed adaption from 7.3 metres AOD to 10.5 metres AOD by 2090. In May 2019 Environment Agency Chair, Emma Howard-Boyd, said *"We need to move away from talking about flood "defence". We cannot win a war against water. We cannot expect to build our way out of future climate risks with infinitely high walls and barriers"*. On 23rd February 2021 James Bevan, Chief Executive of the Environment Agency said "*The reasonable worst case scenario for climate sounds like this:* *Much higher sea levels will take out most of the world's cities, displace millions, and make much of the rest of our land surface uninhabitable or unusable.* *Much more extreme weather will kill more people through drought, flooding, wildfires and heatwaves than most wars have.* *The net effects will collapse ecosystems, slash crop yields, take out the infrastructure that our civilisation depends on, and destroy the basis of the modern economy and modern society*."

	TASC question why these warnings are not being heeded by the UK government, ie why are they continuing to support the building of twin nuclear reactors at Sizewell? **TASC urge PINS to take the comments made by Emma Howard Boyd and James Bevan into account when assessing the SZC project.**
C.8.25 The regulators have also examined the adaptability of the sites to potential changes in flood hazard and are satisfied that additional safeguards are in place to ensure that only suitable sites achieve development and ongoing operational consent. This will also be reviewed in more detail as part of the planning and licensing stage and as part of the Flood Risk Assessment that applicants must undertake in conjunction with their applications to the IPC. C.8.27 The Environment Agency has also noted that sea level rise and land raising of the development will need to be taken into account when considering flood storage loss due to the development, because mitigation of flood risk to the site could have an adverse impact on flood risk in the surrounding area by reducing the capability of area to absorb and disperse flood water. The Environment Agency has noted that at this strategic stage it is not possible to assess the impact on flood risk in the surrounding area from development and that this will need to be considered as part of the flood risk assessment submitted to the IPC as part of the application for development consent.	This statement implies a robust flood risk assessment by the licensing/permitting authorities at the same time as the DCO Examination. However, at Preliminary Meeting 2 the Applicant mentioned their intention to only make modelling of the Soft Coastal Sea Defences available over a third of the way through the Examination process in late June 2020 and that no modelling data would be provided at all for the Hard Coastal Sea Defences during the Examination. **TASC say that if the Applicant cannot demonstrate, after 9 years of consultations, that the SZC site can be kept safe for its full lifetime by the end of the Examination period, then PINS should recommend refusal of the SZC DCO application.** Over a decade after the EA said "it is not possible to assess the impact on flood risk in the surrounding area from development" **TASC are unable to find anything in the DCO documents to allay our concerns arising from this statement**. **TASC consider that the Applicant's intention to only monitor coastal changes between Minsmere Sluice and Thorpeness inadequate-TASC support the MLSG's observations in this respect.**
C.8.28 The report *Climate Change - Adapting to the Inevitable* indicates that a projected 2m sea level rise in the second half of the 23rd century would have a major impact on the UK if no adaptation effort is made to prevent it, including inundating the Norfolk Broads and major parts of London such that the viability of London, key ports and the Sizewell site would be threatened. The Environment Agency has considered this report and note that the latter half of the 23rd century is significantly beyond the expected timescale for the complete decommissioning of the Sizewell site. The Environment Agency has advised that they agree with the report's suggestion that the site might need additional flood protection in the future, as reflected above.	The report referenced in C.8.28 was completed in 2009 so would need updating to consider likely predicted outcomes with current thinking on climate change impacts. TASC appreciate that there are so many unknowns with regard to climate change, not least the willingness of all nations to decarbonise, so the outcomes are unpredictable. However, what the scientists tell us, is that climate change is here and will continue to have increased adverse impacts whatever is currently put into place to mitigate future global temperature rises. The period for which Sizewell C would need to be kept safe goes beyond the decommissioning phase that the EA refer to**. As such the precautionary principle should apply, and TASC consider PINS should recommend refusal of the DCO application.**

C.8.31 This site passes this criterion. This takes into account in particular the advice of the Environment Agency that it is potentially reasonable to conclude that any new nuclear power station on the site could potentially be protected against flood risk throughout its lifetime, including the potential effects of climate change, storm surge and tsunami and considering possible countermeasures. The impacts of possible countermeasures will need to be considered should an application come forward.	**In view of current predictions and longer term uncertainties of the impacts of climate change, TASC consider a decade old assessment that the SZC might 'potentially' be protected against flood risk is clearly outdated and not to be relied on in 2021.**
C.8.33 The Environment Agency has advised that development at the site could avoid or mitigate the effects of coastal erosion or other landscape change scenarios throughout its lifetime, including the potential effects of climate change. The Environment Agency has advised that, based on the current understanding of coastal erosion in this area there is no technical reason that would prevent the site being protected/mitigated from the effects of coastal erosion, although there are potential difficulties.	The EA advice and the statements included in sections C.8.34, C.8.35 provided a decade or more ago, need to be reconsidered in the light of the statements made by their Chair and Chief Executive (included in TASC's WR 'Policy and Need'), as well as the N Scarr report referred to in the TASC comments relating to section C.24 of this document above, together with updated predictions of the impacts from climate change.
C.8.36 The Appraisal of Sustainability has noted that there are existing sand and shingle flood defences in place which may require upgrading to protect the site for the full lifetime of a new power station. It considers that new coastal defences may have potential effects on erosion and visual appearance of the coastline, identifying possible impacts on coastal processes, hydrodynamics and sediment transport from any necessary or upgraded coastal defences.	**TASC highlight that the AoS took place 13-16 years ago which points to the appraisal being out of date**, e.g. Table 1.2 of the Site Report published in October 2010 refers to a construction period of 5-6 years (now 12-14 years including the relocation of SZB facilities) and a maximum workforce of 4,000 (now 8,500). There are now also 2 Beach Landing Facilities (BLFs) and a hard sea defence up to 16 metres AOD and an SSSI crossing of 7.3/10.4 metres AOD to consider. In addition, climate change predictions have changed significantly since 2008.
C.8.37 The Environment Agency has advised that the positioning of the site is important and that the applicant should consider the long term effects of coastal erosion which need to be understood before fixing on a specific location.	The EA comments were made when looking at the prospect of at least one new nuclear reactor so there may have been some flexibility on fixing a specific location for a single reactor. However, the Applicant has applied to build two reactors on a site of 33 hectares ie only suitable to build a single reactor, with the site being constrained by Sizewell B to the south, RSPB Minsmere on the northern boundary, the Heritage Coast on the eastern flank and Sizewell Marshes SSSI on the western boundary. This means there is no flexibility in fixing a location.
C.8.39 Based on the advice above it is reasonable to conclude that a nuclear power station at the site could be protected against coastal erosion, including the effects of climate change, for the lifetime of the site. Mitigation of the effects of coastal processes may be possible through appropriate design and construction of defences or the positioning of elements of the infrastructure on the site. Whilst the current inundation	Based on our comments above, **TASC believe that the Applicant has failed to demonstrate that: (1) the site can be protected from the impacts of climate change throughout its full lifetime including the site's use as a spent nuclear fuel store [see comments on para C.8.19]; (2) the SZC development will not impact the surrounding area; (3) sufficient cognisance has been given to**

and erosion threat at Sizewell is relatively low this does not understate the complex potential nature of coastal processes around this site. The Environment Agency has underlined the importance of understanding the long term trends which are occurring regarding erosion at this site. This will need to include an assessment of the effects on the surrounding area.

C.8.41 The applicant's proposals should reflect consideration of the issues outlined above, including how the site would be protected should the Minsmere Sluice outfall pipe no longer be present; the effects on surrounding areas which may be more susceptible; and, a consideration of the impact of siting outfalls and other associated infrastructure.

the history of coastal change in the SZC area going back 300 years- see N Scarr's report referenced in TASC's comments on section C.8.24 above; (4) the Sizewell-Dunwich offshore bank will continue to provide protection to the SZC site as climate change impacts increase in intensity over time (also refer to the afore-mentioned report from N. Scarr), and (5) both the permanent and temporary beach landing facilities, will not adversely impact coastal processes.

C.8.53 The Appraisal of Sustainability has identified the potential for adverse effects on sites and species considered to be of European nature conservation importance. This means that significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. The findings of the Appraisal of Sustainability on European Sites are drawn from the Habitats Regulations Assessment for Sizewell. The Habitats Regulations Assessment notes that its key findings are limited by the strategic nature of the assessment process and the information available, which does not generally allow for a definitive prediction of effects on the European Sites considered. A precautionary approach suggests that the assessment at this strategic level cannot rule out the potential for adverse effects on the integrity of nine European Sites (Alde-Ore and Butley Estuaries Special Area of Conservation (SAC), Alde-Ore Estuary SPA / Ramsar, Minsmere to Walberswick Heaths and Marshes SAC, Minsmere to Walberswick SPA/ Ramsar, Orfordness-Shingle Street SAC, Sandlings SPA, Outer Thames Estuary SPA) through potential impacts on water resources and quality, habitat and species loss and fragmentation, and disturbance (noise, light and visual). For example, the assessment has identified that development could result in habitat loss which could affect breeding populations of woodlark and nightjar in Sandlings SPA or cause disturbance to little terns in the Minsmere to Walberswick SPA and Ramsar.

TASC have great concerns about the impact that the SZC project will have on the integrity of the mosaic of wildlife habitats that adjoin the site or are linked through shared groundwater supplies and shared foraging routes. We endorse the concerns expressed in the representations of the RSPB/Suffolk Wildlife Trust (SWT)/Suffolk Coastal Friends of the Earth (FOE)/Minsmere Levels Stakeholder Group (MLSG) regarding the threat of the SZC project to these European Sites, as well as to nationally designated sites, and the flora and fauna they all support-particularly in relation to the site access road/proposed car park in Goose Hill, Dunwich Forest and the SSSI crossing.

TASC also contend that the Applicant has grossly underestimated the hundreds of millions of fish, fry and fish eggs as well as other marine biota that will be killed/damaged by the cooling water intake system, which then results in an understatement of the impact on birds such as the little tern and red throated diver, as well as marine mammals and predatory fish species- see TASC WR 'Ecological impact of Sizewell C on marine life'.

The UK is one of the most nature-depleted nations, so **TASC contend that the scale of environmental damage that will be inflicted by the SZC project cannot be mitigated or compensated.** Damage to one part of the mosaic of wildlife habitats neighbouring SZC is, in essence, damage to them all.

C.8.55 The Outer Thames Estuary SPA is considered in the Habitats Regulations Assessment. The assessment concludes that adverse effects on water resource and quality, habitat loss and fragmentation, and disturbance (noise, light and visual) cannot be ruled out until further site specific detail including on

The original assessment of the impact on the Outer Thames Estuary was on the basis of a 5-7 year construction period whereas the Applicant now suggests it would be 12-14 years (including the SZB facilities relocation). The Applicant also proposes a greater number of marine deliveries and two beach

technology and mitigation measures, and processes such as the extent and location of coastal defences, dredging, or marine offloading facilities) are known. Air Quality impacts on the Outer Thames Estuary SPA were screened into the appropriate assessment due to the close proximity of the SPA to Sizewell. However, after further consideration, adverse effects on site integrity have been ruled out. It is considered unlikely that any localised changes to air quality will reach a level that results in impacts on the integrity of the SPA.	landing facilities so the impact on the marine environment and coastal processes will be far greater. The government's review mentioned in C.8.55 could not rule out the possibility of adverse impacts on European sites but Sizewell was still designated as a potential site because of the supposed need to deploy by 2025 as well as a lack of alternatives (see EN6 Vol 2 para C.8.57). We now know that that Sizewell C cannot be deployed by 2025 and there are now alternatives (see TASC WR 'Non-nuclear means of generating 3.2 GW of 'reliable electricity' when needed' so the original review decision is no longer valid. **TASC believe that the adverse impacts on European sites from the Sizewell C project, as set out by FOE, RSPB, SWT and MLSG, should lead PINS to recommend refusal.**
C.8.57 Annex A of this NPS sets out that the Government has concluded that there is an Imperative Reason of Overriding Public Interest that favours the inclusion of this site in the Nuclear NPS despite the inability to rule out adverse effects on European Sites at this stage. This takes into account the need for sites to be available for potential deployment by the end of 2025, the lack of alternatives, and the consideration given to compensatory measures.	As set out in TASC's WR 'Policy and Need' above, there are now alternatives to the SZC project that were not taken into account when the AoS was conducted. We also now know SZC cannot be deployed by 2025 and there is every possibility that it will not even be deployed by 2035**. It is TASC's view that the IROPI designation is no longer justified for the SZC site and the impacts on European sites will be significantly greater than originally assessed, due to the much larger scale of development now proposed.**
C.8.64 The Government notes that the Appraisal of Sustainability has identified potential impacts on nationally designated sites of ecological importance which it considers of strategic significance. Given the scope for mitigation of biodiversity effects identified in the Appraisal of Sustainability for sites of national importance it is reasonable to conclude that it may be possible to avoid or mitigate impacts to an extent. However, the Appraisal of Sustainability has highlighted that the site includes land take from Sizewell Marshes SSSI that could lead to direct impacts.	Since the AoS was carried out, the land take from the SSSI has increased and the duration of construction has doubled from 5-7 years to 10-12 years, plus 2 years for the Sizewell B relocation works adjacent to the SSSI. The 7.3 metre high causeway (to be increased to 10.4 metres by way of adaptive management) with additional 3 metre barriers will, amongst other impacts, create problems for water level management and separate an important part of the SSSI from the existing mosaic of designated wildlife habitats that, according to the RSPB, support over 6,000 species of flora and fauna. **TASC endorse the concerns expressed by FOE, RSPB, SWT and MLSG in this respect.**
C.8.65 The Government has carefully considered whether this site meets this criterion given the direct impact on Sizewell Marshes SSSI. However, given the need to ensure sufficient sites are available for development to meet the Government's energy policy objectives (as described in Part 2 of this NPS), the Government believes that it does. In view of the need for sites and the limited number of potentially suitable	Part 2 of EN6 includes the following references: '*objectives of early deployment by, and hopefully well before, 2025'* [this objective can no longer apply to SZC]; '*setting out siting criteria'* [updated climate change forecasts expose the increased vulnerability of the Sizewell C site to rising sea levels, increased storm surges and more extreme

sites, the Government does not think the issues in relation to this criterion are sufficient to justify not including the site in this NPS. The Government has also noted that there will be further assessment of any proposal for the site at project level and that EN-1 sets out detailed consideration that must be given to issues related to nationally designated sites, should an application for development consent come forward.

weather events, making the original site assessment dangerously outdated]; '*alternatives'* [the statement that there are no alternatives is no longer, if it ever was, applicable to SZC - see TASC WR 'Non-nuclear means of generating 3.2 GW of 'reliable electricity' when needed' [lending more weight to the argument that EN6 is not fit for purpose in assessing siting criteria in 2021], and; the statement (para 2.2.4) "*the IPC should give substantial weight to the benefits (including the benefit of displacing carbon dioxide emissions) that would result from the application receiving development consent*." [Given the CCC's revised target for electricity generation to be net zero by 2035, SZC is not expected to make any contribution to meeting the UK's net zero targets. Indeed, due to the carbon footprint of the build and from the uranium fuel cycle, SZC will likely add to UK emissions- see Stop Sizewell C report 'How much carbon would Sizewell C save?', April 2021

TASC's comments above, highlight that benefits perceived when the NPS was designated no longer apply.

EN6 para 2.2.5 includes the statement "*The fact that a site is identified as potentially suitable within this NPS does not prevent the impacts being considered greater than the benefits."* **TASC consider that the adverse impacts of the SCZ project outweigh any benefits**.

C.8.80 In assessing this site the Government has considered the purpose of the AONB, which is of conserving and enhancing the natural beauty of the area of outstanding natural beauty.

C.8.81 The Appraisal of Sustainability identified that there is the potential for some long lasting adverse direct and indirect effects on landscape character and visual impacts on the Suffolk Coast and Heaths AONB, with limited potential for mitigation given that the site is wholly within the AONB.

C.8.82 This could have an effect on the purpose of the designation. To further understand these effects and the effectiveness of the mitigating actions proposed by the nominator of the site, further detailed assessment at project level is required – the Appraisal of

Sustainability suggests through the provision an integrated landscape, heritage and architectural plan. The potential for remaining effects can best be fully assessed when detailed plans come forward because they depend on a range of factors including the

According to the HRA Site Report for Sizewell para 2.7, the nominated site for the SZC development amounted to 117 hectares but the DCO application (8.4 Planning Statement para 2.2.1) states the main development site will be 371.7 hectares ie 317% the size of that nominated. Virtually all of this is included within the AONB and its hinterlands.

The estimated period for construction has risen from 5-7 years in the AoS and HRA to 10-12 years (actually 12-14 years including the SZB facilities relocation works) in the DCO application, although the experiences at Olkiluoto, Flamanville and Hinkley Point C suggest the SZC timelines are likely to be extended, especially given the rural infrastructure that will be used to get materials to the site and the potential cumulative impact of other infrastructure projects.

The AoS did not consider impacts on the AONB and its hinterlands that reflect the scale of development now proposed. Examples of significant changes include: the height, scale and

detailed proposals for minimisation and mitigation, the cooling technology proposed and location of transmission infrastructure. However, given the limited scope for mitigation, a level of impact is likely to remain.

C.8.83 The Government recognises that whilst there is some potential for partial minimisation and mitigation of the effects, there could be remaining effects on the AONB. However, as explained in Part 2 of this NPS, there is a need to ensure sufficient sites are available for development to meet the Government's energy policy objectives. In view of this and in view of the limited number of potentially suitable sites, the Government does not think the issues in relation to this criterion are sufficient to justify (against this criterion) not including the site in this NPS. The Government has also noted the fact that there will be further detailed assessment of any proposal for the site should any application for development consent come forward.

C.8.84 The Government also notes that there may be some visual impacts on the setting of other cultural heritage features in the area. Impact and mitigation measures will need to be considered by the IPC, but at this stage the potential effects are not felt sufficient to outweigh the need for sites as set out in Part 2 of this NPS, particularly given the need for further investigation and the scope for some mitigation that has been identified.

location of the hard and soft coastal defences; the size of the site; the height of the main platform; the height of the causeway across the SSSI; additional beach landing facility; size of car park on Goose Hill, in Dunwich Forest; additional pylons.

TASC believe the adverse effects of this project, both during construction and operation will impact on the statutory purpose of the AONB, ie to conserve and enhance natural beauty, as well as impacting the attributes supporting the AONB's designation ie tranquillity, wildlife value, scenic beauty, landscape value, relative wildness and dark skies.

EN6 para C.8.70 suggests that visual impact might be reduced by siting SZC on the 'same visual axis' as SZA and SZB but from the Applicant's current proposals, with the sea defences being 40 metres seawards of the current bund, this is no longer the case. From the coastal path, which is very popular with tourists and locals alike, the sea defences and buildings on the raised platform will be an intimidating and foreboding industrial complex in an otherwise reasonably open landscape.

TASC endorse the representations made by the AONB partnership

TASC's opinion is that the adverse impacts of SZC on the AONB vastly outweigh any perceived benefits of the SZC project.

C.8.88 The nominated area is approximately 117 hectares. Based on the advice of the Office for Nuclear Regulation there is sufficient area within the nominated boundary to house and provide sufficient defence-in-depth for essential infrastructure. However, the areas to the south of the existing Sizewell A and B Stations and to the west of longitude grid reference 64702 do not provide sufficient space for effective defence-in-depth for a nuclear reactor, including the associated turbine hall, spent fuel and intermediate level waste stores. Similarly, siting such activities into the land north of latitude grid reference 26453 could present security challenges because of the narrowing width of the nominated land. These parts of the site could still be used for locating supporting infrastructure that has no potential to directly cause a radiological hazard.

C.8.89 The size of the site and the potential impact this could have on the AONB remained of concern in some responses. To reduce the likelihood of further land being needed, and increase the usability of their site, nominators were encouraged to ensure that the area nominated included within it all likely actual site

As mentioned above in comments on EN6 para C.8.80 to C80.84 the size of the main development site is 371.7 hectares of which the licenced site is 33 hectares.

In C.80.89 the Applicant has acknowledged that a single reactor requires 30-50 hectares to cater for its operation and radioactive waste storage. While the ONR agreed with this estimate, they advised that additional space would be needed to provide for security in depth and to accommodate decommissioning.

This DCO application is for 2 reactors on a site of 33 hectares and in **TASC's opinion,** is clearly too small with only half the space required and the Applicant has not demonstrated how the site can be safely operated and then decommissioned.

By virtue of trying to include 2 reactors on a site that is only suitable for a single reactor, the Applicant proposes to consume more of the SSSI, more of the AONB (including the 1,350 space car

plans and all reasonable variations to those plans. It is therefore possible that the nominated area is in fact larger than the actual site plan that will be put forward, in due course, for development consent. Nominators have indicated that in their view the size of site required for the operation of a permanent site of a single nuclear power unit allowing for operation, maintenance, storage of spent fuel and intermediate level waste would be between 30 to 50 hectares. The Office for Nuclear Regulation concur with this estimate. In addition, considerations of the space needed to provide for security defence-in-depth show that there should be enough land available at this site.

C.8.90 Although the Office for Nuclear Regulation has identified areas of the site which may not provide sufficient defence-in-depth for a nuclear reactor, based on the advice of the Office for Nuclear Regulation it is reasonable to conclude that there is enough land within the boundary nominated to safely and securely operate at least one single unit nuclear power station, including the safe and secure storage of all the spent fuel and intermediate level waste produced through operation, and from decommissioning, on the site of the station until it can be sent for disposal in a geological disposal in a geological disposal facility.

park in Dunwich Forest and the premature felling of Coronation Wood) and more of the Heritage Coast (causing coastal squeeze).

TASC consider that this application should be rejected due to lack of sufficient space for 2 EPR nuclear reactors.

C.8.94 The Environment Agency has also advised that there are important local marine nursery grounds for mackerel, herring, sprat and plaice. There are populations of migratory trout on this coast, and there are local populations of twaite shad. The Appraisal of Sustainability notes that a potentially significant effect could occur as a result of the return of cooling water to the sea at elevated temperatures. This could result in adverse impacts on both sediment transport and water quality. It has identified potential indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges although it notes that any potential impacts would be assessed during detailed design and considered in any application for a consent to make discharges. The Environment Agency has also advised that any potential impacts would be assessed during detailed design and considered in any application for a consent to make discharges. This would require the discharges to meet regulatory standards for the protection of the quality of estuarine or coastal waters in line with future requirements of the Water Framework Directive.

C.8.95 Responses were concerned about damage to fish populations caused by the intake of larger volumes of water for any new station in combination with

TASC are disappointed to see that the Applicant has not adopted the Best Available Techniques to reduce mortality in the marine environment- coastal power plants are recommended to use cooling towers to reduce the volume of sea water intake and therefore the entrainment of marine biota.

As the next best mitigation measure, the recommended best practice is to utilise a fish deterrent device such as an acoustic fish deterrent. The Applicant has not included a fish deterrent in its proposals. **TASC has calculated that, based on actual recorded fish impingements at SZB, the cooling water intake for Sizewell C will impinge over 20 million fish per annum** and, as most of these fish are soft-bodied they will not survive the fish return system and will ultimately pollute the seas at the outfall pipe. As set out in TASC's WR 'Ecological impact of Sizewell C on marine life' these impingements are only a small part of the destruction of the marine biota in the Sizewell area.

TASC urge PINS to reject the Applicant's proposals for their cooling water intake system on the grounds that best practice is not being applied and the damage to the marine environment is unsustainable. TASC consider

Sizewell B. However, there are forms of mitigation available to protect marine ecology from the effects of cooling technology. The Environment Agency's report on cooling outlines these forms of mitigation. These include location and design of intake structures and screens and the use of fish deterrent and fish recovery return systems.

SZC will cause substantial biodiversity loss in the marine environment.

C.8.102 The key findings of the Sizewell Appraisal of Sustainability and Habitats Regulations Assessment highlight areas of significance on, amongst other things: i) the site lies on the Suffolk Heritage Coast and is wholly within the Suffolk Coast and Heaths AONB; ii) potential adverse effects on a number of nature conservation sites of UK and European importance including Minsmere-Walberswick Heaths and Marshes SSSI and SAC, Minsmere-Walberswick SPA and Ramsar, Sizewell Marshes SSSI, Leiston-Aldeburgh SSSI, Sandlings SPA, Alde-Ore Estuary SSSI,SPA and Ramsar, Alde-Ore and Butley Estuaries SAC and Outer Thames Estuary SPA; iii) effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling; iv) there are existing sand and shingle flood defences in place, which the Appraisal of Sustainability considers may require upgrading to protect the site for the full life time of a new power station, which may have potential effects on erosion and visual appearance of the coastline. The Appraisal of Sustainability finds these effects significant, but mitigation opportunities may be available following further study; and v) The Appraisal of Sustainability has found that Sizewell is not close to any other site and therefore does not form part of a cluster. This means that regional cumulative effects are not considered relevant for this site. However, the potential for adverse effects from Bradwell and Sizewell on the European designated site of the Outer Thames Estuary indicates that there may be interactions and cumulative effects on biodiversity should both sites be developed. Guidance on the consideration of cumulative effects is in EN-1. For instance Section 4.2 says that "the IPC should consider how the accumulation of effects might affect the environment, economy or community as a whole, even though they may be acceptable when considered on an individual basis with mitigation measures in place".

All of the areas of significance identified in the Appraisal of Sustainability as set out in C.8.102, are still relevant for the assessment of the DCO application but the situation has deteriorated because of: (1) the worsening predictions of the impacts from climate change; (2) the greater awareness of the impact of the cooling water intake system on the marine environment; (3) the cumulative impact on marine environment, with particular attention to the Blackwater herring stocks should Bradwell B go ahead; (4) the cumulative impact from other infrastructure projects, including the 2 SPR windfarms, new interconnectors, Felixstowe Docks, and many large housing developments.

TASC consider the cumulative adverse effects on the environment, biodiversity, the hospitality industry (especially at a time it is looking to recover from the impacts of the Covid-19 pandemic), other businesses and the community as a whole vastly outweigh any short-term financial gain that some local businesses might benefit from during construction.

Many of the construction jobs on offer will not be for locals, as evidenced by statements from EDF saying they want to transfer the workforce from HPC. Of the 900 permanent jobs on offer, a fair number will be taken by persons outside the local area and those available to locals are expected to be in the less well-paid occupations. The jobs lost in the hospitality industry will weigh heavily against the new jobs created. It is worth considering that the £20 billion estimated cost of SZC means that each of the 900 permanent jobs will cost circa £22 million per job.

TASC endorse the findings of Stop Sizewell C's report 'Sizewell C project: Economic Statement Response'.

C.8.107 The Appraisal of Sustainability has found that the rigorous system of regulation of routine discharges from any new nuclear power station at Sizewell should ensure that there are no unacceptable risks to the

Please see TASC's WRs Ecological impact of Sizewell C on marine life', 'Nuclear waste' and 'Emergency Planning' to learn of our concerns

health of the local population under normal operating conditions.	relating to potential health impacts arising from this development.
C.8.108 The Appraisal of Sustainability also concludes that there is a very small risk of adverse health impacts arising from an accidental release of radiation but the multiple safety features within modern nuclear plants makes such an event exceedingly unlikely. Section 3.13 of this NPS (Human health and wellbeing) sets out that the risk of an accident resulting in exposure to radiation for workers, the public and the environment is very small because of the UK's strict regulatory regime. Section 3.13 should be referred to for further guidance.	TASC draw PINS attention to paragraph I.5 of the July 2018 BEIS document 'GOVERNMENT RESPONSE: CONSULTATION ON THE SITING CRITERIA & PROCESS FOR A NEW NATIONAL POLICY STATEMENT FOR NUCLEAR POWER WITH SINGLE REACTOR CAPACITY OVER 1 GW BEYOND 2025' which states "*All assessments against the strategic criteria, both for the new NPS and in a future nominations window, will cover the lifetime of the site. That is the operation and decommissioning and the safe and secure storage of all the spent fuel and intermediate level waste produced from operation and decommissioning until it can be sent for final disposal in a geological disposal facility ("GDF")."* **In TASC's opinion, the Applicant has not demonstrated that SZC can be kept safe for the period covering safe removal of spent fuel to a GDF.**
	<u>TASC Conclusion</u> **For all the reasons set out above TASC, conclude that the Sizewell C site is not a suitable location for the Applicant's proposed SZC project. TASC contend that the proposed SZC project does not meet the February 2019 NPPF definition of sustainable development insofar as it does not *"meet the demands of the present without compromising the ability of future generations to meet their own needs"***

Appendix D

Together Against Sizewell C

<u>TASC Response to BEIS revised EN6</u>

<u>Proposed Criteria for Nuclear Power Reactors over 1GW 2026-35.</u>

<u>9-3-2018</u>

Pages 1-7

TASC is extremely concerned that the suggested criteria appear to be a developer's charter, and gives little guidance to planners or consultees as to the acceptability of the criteria. In many cases we believe the regulators should have the right to override the nominators judgement, especially since the consequences of harm from this type of development are potentially so great, cumulative and long lasting.

The case for new nuclear is poor there is no National need or IROPI.

Our response to the proposed criteria on Pages 19 and 20 at 2.15 follows.

Specifically our answers to the consultation questions are as follows.

QUESTION 1. We do not consider any of the proposed exclusionary and discretionary criteria are appropriate.

BEIS only exclusionary criterion, demographics, is based on incorrect data. We detail our rationale for our opinions below.

QUESTION 2. We wish to make the following comments and recommendations:-

NUCLEAR SAFETY AND SECURITY

- **Flood risk, Tsunami and storm surge.**

We submit this criterion should be exclusionary.

In view of climate change, sea level rise, East Anglia land tilt, increased storms and lifetime risk ie spent fuel hazards on site until energy generation ceases plus up to 100 years. Refer to DEFRA climate change reports, EA Flood zones, I.Mech E report. **There should be no sites allocated in EA flood zone 3. (I in 100 year event).** This therefore excludes previously nominated sites at Bradwell, Oldbury, Hartlepool, and part of Sizewell which were only included in the original EN6 because of the policy need for nuclear before 2025. We believe that Dungeness was removed from the original EN6 because of severe flood risk, but we are unable to find any reference to this exclusion. A notional Sizewell C will require a foundation depth of 50 metres, and much of the construction and operation will be below sea-level. We submit at all times there should be no risk of flooding from sea or weather. Increased risk of flooding, both from fluvial and the sea, to neighbouring property, towns, villages and transport routes must be taken into account. The increased risk from flooding to neighbouring hazardous facilities eg Sizewell B, Hartlepool AGR and Bradwell ILW store should be exclusionary. The substantial and combined risk indicates this should be **an exclusionary criterion and the regulator's view should be final. The policy refers to a sequential test but we submit this should already exclude the four sites mentioned above but also cannot be assessed due to the fact that sites are in different ownership. EU directive 2014/87 design 14 and 15 may apply. Sizewell C fails this criterion for example the proposed site platform is higher than Sizewell B, but lower than Sizewell A. Flood risk in the neighbouring town of Leiston is already high. A report was prepared by AECOM for Suffolk County Council on Leiston Surface water management but we cannot find the link to this report.**

http://www.imeche.org/policy-and-press/reports/detail/climate-change-adapting-to-the-inevitable

DEFRA various reports on climate change including.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69254/pb13358-climate-change-plan-2010-100324.pdf

Environment Agency Flood risk map for Sizewell area. https://flood-map-for-planning.service.gov.uk/summary/645966/263714

- **Coastal Process.**

This should be an exclusionary criterion.

Referring to the Sizewell C project the impact of an operational cooling water system and groyne effect and the temporary effect of (when temporary could mean 10 years) jetties or piers on an already eroding coast line, added to increased risk of erosion from storms could indicate a catastrophic impact on neighbouring communities and further damage to cliffs forming a SSSI at Thorpeness. Failure to adhere to previously agreed planning limits at the east of the site will also lead to coastal squeeze. The Shoreline Management Plan for this zone, even without any SZC, considers loss of the river sluice at Minsmere north of the SZC site and breakout of the Alde River at Slaughden south of the site. This is a sign that the whole coastline is unstable, particularly over the site life time. There should be no marine dredging in a prescribed area. **This should be an exclusionary criterion and the regulators view should be final. This criterion should cross refer to flood risk and cooling water criteria. Sizewell C fails this criterion.**

Shoreline management plan for the area. http://www.suffolksmp2.org.uk/policy2/smp7index.php

- **Hazardous facilities.**

This should be an exclusionary criterion.

This criterion should include existing and/or still hazardous nuclear facilities in the immediate vicinity of any construction site which potentially risks the safety of those reactor sites. Eg.Use of tower cranes during construction may not be possible. Vibration may compromise the seismic detectors. Sizewell, Sellafield, Wylfa? This should be **Exclusionary and reference should be made to the emergency plan for the nuclear site. This confirms the need to include construction as a part of National criteria. Sizewell C fails this criterion. EU Directive 2014/87 Article 8A, 14,15,17,and 21 may apply.**

- **Civil aircraft.**

Sites next to airports should be rejected. Even if the reactor is proof against air crash the other facilities on site may not be. See the Lydd airport case ONR PAR. Should be an **Exclusionary Criterion.**

- **Demographics.**

This is already an exclusionary criterion but the evaluation in the proposals is incorrect. This must be an exclusionary criterion based on realistic data similar to the ONR reference as below.

We do not understand the table in 2.47. This implies that up to **870,000** population could live within 3-5kms of the site. We are of the view that the inclusion of this table is **a serious error in the consultation.** The original EN6 Demographics for Sizewell stated at C.8.7 that the semi urban criteria was exceeded. In the case of Sizewell, the local population up to 4kms radius from the reactor is around **7500** people. The table does not concur with the Hinkley Point assessment ONR-DEF-AR-12-067 page 4 of 23 http://www.onr.org.uk/hinkley-point-c/site-evaluation.pdf which proposed site reference limits of **417 persons per square kilometre for new build sites**. The semi urban criteria was assessed as 1250 persons per square kilometre. Sites which may be nominated were originally remote sites with a reference density of 250 persons per square kilometre. We agree that this criterion should be **exclusionary** but seriously question the use of the Hansard table as (wildly inaccurate and potentially misleading) reference limits. Nominees should use the **417** persons per square kilometre as

a reference, and refer to the ONR PAR assessment for any emergency plans for neighbouring sites with live reactors, fuel in pond or store, or in the case of Sellafield the whole site. We submit this will not be a difficult calculation using the ONR PAR reports or Local authority emergency plan as a guide. This should be considered alongside the emergency plan for severe accident. **Exclusionary. EU Directive 2014/87 14,17 and 21 may apply. Sizewell C may fail this criterion.**

ENVIRONMENTAL PROTECTION.

- **Internationally designated sites.**

This should be an exclusionary criterion and cross reference should be made to many other environmental protection features.

There is no case for new build in a designated area or impacting on designated sites since no national need can be justified. It is not possible to minimise or mitigate the many cumulative environmental effects caused by construction of this magnitude. **Exclusionary. Sizewell C fails this criteria.**

- **Nationally designated sites.**

This should be exclusionary criterion.

There is no special case for building in, or adjacent to, a National Park or Area of Outstanding Natural Beauty, or in a SSSI, therefore this should be **exclusionary**. **Sizewell C fails this criteria.**

- **Areas of Amenity and cultural heritage and landscape value**.

This should be an exclusionary criterion.

Natural Capital justification. Setting and cumulative impact on the landscape should all be exclusionary. Negative Impact on AONBs designated for landscape quality cannot be justified. Impact of construction has to be considered. This should be **exclusionary. Sizewell C fails this criteria.**

OPERATIONAL REQUIREMENTS

- **Size of site.**

This should be an exclusionary criterion.

This cannot be discretionary as the size of the nuclear licensed site should be limited by ONR in EN6 2011 comment C.8.89 at 30-50 hectares per reactor. We do not agree that the Sizewell B size of site of 26 hectare should be used as an example of a suitable size of site. Hinkley Point C (HPC) is at least 66 hectares albeit for two reactors. The size of many sites is decreed by geographical and geomorphologic factors, previously agreed planning lines and visual impact statements. The developer should be encouraged to show the actual size of site. For example at Sizewell the original scoping report indicates a site size of 31ha. Since then the size of site has not been divulged allowing the promoter to continue to state that there could be two reactors replicating HPC. This scale of development cannot even be achieved by raising the site and expanding it over a marsh (described as a swamp by Nuclear Electric in their 1993 submission) which is also a SSSI and by diverting a river. Only 36 hectares are available. The proposal from nominees must include all necessary facilities including radioactive waste, encapsulation plant and Spent fuel stores. The latter are large buildings roughly 110 metres by 50 metres for Sizewell B, but the capacity and consequent footprint will have to be calculated for any new build sites. We wish to draw attention to the situation at HPC where the later inclusion of spent fuel storage buildings and variation to coastal wall have resulted in a “non-material

change" application to the authorised plans which in no way can be described as a minor change. These HPC changes both potentially impact the size of nuclear licenced site. All plans should include ancillary buildings. Without this there will be creeping development of extraneous buildings which affect both size of overall site and landscape visual impact. The footprint of all buildings and usage which is intended for the site must be fixed at time of the DCO. The Planning Inspectors should be given authority to recommend refusal if the application of new build exceed the ability of the site to contain all the growth needed for the Nuclear new build.

This therefore should be exclusionary. EU Directive 2014/87 14,15 may apply. We submit two reactors cannot be built on the Sizewell C site which is only 36 hectare.

ADDITIONALLY 1

The following should be an exclusionary criterion.

There is concern for the total size of site during the building process. Some sites are in very sensitive areas and consideration should be given to all the processes to be used, for construction, borrow pits, layup areas, storage of spoil and any accommodation need. This also applies to adequacy of the road/rail network, park and ride and freight consolidation. It is essential to allow for the cumulative environmental impacts from noise, dust and pollution on residential amenity over a long construction period and long periods of working up to 24/7. This should cross refer to other criteria for their combined impact which may affect many of the environmental status criteria. This is not primarily an issue for regulators but should be taken into account by Planning Inspectors. Therefore we submit the total and overall combined effect of the construction of a massive undertaking must be considered in the whole throughout building, operation and decommissioning. **Sizewell C would fail this criterion. The local authority has already commented about negative impacts on the surrounding area arising from the construction site.**

Footnote prior to or coincident with construction of a Sizewell C there would be a 54 month site preparation task to rearrange Sizewell B facilities. This could and probably will be undertaken alongside the dismantling of (parts of) the redundant Sizewell A. The combined impacts of all these tasks must be known and the impacts on highways, environmental receptors and workforce availability should be assessed. The Rochdale Envelope which appears to be an attempt to bundle up and even generalise impacts without full assessment needs to be considered and must be resisted.

- **Access to suitable sources of cooling (water).**

The impact of cooling water systems on coastal process, cumulative thermal impact on safe operation of other working reactors, allied to temperature rise of the sea due to climate change may approach the safe operating limit of the chosen reactor, sufficient to reduce the output and utilization of the plant. Fish, fry and eggs mortality and presence of nearby fishing and breeding grounds and consequential impact on bird habitats must be **exclusionary** or at minimum compensatory. Eg **Heysham** appears to have a cooling water temperature issue related to multiple sites due presumably to depth of waters. The additional temperature and pollutants introduced into the sea or river by the sites return system must be assessed against OSPAR and be shown to not breach its criteria. The impact of any cooling water towers on the landscape must also be assessed. Bradwell A which had lower output reactors of around 500MW capacity already has had a cooling water issue and **Bradwell should be excluded** from the list, certainly for higher output reactors.

This should be an exclusionary criterion and the regulators view should be final. EU Directive 2014/87 14,15 may apply. Sizewell C may cause damage to the marine environment

ADDITIONALLY 2

- **Town water availability.**

This should be an additional criterion and the regulators view should be final.

This has not been considered at all in the consultation documents and must be an **exclusionary criterion. There must be an adequate supply of pure town water at all times for safety and operational purposes and human need shall override industry need.** The impact of desalination plant which might be considered as an alternative source must be assessed alongside the size of site and any impact on the environment from chemicals used as part of any desalination process. The demand for water for construction purposes must also be assessed, alongside adequate sewage treatment and effluent control. EU Directive 2014/87 15 may apply. **There may be insufficient water supplies to Sizewell.**

Matters flagged for detailed consideration by PINS/ONR/EA

Nuclear safety and security.

We believe the following criteria are best **considered as part of the nomination process**. They form part of the safety principles and acceptability of risk without which the whole nuclear policy and public acceptability, openness and transparency will fail. We would draw attention to the views of Otterhampton Parish Council, post DCO for HPC, which complained of errors in the process and a general concern that members of the public were ignored during the public examination. We also do not believe it right that there is a split responsibility with ONR and EA. It is considered too late in the planning process for the following to be taken into account at the DCO stage. These criteria should be used to assess site suitability at an early stage.

- **Seismic risk.** Exclusionary
- **Faulting** no comment
- **Non Seismic ground condition**.

  This may preclude certain sites due to "waste" costs eg landfill taxes, transport of waste and stability of ground. The impact on groundwater, some of which is tidal, and potential pollution of groundwater is of concern. The prospect of ground heave needs consideration.
- **Meteorological conditions**.

  See previous comments on climate change. DEFRA report.
- **Aircraft movements**. Exclusionary.

- **Mining Drilling and underground operations**.

  Exclusionary plus co-ordinate with any fracking site or GDF proposals.
- **Emergency planning**.

  The ONR PAR report should set the criteria which also has to include severe accident planning according to EU2014/87 at 21 and article 8A. A suggestion in the Nuclear Safety Standards Bill that **the operator, and, or the local authority, should be involved in**

setting emergency plans should not be permitted because of a potential conflict of interest. The LA and Operator should only be involved in **implementing** an Emergency Plan. Even so for Sizewell, Suffolk CC has carried out the VECTOS evacuation modelling but this assumes 75% self evacuation. Under new severe accident criteria (EU2014/87) and judged against IAEA standards there is a need for action within a "few hours" (ONR PAR for Sizewell B allows for up to 30kms). Existing VECTOS evacuation study for Sizewell indicates around 5179 people could be evacuated in 164 minutes. The construction of new reactors alongside an existing hazard eg Wylfa, Sellafield and Sizewell B significantly adds to the size of the local population, with day visitors, holiday makers in caravan accommodation and a number of outage and construction workforce of anything up to 7500, all requiring immediate evacuation. The construction of wind farms in the immediate vicinity of Sizewell B has already confirmed that those people without hard shelter require immediate evacuation and pre-distributed K Iodate in the event of an off-site incident at Sizewell.

Emergency planning should be guided by the Demographics criteria and considered as part of the site nomination process.

We therefore contend that new build is not safe alongside a live or fuelled reactor nor at Sellafield. Therefore must be **Exclusionary**.

The VECTOS evacuation modelling can be found at
file:///E:/Documents/VECTOS%20report%20from%20SCC.pdf

The Sizewell Site Emergency Offsite Plan (subject to review) is at
http://www.suffolkresilience.com/assets/PDF-plans/Sizewell/NPM-Sizewell-Off-Site-Plan-Issue-3.5-dated-28-Feb-17.pdf

SOCIETAL ISSUES

- **Significant infrastructure/resources.**

A transport study is essential early in the process based on independent analysis. The modal split chosen should not interfere with existing services. Highways routes in themselves should not introduce environmental problems.

OPERATIONAL REQUIREMENTS

- **Access to transmission infrastructure**.

This should be an exclusionary criterion and form part of the national process.

We do not consider large scale generation is essential or advisory for security of supply. Grid lines become an easy target and may become unstable due to climate change. DEFRA report. We consider that there should be a full study of all proposed connections and an assessment of how storage technologies eg hydrogen should be sited. The potential for marine connections and interconnections with European and other countries needs assessment. In a number of cases the grid lines are potentially damaging to nationally significant sites including Sizewell, Bradwell, Wylfa and Sellafield. In previous CEGB and Nuclear Electric site assessments, grid connections were taken account of and sites rejected for unacceptable impacts from grid lines. DEFRA reports on climate change can be found at:-
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69254/pb13358-climate-change-plan-2010-100324.pdf

- **Size of site for decommissioning and construction.**

This should be an exclusionary criterion and form part of the national process.

Any construction requires enormous lay-up and spoils storage areas and associated hostel accommodation over a long period of time. This impacts on the environment and amenity and must form part of the national criteria. The long-term impact of construction means it must be considered

as part of National criteria, taking into account environment, emergency planning, waste management and demographics**. Sizewell C would fail this criterion, requiring 300ha most within an AONB.**

Written and sent on behalf of TASC (Together Against Sizewell C)

[redacted]

Appendix E

Net Zero Without Nuclear updated.doc›

Appendix F

Together Against Sizewell C

TOGETHER AGAINST SIZEWELL C (TASC) WRITTEN REPRESENTATION

SIZEWELL C PLANNING APPLICATION INQUIRY

DEFRA's 25 year environmental plan

Chris and Jennifer Wilson (TASC Committee Members)

Summary: Together Against Sizewell C: review of DEFRA summary of targets in their 25 year environment plan (EA 25yr plan) in relation to the Applicant's proposed Sizewell C project to build twin EPR nuclear reactors on the East Suffolk Coast in Suffolk Coast & Heaths Area of Outstanding Natural Beauty.

1. In 2018 Prime Minister, Theresa May, announced the UK government's '25 year plan for the environment' with the stated aim of improving the state of the UK's environment within 25 years. DEFRA published a summary detailing 10 key areas for the focus of attention, and these headings are set out below. It is **TASC's belief that these aims should underpin all government policy** so that

biodiversity loss and dealing with the impacts of climate change are considered together. Hence this report looks at the Sizewell C project through the prism of the 25-year plan.

2. Government's current energy policy was formulated over 10 years ago, is out of date as exemplified by the apparent government support for Sizewell C (SZC). **TASC have referenced below issues relating to the Sizewell project where we consider the impacts contradict DEFRA's stated aims** as embodied in the 25 year plan for the environment**.**

Clean air

3. SZC firstly requires the relocation of some Sizewell B (SZB) facilities, to make way for SZC: this relocation and associated activities are scheduled to take 2-4 years and has already involved the felling of Coronation Wood, mature woodland over 100 years old; construction of SZC is expected to take 10-12 years but is likely to take longer given delays experienced by other European Pressurised Reactor (EPR) projects of the same design, such as Olkiluoto in Finland, Flamanville in France and Hinkley Point C in Somerset. During this time, air pollution will be generated by the demolition of these SZB buildings and by up to an estimated 900-1,500 HGVs (depending on which option the Applicant finally opts for), over 700 staff buses, 10,000 car/van journeys, per day, earth moving equipment relocating millions of tons of soil and aggregates throughout the main development site of over 900 acres, making millions of tonnes of cement in the site's own concrete batching plant sited in Suffolk's AONB, felling hundreds of trees and grubbing out of hedgerows. These are all activities that will negatively impact air quality.

4. DCO document 8.18 'Freight Management Strategy' advises as follows:-Table 2.1 shows that 12.1 million tonnes of materials will need to be transported to the development sites, and paragraphs 2.1.6-2.1.9 show that the overwhelming majority of materials are coming from great distances (many from Somerset/Dorset) thereby adding vehicular emissions/pollutants over many years to counties through which vehicles will travel (**TASC have enquired whether all the local authorities that will be affected, have been advised**); Table 4.1 shows the anticipated HGV journeys based on various transport scenarios [note: **TASC have ignored the lowest figure of 700 HGVs per day as we believe the number of train journeys required for that option is unrealistic-see TASC WR 'Comments on EDF's Amended Proposals for Rail Based Transport of Materials for Construction of Sizewell C Power Station']**. **TASC also point to** paragraph 4.1.12 which states that, '*Early years* [vehicle] *movements would be unaffected (as the green rail route would not be in place and the temporary BLF would not have been constructed)'*, **exposing those along the B1122 during the early years to unacceptable levels of pollution.**

5. There will be many vehicle/plant movements across and adjacent to Sizewell Marshes SSSI and the RSPB Minsmere Ramsar site. **TASC have concerns about the impact that dust and airborne pollutants will have on these sites** including the cumulative impact of NOx from a 10-12 year or longer build, combined with the subsequent exposure of the designated wildlife habitats to routine daily worker/delivery vehicle movements and testing the diesel generators once operational.

6. Other concerns regarding air quality relating to the SZC project are set out in TASC's WR "Air quality ".

Clean and plentiful water

7. East Suffolk is one of the driest regions of the country and already experiences periods of water shortages. Climate change predictions, include more extreme weather events meaning greater frequency and greater severity of droughts. This subject was mentioned in the "Escaping the Jaws of Death: ensuring enough water by 2050" speech by Environment Agency Chief Executive, James Bevan on 19th March 2019, in which he said:

8. ***"Climate change is what's happening. It means that in the UK we will have hotter and drier summers. By 2040, we expect more than half of our summers to exceed 2003 temperatures.***

9. ***"That will mean more water shortages: by 2050, the amount of water available could be reduced by 10-15%, with some rivers seeing 50%-80% less water during the summer months. It will mean higher drought risk, caused by the hotter drier summers and less predictable rainfall.***

10. ***"Result: on the present projections, many parts of our country will face significant water deficits by 2050, particularly in the south east where much of the UK population lives***".

11. SZC is anticipated to use up to 3.5 million litres of mains water per day during construction and up to 2 million litres per day during its 60 year operation. Any local abstraction/sourcing would risk harming local supplies for households, farmers and other businesses. Any transfer of water from another water management zone could negatively impact that area. EDF's DCO application does not confirm the actual source of the potable water supply even after 9 years of supposed consultation. **See TASC's WR 'Potable Water Supply for Sizewell C'.**

12. SZC would sit in the heart of Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB) located next to adjoining nationally and internationally designated nature reserves, with much of the flora and fauna dependent on inter-connected groundwater levels. SZC could impact the water levels and risk polluting them e.g. through the building of an elevated causeway across Sizewell Marshes SSSI and the subsequent use by vehicular traffic. **TASC refer PINS to the concerns raised by Suffolk Coastal Friends of the Earth (FOE), Suffolk Wildlife Trust (SWT), the RSPB and Minsmere Levels Stakeholder Group (MLSG) in this respect. TASC have specific concerns in respect of the impact on the hydrology in areas adjacent to Sizewell C from the 150+ feet deep, 1.5 metre thick cut-off wall the Applicant is planning to install around the platform area that is intended to accommodate the reactor bases: to TASC's knowledge an EIA has not been supplied by the Applicant. (For details of the cut-off wall see FOI Document attached at appendix A)**

13. In terms of bathing water quality, SZC will draw into its cooling water system 2.5 billion gallons of sea water per day, impinging (trapping on the protective grilles) at least 20 million fish per annum [see attached schedule- appendix B] and entraining (passing through the grilles alive into the 3 kilometres of pipes) millions more fish and other marine biota. **This water is then returned to the sea 10-12.5 degrees C hotter, together with the bodies of dead and dying fish and other marine biota as well as a cocktail of chemicals, heavy metals and radionuclides in a thermal plume.** In connection with the marine biota and chemicals included in the thermal plumes, the following is extracted from a report to the Welsh Government, 'The implications of Hinkley Point C for Wales environment and its people', that reviews the cooling water systems for the EPR reactors being built at Hinkley Point C [full report at Appendix C] From page 16:-

14. *1.2.3 Thermal properties of Hinkley Point C water discharge. Concerns were raised by stakeholders over the thermal impacts of the discharge waters. A predicted discharge, of up to 11.6 million cubic metres, of cooling water, will be returned at a maximum of 12.5°C above the ambient seawater temperature. This could impact the ecological community surrounding the outflow, particularly any non-mobile species. Although this impact will be temporary and will only occur for the lifetime of the operations (~60 years), considerations of the short and medium-term impacts on the directly affected habitats and associated species are needed. One concern is that there may be an influx of warmer water species, including non-natives, which could establish populations out-competing existing native species. There is also a concern that higher temperatures could impact local thermally-sensitive species and habitats.*

15. 1.2.4 Chemical properties of Hinkley Point C water discharge. Issues raised included concerns about:

- *Toxicity of biocides (used to control biofouling) and their residual toxicity, including the rate that these chemicals degrade and disperse in the environment. Specific concerns were raised regarding their impact on important food species such as the macroinvertebrates (e.g. Macoma balthica) within the sediment.*

- *The use of chlorination to remove biofouling within the intake system and the potential bioaccumulative impacts of the chemicals used on the immediate and wider marine ecosystem. NNB GenCo documentation states that the use of chlorine could kill 0.05% of the Inner Channel phytoplankton (the basis of the food web), and there could be cumulative impacts over the life of the operation (~60 years).*

16. TASC believe that these concerns can be applied to SZC and while we understand that the Applicant is not planning to use chlorination at SZC, **TASC remain concerned about the environmental impact that will arise from the removal of biofouling from the SZC cooling water system.**

17. TASC consider that, if SZC is deployed, clean bathing water in Sizewell Bay will be compromised, especially during the years it operates in parallel with Sizewell B. TASC refer PINS to our WR 'Ecological impact of Sizewell C on marine life'.

18. TASC also note from the above mentioned report (Appendix C), the following comment in paragraph 4.3 on page 57: *"For such a high profile and major new build nuclear power station, i.e., HPC, it is therefore surprising that the complex modelling studies were not overseen from the onset by either an individual independent expert or, preferably, a small group of experts. It appears from discussions between the Group and EDF and Cefas that in this case the modelling review was undertaken by Cefas (advisory). We believe that this arrangement raises understandable public concern about the degree of independence of the review process."* **TASC request PINS to consider whether these comments made in respect of the HPC DCO application apply equally to the SZC DCO application.**

<u>Thriving plants and wildlife</u>

19. The SZC site is surrounded by or adjacent to a mosaic of wildlife-rich habitats that have evolved over hundreds of years and contain many rare species hence the designations: AONB, SSSIs, SPAs, SAC, Ramsar Site, MCZ and County Wildlife Sites. **TASC endorse and refer PINS to concerns raised by the RSPB, SWT and FOE in connection to damage anticipated to the habitats and the species, both rare and common that inhabit these areas.**

20. As mentioned above, the sea around Sizewell, from which cooling seawater is drawn, is a fertile nursery ground for fish fry and pipefish. These seas are already suffering the impact from the SZB cooling water system and SZC is expected, due to the greater volume of sea water consumed by the cooling water system, to significantly add to the degradation of the marine environment by increasing fish and other marine biota mortality and by adding chemicals, metals and radionuclides to the sea at the outlet pipe.

21. With many established wildlife sites at risk from the SCZ development including irreplaceable healthy and sustainable ecosystems, the project will harm areas that would otherwise be acting as a springboard to sustain and enhance biodiversity**. TASC endorse FOE's report criticising the Applicant's claim that SZC will produce a Net Biodiversity Gain.**

22. TASC believe that the SZC project conflicts with the following aims copied from DEFRA's summary of the EA 25yr plan:-

- *reversing the loss of marine biodiversity and, where practicable, restoring it;*
- *making sure populations of key* [marine] *species are sustainable with appropriate age structures;*
- *restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term;*
- *taking action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible to prevent human induced extinction or loss of known threatened species in England;*
- *increasing woodland in England in line with our aspiration of 12% cover by 2060: this would involve planting 180,000 hectares by end of 2042.*

23. **TASC also contend that the Applicant, by felling Coronation Wood when there were alternative locations to site some of the Sizewell B relocated facilities (e.g. Visitors Centre, Training Centre and Car Parks) outside the AONB, are in breach of EN1 paragraph 5.3.4** which says "*The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests."*

24. **TASC view is that the SZC project does not meet the aims of EN1 paragraph 5.3.5** "*The Government's biodiversity strategy is set out in 'Working with the grain of nature.' Its aim is to ensure: a halting, and if possible a reversal, of declines in priority habitats and species, with wild species and habitats as part of healthy, functioning ecosystems; and the general acceptance of biodiversity's essential role in enhancing the quality of life, with its conservation becoming a natural consideration in all relevant public, private and non-governmental decisions and policies."*

25. **TASC draws PINS attention to their obligations regarding EN1 paragraph 5.3.8,** *"In taking decisions, the IPC should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment."* and EN1 paragraphs 5.3.9 to 5.3.17 also relate.

26. TASC contend that SZC will have significant adverse impacts on plants, wildlife and designated wildlife sites that could take decades to recover, if ever.

<u>Reducing the risks of harm from environmental hazards</u>

27. **TASC's view is that SZC will increase the risk of harm to people, the environment and the economy** by:

- increasing the risk of coastal erosion with the construction of a permanent beach landing facility, a temporary jetty and 12.6 metre high hard sea defences with a programme of managed adaptation with an anticipated height of 16 metres;
- increasing the risk of flooding to adjacent properties, including protected wildlife sites, by the hard sea defences;
- harming the existing, sustainable tourism industry by driving away visitors with 24 hour per day, 10-12 year construction work introducing air, dust, light and noise pollution and thousands of vehicle movements each day into a rural location;
- harming existing businesses and support services by taking employees away from those businesses and service providers;
- creating hazardous radioactive waste in the form of spent fuel which will be stored on an already eroding coast subject to the impacts of climate change. **TASC's view is** that the Applicant has failed to demonstrate that the site can be kept safe for its entire lifetime i.e. until

the last spent fuel is removed from the site. Note: The Applicant's Climate Change Resilience considerations extend only to the year 2099 [see APP-342, 6.3 Vol 2 MDS Chapter 26 climate change, paragraph 26.5.2].

i. **TASC draw PINS' attention to the BEIS's document, '**Government's response to the consultation on the siting criteria and process for a new national policy statement for nuclear power with single reactor capacity over 1GW beyond 2025', dated July 2018, which states at I.5 page 45, *"All assessments against the strategic criteria, both for the new NPS and in a future nominations window, will cover the lifetime of the site. That is the operation and decommissioning and the safe and secure storage of all the spent fuel and intermediate level waste produced from operation and decommissioning until it can be sent for final disposal in a geological disposal facility ("GDF")."* **In TASC's opinion, the Applicant's DCO documents do not demonstrate adequate Climate Change Resilience as TASC have been unable to find that the above requirement is met.**

ii. TASC refer PINS to the TASC WRs 'Nuclear waste' and 'Health wellbeing and low level radiation' as well as N Scarr's WR 'Sizewell C – Coastal morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments. May 2021'. Note: as there is no GDF in existence in the UK and no guarantees that one will be built, **TASC's view is protection of the SZC site needs to be demonstrated as viable for a period of time over which spent nuclear fuel and other nuclear waste generated during the plant's operation is likely to remain on the Sizewell site.**

Using resources from nature more sustainably and efficiently

28. SZC requires:-

- a constant supply of uranium, a finite resource mined overseas causing extreme environmental damage; the uranium lifecycle associated with nuclear power is complicated and multi-staged, each step, from mining to final disposal of the spent nuclear fuel removed from the reactor, adding significantly to the carbon burden, with only the actual use of the uranium in the reactor core coming close to its trumpeted 'low carbon' benefit, and
- Is likely to have an unsustainable impact on the marine environment (as mentioned above)
- could have an unsustainable impact on fresh water supplies. As mentioned above, Sizewell C will consume unsustainable volumes of mains water throughout its 10-12 year build and its 60 year period of operation.

29. **TASC would like PINS to consider that there are alternatives** which use free on delivery resources and which are effectively inexhaustible in the form of wind, solar, wave and tidal forces, so do not consume finite resources such as uranium and fossil fuels. Combined with storage of excess production e.g., by way of pumped hydro or production of green gases, dispatchable power is available to complement the variable elements of renewables.

Enhancing beauty, heritage and engagement with the natural environment

30. SZC will be sited at the heart of Suffolk Coast and Heaths Area of Outstanding Natural Beauty (the AONB) on a Heritage Coast. AONBs are established as an area that is recognised by the United Kingdom government as having national importance. This importance is reflected in its designation under the National Parks and Access to the Countryside Act (1949). The primary statutory purpose of the AONB is to, *"Conserve and enhance the natural and cultural heritage of the UK's Areas of Outstanding Natural Beauty, ensuring they can meet the challenges of the future".* The AONB status affords the area legal

protections under the Countryside and Rights of Way Act 2000 (the CRoW Act) and the National Planning Policy Framework (NPPF)

31. Section 85 of the CRoW Act states, *"In exercising or performing any functions in relation to, or so as to affect, land in an Area of Outstanding Natural Beauty, a relevant authority shall have regard to the purpose of conserving and enhancing the natural beauty of the Area of Outstanding Natural Beauty".*

32. S. 172 NPPF states, *"Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to these issues. The conservation and enhancement of wildlife and cultural heritage are also important considerations in these areas, and should be given great weight in National Parks."*

33. And with regard to the Suffolk Heritage Coast, S.173 NPPF, as revised in 2018, states: "*Within areas defined as Heritage Coast planning policies and decisions should be consistent with the special character of the area and the importance of its conservation. Major development within a Heritage Coast is unlikely to be appropriate, unless it is compatible with its special character"*

34. The AONB lists its attributes as:-

- Landscape quality
- Scenic quality
- Relative wildness
- Relative tranquillity including relatively dark skies
- Natural Heritage Features
- Cultural Heritage assets

35. EN6 Volume 2 Annex C: paragraph C.8.73 says, "*the Appraisal of Sustainability has found that there is the potential for some long lasting adverse direct and indirect effects on landscape character and visual impacts on the Suffolk Coast and Heaths AONB, with limited potential for mitigation."* **TASC wish to remind PINS that the Appraisal of Sustainability was based on at least one reactor being built over a 5-6 year period on a development site of 117 hectares whereas the current SZC proposal is for two reactors being built over 12-14 years (including the relocation of Sizewell B facilities) on a main development site of over 370 hectares.**

36. In TASC's opinion, SZC will:

- substantially increase the industrialisation of the AONB, detracting from the attributes giving rise to its designation (tranquillity/wildlife value/scenic beauty/dark skies);

- require the building of a 7.3 metre high (to be adapted to 10.5 metres in due course) causeway across/through Sizewell Marshes SSSI, with a culvert of indeterminant size (various widths and lengths are given in the DCO documentation) with 3 metre high barriers, which will further intrude into the landscape;

- spoil the Heritage Coast skyline/profile with dominant industrial buildings, high chimney stacks and additional 4 pylons, on a large platform raised to 7.3 metres AOD, and adversely affect the scenic beauty with a 100 metre permanent beach landing facility and a 500 metre temporary (8-10 years) jetty (which will introduce a built environment visible from a great distance);

- cut the AONB in two with a new access road from the B1122 to the SZC site;
- harm many international and national designated wildlife habitats including those associated with RSPB Minsmere and beyond;
- introduce spoil heaps, accommodation blocks, 36 metre high (+3.5m high stack) power generation plant into the AONB hinterland during the construction period
- introduce a dominant, up to 16 metres high, concrete sea wall of indeterminant width and structure, which will be exposed when the soft sea defences are washed away in future storm surges;
- introduce soft sea defences that will be built approximately 40 metres further seawards than the existing bund creating coastal squeeze, with the intention of replacing this feature each time it gets washed away adding more material to an unstable coastline and the constant maintenance will introduce plant and machinery activity into a tranquil environment;
- harm the historic rural landscape by converting productive farmland into the Sizewell Link Road and roundabouts, breaking up multi-generational farms.

37. The above aspects of the development combined with others too numerous to list here, will introduce light, noise, vibration, dust, air pollution and a massive built environment causing harm to all of the attributes that gave rise to the designation of the AONB. Given the relatively low-lying nature of the AONB's landscape, SZC's industrial buildings and infrastructure will have a significant adverse impact on the scenic beauty and landscape value of the AONB during both construction, operation and decommissioning. Tranquillity, dark skies, relative wildness and designated wildlife habitats/species will all have significant adverse impacts. **TASC's opinion is that these impacts will threaten the integrity of the AONB's status. Given the significant adverse effects this project would have on the visual receptors, landscape and special qualities of the AONB, great weight should be given to these.** It seems that the Applicant, in a desperate attempt to reduce the unacceptably high HGV movements has, in the late changes, introduced proposals that will be detrimental to the AONB, such as the temporary jetty and enhanced beach landing facility, without weighing the potential benefit of those changes against the need to protect the AONB.

38. TASC endorse the concerns expressed in the representations made by the AONB partnership.

<u>Mitigating and adapting to climate change</u>

39. Climate change will bring higher sea levels, increased storm surges and more extreme weather events to an already eroding east coast but the speed of impact on the SZC site is uncertain. The Environment Agency predict that Sizewell could become an island within 100 years. SZC will not start operating until the mid to late 2030s, have a minimum operation period of 60 years, 30 years of decommissioning and will then be required to store spent nuclear fuel on site for a further 60-90 years with all the attendant dangers this presents. Appropriate application of the precautionary principle should be invoked

40. Environment Agency Chair, Emma Howard Boyd, said in a 2019 speech, "*We need to move away from talking about flood 'defence'. We cannot win a war against water. We cannot expect to build our way out of future climate risks with infinitely high walls and barriers.*" EDF's DCO application in May 2020 proposed a hard sea defence of 10.2 metres. In their November 2020 '5th' consultation, the Applicant proposed hard sea defences of 14 metres, an increase of 3.8 metres in just a few months, highlighting the uncertainty of the impacts from climate change, also emphasising how quickly

predictions might change in the future and the danger of siting such a hazardous development in an unstable location that will need to be kept safe well into the second half of the next century. **TASC endorse the concerns raised by N Scarr in his report 'Sizewell C – Coastal morphology, climate change and the effectiveness of EDF's Flood Risk and Shoreline Change assessments. May 2021', about the ability of the Applicant to be able to demonstrate that the SZC site can be kept safe for its entire life.**

41. The nuclear industry claims that new nuclear power stations are needed to help deal with the climate emergency, a view with which TASC strongly disagrees. The earliest SZC could be operational is 2034 but, given past experiences, this date is likely to be overly optimistic. The Applicant calculates that the carbon debt from construction alone (ignoring the carbon debt from the uranium fuel production process, decommissioning and waste disposal) is 6.2 million tonnes. The DCO documents show, based on certain forecasts relating to electricity demand and grid decarbonisation, that by the time SZC becomes operational, the carbon intensity of the UK electricity grid will have reduced to a level where it would take SZC 6 years of operation to repay the carbon debt from construction. However, the applicant has not considered the need for the UK to achieve its legally binding target of net zero by 2050 nor has it factored in the recommendation from the Committee on Climate Change to fully decarbonise the electricity grid by 2035. **TASC's opinion is that the likelihood is SZC will add to the UK's carbon emissions and not help at all with decarbonisation, especially as the Applicant's figures also ignore the carbon debt from decommissioning and the backend of the fuel cycle.**

42. TASC endorse the report prepared for Stop Sizewell C, April 2021, 'How much Carbon would Sizewell C save? '

Minimising waste

43. Nuclear power will create waste that will negatively impact generations to come. Much of the radioactive waste is categorised as low and intermediate level waste but still needs to be dealt with carefully with only limited prospects offered by recycling. High level waste i.e. spent fuel and other heat generating waste, although only comprising around 3% of all waste arising, will remain dangerous for thousands of years and has the added burden of requiring many other metals and materials to be used to make the storage containers. There is no proven or universally accepted safe method for the management of spent nuclear fuel anywhere in the world.

44. The manufacture of the fuel also has a huge waste footprint i.e. from the mining, milling, fabrication and enrichment of uranium much of which is left as a dangerous legacy waste in the poor communities where the mining takes place.

45. Further information is included in TASC's WR 'Nuclear waste'.

46. Alternatives, such as wind power do not have such a long term waste issue, especially now recyclable wind turbine blades are being developed. (See https://www.reuters.com/business/sustainable-business/end-wind-power-waste-vestas-unveils-blade-recycling-technology-2021-05-17/).

Managing exposure to chemicals

47. However careful the nuclear industry may attempt to be or say they will be, the operation of a nuclear power station will result in many potentially dangerous chemicals, ionising radiation and pollutants being released into the natural environment. The releases are included in the vast amounts of liquids pumped into our seas and through gaseous emissions including elements such as Tritium,

Carbon-14, Noble gases, Iodine radionuclides, Ammonia, Chlorine, Hydrazine, Boron and metals such as Zinc.

Enhancing biosecurity

48. Through the felling of native trees, grubbing out of hedging, excavation and dumping of aggregates and soils, SZC will not enhance our biosecurity and is expected to result in the loss of rare, impossible-to-replace biodiverse natural habitats.

49. While not strictly a biosecurity issue as such, **TASC point PINS to our comments above relating to the cooling water system** a process which will have the effect of causing further degradation and destabilising to the UK's depleted natural environment. TASC's concerns about SZC's adverse impact of the cooling water system thermal plumes on native marine life, is supported by the following extract from a report to the Welsh Government, 'The implications of Hinkley Point C for Wales environment and its people', that reviews the cooling water systems for the EPR reactors being built at Hinkley Point C [full report at Appendix C], page 16 paragraph 1.2.3: *"One concern is that **there may be an influx of warmer water species, including non-natives**, which could establish populations out-competing existing native species. There is also a concern that higher temperatures could impact local thermally-sensitive species and habitats."*

CONCLUSION

50. As can be seen from the above comments, in TASC's opinion SZC is not sustainable nor desirable because of the adverse impacts on water supplies, the marine environment, both rare and common flora and fauna, designated landscapes, designated wildlife sites, the release of pollutants as well as the unsuitability of the site due to climate change impacts. **TASC believe the proposed development therefore contradicts, in all aspects, the thrust, objectives and intentions of the government's own 25 year plan for environmental recovery in the UK.** As the UK attempts to recover from the effects of the pandemic there is a greater awareness of the need to preserve our special places, such as the AONB, for our mental and physical well-being. **TASC urge the Planning Inspectorate to weigh the above-mentioned adverse impacts heavily against the perceived benefits and recommend refusal of the SZC DCO application.**

51. TASC take the opportunity to remind PINS of the UN's definition of sustainable development: "Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and consider if Sizewell C meets this definition.

Appendix A - FOI document from the ONR showing details of the cut-off wall

25 Yr Env Plan
Appendix A ONR FO

Appendix B - Schedule of anticipated fish impingement

25 Yr Env Plan
Appendix B SZC Fish

Appendix C - The implications of Hinkley Point C for Wales’s environment and its people

25 Yr Env Plan
Appendix C Implicat

Department for
Business, Energy
& Industrial Strategy

New Nuclear Siting – Response to the NGO Forum

1. Introduction

A dedicated meeting was held between BEIS and members of the NGO forum on 22nd February 2018 as part of the consultation on the siting criteria and process to be used in developing the new National Policy Statement (NPS) for nuclear. The views expressed by members of the NGO forum at the meeting were carefully considered, and government's response to the consultation was published in July 2018[1]. Following this meeting, the BEIS NPS team attended a routine BEIS-NGO forum meeting on 19th September 2018 to provide an update on progress with the NPS. At this latter meeting it became apparent that forum members felt there was a need for further information, particularly in relation to the strategic considerations of flooding and climate change. As a result, this response has been produced to provide additional information on these points as well as those raised by TASC in the note shared in advance of the meeting. This response follows the structure of TASC's note. We hope that this addresses the concerns raised in the note and look forward to engaging with the NGO Forum further as part of the consultation on the draft NPS in due course.

2. Approach to Siting

Before responding to the specific points raised in TASC's note, it is useful to set out the context of the new NPS for nuclear within the wider approach to siting of nuclear power stations. Siting encompasses a range of considerations, and generally these are not 'closed out' at a single point in time. It is accepted that there are varying levels of certainty throughout the siting process, particularly at earlier stages where development proposals may be less well defined. Rather than allowing any uncertainty to prevent decision-making, the siting process is intended to assess matters using the level of detail available at the relevant stage of the process. It follows that decisions made in relation to the suitability of sites at an earlier stage in the process will not be definitive and will be subject to appropriate conditions and/or the outcomes of later appraisals and assessments.

In this way, matters of relevance to siting are considered and reviewed in a staged and proportionate manner as project proposals are developed and eventually implemented. While the goal of each step of the siting process is to test and ultimately provide confidence in the suitability of sites, the outcome of no single step should be viewed as a definitive judgement on the site – this can only be obtained via the process as a whole. The relationship between the siting process and project development is illustrated in Figure 1. Note that this figure is intended only to illustrate how the siting process interacts with and covers the full lifecycle of the project. It should not be considered to accurately represent the relative durations or scopes of different processes or phases, and the precise point at which specific activities are undertaken will vary for any given project.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/727628/NPS_Siting_Criteria_Consultation_-_Government_Response.pdf

Department for Business, Energy & Industrial Strategy

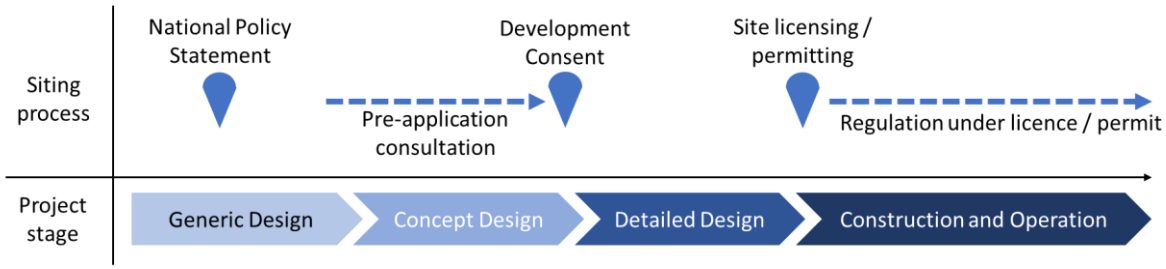


Figure 1 Illustrative overview of the nuclear siting process

The NPS can be viewed as the first step in the siting process, whereby potential sites are considered and assessed at a strategic level based on siting criteria which are applicable to any generic nuclear project. Decisions in relation to the suitability of sites made in the NPS will reflect potential suitability and will be subject to later project-level assessments.

Should a developer wish to obtain development consent at a site listed in the NPS, they will need to go through a process of pre-application consultation before submitting a planning application. Throughout this process, the developer is expected to share their proposals for the site with interested parties and refine these proposals based on feedback received. These proposals would be expected to address the general principles and policies identified in the NPS, as well as any site-specific issues which were identified during the NPS site assessments. When deciding whether or not to grant development consent, the Secretary of State would have regard to the impacts identified in the NPS.

Should a project be granted development consent it will also need to obtain a nuclear site licence and any necessary environmental permits. At these stages it is expected that the developer's proposals will be well advanced and as such detailed assessments of the safety of the facility and impacts on the environment will be undertaken. These will be required to confirm that all matters relevant to siting have been accounted for adequately in the design of the facility before the relevant licence or permit is granted.

Ultimately, any projects which meet these requirements will then be able to operate as regulated under their licence and permits. In particular, the independent regulators will require the operator to periodically review their safety and environmental arrangements to confirm that, or otherwise modify them so that, they remain appropriate.

In this way, the NPS is the first step in a process which ensures that nuclear power stations are developed and operated appropriately. It provides an early opportunity for public consultation on the siting process. However, the NPS cannot and should not be assumed to represent a complete and standalone assessment of siting.

3. Regulatory Input into the NPS

Under the Planning Act 2008[2], the Secretary of State may designate a NPS in relation to one or more specified descriptions of development. National Policy Statements set out national policy for the type of development being considered, and this can include identifying locations which may be suitable for that type of development. For the new NPS for nuclear, Government will include sites

[2] https://www.legislation.gov.uk/ukpga/2008/29/contents

which are judged to be potentially suitable for deployment of a nuclear power station with single-reactor capacity above 1GW between 2026 and the end of 2035.

We have been and will continue to work closely with the relevant regulators throughout development of the new NPS for nuclear. To ensure transparency, alongside the draft NPS (and its associated draft environmental reports carried out by Government), we intend to publish the developer nominations and advice from regulators in relation to the assessment of sites against the siting criteria. These documents may include redactions where there is a particular need to maintain confidentiality (such as for reasons of data protection, security or commercial sensitivity).

However, it is useful to recognise that the NPS is just the first step in the siting process and that regulators will have significant involvement through the later development consent and regulatory stages.

4. The need for nuclear

The Overarching NPS for Energy (EN-1) sets out the need for nuclear based on a wide range of modelling outputs and is written with future economic and technological changes in mind. Given the substantial uncertainties in modelling the energy and emissions system to 2050, the Government considered a wide range of possibilities in developing EN-1 (including those with and without nuclear).

Government continues to believe nuclear has an important role to play in the UK's energy future as we transition to the low-carbon economy. The public will have an opportunity to comment on the ongoing need for nuclear as part of the consultation on the draft new NPS for nuclear.

5. Updates to the siting criteria following Fukushima

Following the accident at Fukushima Dai-ichi in 2011, the Secretary of State for Energy and Climate Change requested that the HM Chief Inspector of Nuclear Installations examine the circumstances of the Fukushima accident to see what lessons could be learnt to enhance the safety of the UK nuclear industry. Part of this review covered siting, and the conclusion was that there was no need to change the current siting strategies for new nuclear power stations in the UK.[3]

More generally, as a contracting party to the Convention on Nuclear Safety, the UK submits periodic reports which outline the measures taken to meet the obligations of the convention, including Article 17 related to siting. The most recent report was published in January 2017[4] and a new report will be published in due course to support the next review meeting.

6. Flooding, Coastal Processes and Climate Change

6.1. Purpose of the NPS site assessments

As outlined in section 2, the NPS is just the first stage in the overall siting process and allows consideration of siting related matters in advance of detailed project proposals. With this in mind, the purpose of listing sites in the new NPS for nuclear is to assess at a strategic level, the technical

[3] http://www.onr.org.uk/fukushima/final-report.pdf
[4] https://www.gov.uk/government/publications/compliance-with-the-convention-on-nuclear-safety-obligations-7th-national-report

safety, environmental and operational issues associated with siting which can be assessed at a national level to provide a level of confidence in the potential suitability of sites.

In this way, the criteria act as a preliminary sift to focus development at locations most likely to be suitable for deployment and provide an opportunity for national consultation and parliamentary scrutiny in addition to the local consultation that comes at the development consent stage.

The NPS siting process is intended to supplement, but not replace, the mandatory processes and assessments (e.g. Nuclear Site Licensing, Environmental Permitting, Development Consent, etc) which must take place prior to deploying a nuclear power station and which examine the suitability of the proposed development in detail.

6.2. Principles of the siting criteria

In light of this purpose, Government considers that an appropriate strategic siting criterion is one which is:

a) **Capable of assessment at a national level**, that is in principle any area of the country could be assessed against it without the need for detailed site investigations,

b) **Site-based** rather than dependent on a specific technology or project,

c) **Meaningfully related to the later steps**, i.e. meeting the criteria for the NPS must provide a level of confidence that a site could satisfy the relevant requirements at the later stages (for example, DCO or Nuclear Site Licence), and

d) **Capable of distinguishing between sites**, i.e. the criteria must be sensitive to variations across England and Wales.

6.3. Implications for the flooding criterion

The flooding criterion, as set out in Paragraphs I.17 to I.27 of the consultation response, has been developed taking into account the siting criteria principles set out above. In particular, the flooding criterion must provide a level of confidence that the later project-level assessments will be able to demonstrate compliance with the relevant statutory and regulatory requirements, without duplicating these later assessments. With respect to flooding, the requirements that must ultimately be met before operating a nuclear power station are summarised in Annex A.

However, while it is important that the flooding criterion provides a level of confidence that these requirements will be met, it is also important (in order to maintain an effective siting process) that it does not seek to duplicate or replace the later assessments. In addition, there are limitations to what can be done as part of a national, site-based assessment due to the absence of detailed project-specific information such as the site layout, topography and design of sea defences. So there is a need to strike a balance between providing sufficient confidence within the limits of what is appropriate and possible at a strategic level.

In practice this is achieved firstly by requesting that developers outline the measures that they would take to meet their statutory obligations in relation to flood risk management (as summarised in Annex A) and secondly by requesting advice from independent regulators regarding whether these measures are likely to be both appropriate and feasible. In this context, tools such as the

Environment Agency's flood map for planning[5] (or equivalently NRW's Development Advice Map[6] for sites in Wales) are useful for approximate considerations of the level of challenge associated with meeting these statutory requirements but they cannot provide a detailed commentary on the flood risk associated with the developed site as they do not account for the as-developed site topography, or the presence of existing sea defences or any enhancements to these which the developer may make. Therefore, while in a general sense there is a presumption against development within Flood Zone 3 (or equivalently flood risk zone C2 in Wales), we would not necessarily consider a site to be unsuitable solely on this basis if sufficient confidence is available that the site can be developed appropriately.

As part of this strategic assessment, careful consideration is also given to nearby sensitive receptors which could be impacted by development of the site, including due to the construction of sea defences. These receptors might include, for example, nearby communities or industrial sites or areas subject to environmental designations, including European Sites.

The flooding criterion ensures that the level of challenge associated with developing a site and that the risks introduced by developing that site are given early consideration and are factored into the balanced assessment of each site. However, the outcome of this assessment will not and cannot be definitive in terms of the suitability of the site – to do so would be to prejudge both the development of the site and the statutory and regulatory assessments which follow.

Sites that are judged to be potentially suitable with regards to all siting criteria will be set out in the draft NPS for public consultation and Parliamentary scrutiny. We will welcome the views of interested parties during this consultation.

6.4. Climate Change

As set out above, it is important that the risks posed by climate change are assessed in detail during the development of a nuclear power station and these are considered at a strategic level during the NPS strategic siting assessment. Any climate change impact will depend on two main variables: the lifetime of the site, and the scale of climate change over this lifetime.

In assessing site nominations for the new NPS, Government's baseline assumption is that the full lifetime of a new nuclear power station, including interim storage of waste, could be up to 160 years. This is a conservative estimate based on Government's current policy for the long-term management of radioactive waste based on geological disposal coupled with safe and secure interim storage, an assumption that this interim storage will take place on-site, and the current indicative schedule for the availability of a Geological Disposal Facility (GDF). However, it is noted that a GDF could be available significantly sooner than this and that Government has reserved the right to explore other approaches in the event that, at some point in the future, such an approach does not look likely to work, either of which could act to reduce the overall site lifetimes.

[5] https://flood-map-for-planning.service.gov.uk/.
[6] https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=2

As stated in the siting criteria[7], nominators are expected to use the most up-to-date climate change projections in their submissions. At the time of requesting and submitting nominations this was UK Climate Projections 2009 (UKCP09). However, we are conscious that updated climate change projections, in the form of UKCP18, were published recently. Therefore, before making a recommendation in relation to the inclusion of a site in the draft NPS, we will consider the impacts of UKCP18 particularly in relation to flood risk.

However, it is important to frame this consideration of climate change in the context of the approach to assessing the flooding criterion outlined above. It will not be possible to carry out detailed flood modelling, accounting for either the new or current climate change projections, at the strategic level due to the requirement to understand the detailed site layout, topography and sea defences. Instead, consideration of these updated projections will be based on expert judgement as to whether it is feasible that the site could be protected, including potential adaptations that could be made to accommodate uncertainty in climate change projections, and an understanding of the potential constraints such as sensitive social and ecological receptors which could be impacted by flood protection measures.

It is important to reiterate again that this is only the first step in the siting process. The impacts of climate change will be considered throughout the development and, ultimately, operation of any nuclear power station.

7. Criteria perceived to be missing or miscategorised

In TASC's note and at the forum, it was suggested that a number of socio-economic and environmental criteria were missing (e.g. in the case of the socio-economic impacts of construction and town water) or miscategorised (e.g. in the case of impacts to landscape designations). Specific responses to many of these points were included in the consultation response[8] and are not repeated here.

In relation to landscape designations, the general position as to why the environmental criteria are discretionary was provided in the consultation response. However, we recognised at the forum that there were specific concerns in relation to Areas of Outstanding Natural Beauty (AONB) and feel that this is a useful example to highlight the general approach.

Areas of Outstanding Natural Beauty are established and protected under the Countryside and Rights of Way Act 2000[9]. Under this Act, the Secretary of State must "have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty" in performing any function – such as designating a NPS, or granting development consent for a project – in relation to, or which would affect land in an AONB. In general, the weight applied to these designations as part of decision-making will depend on the special qualities of the AONB which could be affected, the manner in which these qualities could be affected by the development and the likelihood with which these effects could be mitigated

[7] See, for example, paragraph I.25 of Government's consultation response.
[8] See paragraphs 2.82 to 2.86 and 2.93 to 2.96.
[9] https://www.legislation.gov.uk/ukpga/2000/37/contents

When assessing sites for the NPS, the potential impacts of development of that site on any AONBs will be considered. As part of this, both the feasibility and efficacy of the mitigations proposed by the developers will be considered, drawing on the advice of Natural England (or NRW for sites in Wales). As is set out at paragraph I.83 of the response to the siting consultation, Government's view is that it would be undesirable for nominators to propose the development of a new nuclear power station in an area likely to cause significant adverse impact on an AONB, unless there are clear strategic reasons for doing so and the nominators can confirm that they are able to avoid, minimise or mitigate those effects. If it is ultimately concluded that the site is unlikely to be developable without adversely impacting an AONB ministers will have to consider whether this impact might be acceptable in light of the overall need for nuclear generation. In this way, it is appropriate that this criterion is discretionary as this consideration will depend on the nature of and interactions between the development and AONB. As mentioned in section 6.3, the draft list of sites will be set out in the draft NPS. We will welcome the views of interested parties during the consultation on the draft NPS.

Department for
Business, Energy
& Industrial Strategy

Annex A. Flood risk requirements for nuclear power stations

There are a number of statutory and regulatory requirements which must be met in order to construct and operate a nuclear power station. In the case of flooding, these requirements are set out below. The purpose of setting these out is to demonstrate how the NPS siting criteria have been developed taking into account the relevant project-level statutory and regulatory requirements. However, it is important to reiterate that the strategic assessment supporting the identification of sites in the NPS is not intended or able to duplicate or replace these requirements.

- to obtain and comply with the conditions attached to a nuclear site license, as required by the Nuclear Installations Act 1965[10],
- to ensure that risks to the public and workers (including as a result of flooding) are reduced to a level that is As Low As Reasonably Practicable (ALARP), as required by the Health and Safety at Work Act etc. 1974[11],
- to obtain and comply with any conditions attached to an environmental permit for any flood risk activities, as required by the Environmental Permitting (England and Wales) Regulations 2016[12],
- to assess the impacts of the proposed development on the environment, including the expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters (e.g. flooding), as required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[13],
- to determine whether the proposed development is likely to have a significant effect on a European Site, and, if so, carry out an "appropriate assessment", as required by the Conservation of Habitats and Species Regulations 2017[14], and
- to demonstrate compliance with the assessment principles outlined in a relevant National Policy Statement where one has effect for the proposed development, as required by the Planning Act 2008.

In practice[15], these requirements are met through the undertaking of a Flood Risk Assessment (FRA) and nuclear safety case by the operator and permissioned by the relevant regulator (either the EA or ONR) or the Secretary of State (SoS) in the case of a planning application. The principles that the ONR and EA apply in the permissioning of flood risk activities are set out at a high-level in their joint advice note on flooding[16], and in more detail in ONR's Safety Assessment Principles[17] and Technical

[10] https://www.legislation.gov.uk/ukpga/1965/57
[11] https://www.legislation.gov.uk/ukpga/1974/37
[12] http://www.legislation.gov.uk/uksi/2016/1154/contents/made
[13] http://www.legislation.gov.uk/uksi/2017/572/contents/made
[14] http://www.legislation.gov.uk/uksi/2017/1012/contents/made
[15] For this example, reference is made to the expectations of English planning policy as outlined in the NPPF and English environmental regulation as overseen by the Environment Agency. The new NPS for nuclear will list the requirements for both England and Wales
[16] http://www.onr.org.uk/documents/2017/principles-for-flood-and-coastal-erosion-risk-management.pdf
[17] http://www.onr.org.uk/saps/

Assessment Guide on External Hazards[18] and EA's guidance on flood risk assessments for environmental permits[19]. Similarly, while the principles that the SoS will apply in the consideration of planning applications for new nuclear power stations have yet to be set out in the new NPS for nuclear, it is expected that these will align as far as is relevant with the principles set out in section 14 of the National Planning Policy Framework[20] (NPPF) and the corresponding guidance[21].

These principles outline a number of expectations to be met by the developer through the design and operation of the nuclear power station and demonstrated through the FRA and nuclear safety case. A summary of the main expectations which are of relevance to siting[22] is given below.

- Identification of all credible forms of flooding including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. For the nuclear safety case, this must encompass the most onerous event expected to occur no more than once in 10,000 years – which is termed the 'design basis',
- Identification of the effects of climate change. It is normally expected that this would cover both 'reasonably foreseeable' climate change (such as that resulting from a medium emissions scenario) – to be incorporated within the design basis – and 'credible maximum' climate change (such as that resulting from a 'high-end' scenario),

As part of the nuclear safety case:

- Design Basis Analysis to demonstrate that the as developed site will be protected against the design basis flooding event. This analysis must demonstrate either an absence of consequences or that the consequences are both tolerable[23] and have been reduced to a level that is ALARP.
- Beyond design basis analysis to demonstrate an absence of 'cliff-edge effects' (i.e. that a small change in flood magnitude above the design basis does not lead to a disproportionate increase in consequences).
- Demonstration of adaptability of sea defences to accommodate more onerous climate change scenarios, including for example a credible maximum prediction.
- As part of both the design basis and beyond design basis analysis described above, the impact on accident management and emergency preparedness arrangements, such as site

[18] http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-013.pdf
[19] https://www.gov.uk/guidance/flood-risk-activity-risk-assessment-for-your-environmental-permits
[20] httphttps://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change
[21] https://www.gov.uk/guidance/flood-risk-and-coastal-change.
[22] There are also requirements placed on operators throughout the lifetime of the nuclear power station, including to maintain and operate any flood risk protection measures and to periodically review the nuclear safety case (giving consideration to any changes in climate change predictions), which are not discussed here.
[23] Tolerable in this context is taken to mean below the relevant numerical target and legal limits as set out in ONR's SAPs.

access and services, and also consequential hazards from adjacent nuclear and non-nuclear facilities, should be considered.

As part of the FRA:

- Application of the Sequential Test demonstrating that the design of the nuclear power station, in particular the siting of key structures, has been developed in such a way to minimise the risk of flooding.
- If, following application of the Sequential Test the site is still located in an area of high flood risk (i.e. flood zone 3), an Exception Test is required. This test requires demonstration that the proposed development will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Cour des comptes

ENTITIES AND PUBLIC POLICIES

THE EPR SECTOR

Thematic public report

Summary

July 2020

AVERTISSEMENT

This summary report is intended to facilitate the reading and use of the Audit Office report.

The Cour des comptes [Audit Office] is only accountable for the report.

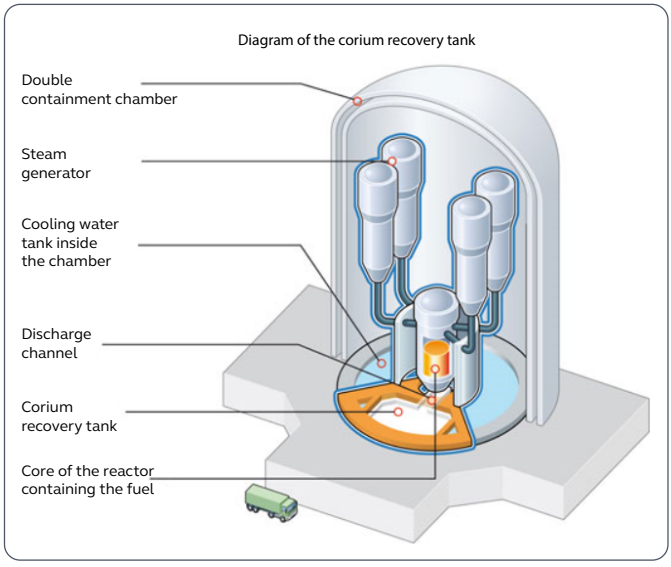
The responses from the administrative bodies and ministries concerned appear in the follow-up to the report.

Summary

An EPR reactor project drawn up under unfavourable conditions

In 1989 the French group Framatome and the German group Siemens started to design a new nuclear reactor called, in 1992, the "European Pressurized Water Reactor" (EPR). This project drew on the lessons learned from several decades of electronuclear production and also met increased security requirements after the accidents at Three Mile Island, in the United States, in 1979, and Chernobyl, in Ukraine, in 1986. The French and German governments supported this Franco-German reactor project from its inception, and electrical engineers from both countries joined it in 1992, although they did not share the same goals. German engineers intended to evolve the "Konvoi" reactor used on the other side of the Rhine, while EDF wanted to evolve the N4 series, the last reactor model then under construction. After the decision by the Germans to phase out nuclear energy in 1998, France became the sole backer of this project, whose acronym assumed the meaning « Evolutionary Pressurized Reactor » (EPR). However, the broad design options jointly defined by engineers from both countries, although they led to difficulties, were not called into question.

View of the vessel and the EPR reactor building (including corium recovery tank located under the vessel)



Source: IRSN

An EPR reactor project drawn up under unfavourable conditions

From 2001, the newly created Areva group developed a "turnkey" EPR sales strategy, thus opposing that of EDF, which intended to remain the frontrunner in "new nuclear power" in France and abroad. The rivalry between these two public groups, not arbitrated by the public authorities of the time, turned into dangerous overbidding within the French nuclear sector.

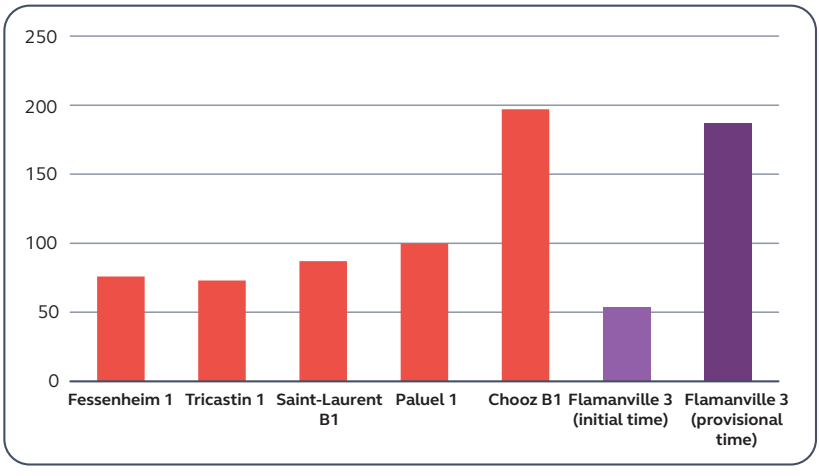
It was under these conditions that in 2003 Areva signed a contract to sell an EPR to the Finnish electrical engineering company TVO and that EDF launched, in 2004, the construction of the first EPR in France, in Flamanville. This race between the two French companies led to the hasty launch of construction sites for these first two EPRs, based on incorrect technical references and insufficient detailed studies. This lack of preparation also led to an underestimation of the difficulties in building the EPRs. The nuclear industry has shown too much self-confidence, inspired by the successful building and operation of a fleet of 58 reactors.

The building of the Flamanville EPR: an operational failure with multiple causes

On the date of publication of the report, the 3.3 times increase in the construction cost and at least 3.5 times increase in the commissioning time of the Flamanville EPR compared to the initial forecasts represented a considerable deviation, even for a "pilot" reactor.

This development is the result, first of all, of an initial unrealistic estimate of the duration and the cost of building the Flamanville 3 EPR. While the average reactor construction time worldwide was 121 months between 1996 and 2000, the initial construction time scheduled for the Flamanville EPR was 54 months - six months longer than the initial time planned for the construction of the Finnish Olkiluoto 3 reactor. This flagrant underestimation of the construction time created huge pressure to try to keep to the very tight delivery times. The duration of construction of the Flamanville EPR is today estimated at 187 months, before taking into account the impact of the covid-19 epidemic, thereby risking a further extension of this duration.

Construction time of pilot reactors (in months)



Source: Cour des comptes based on EDF data

The building of the Flamanville EPR: an operational failure with multiple causes

The construction engineering time was estimated at 5 million hours' work; 22 million will be needed. Almost 4,500 modifications have been made since construction started, regularly leading to suspension of the project, in order to give engineers the time to deal with the difficulties encountered.

This deviation is the result, furthermore, of a lack of organisation of EDF's monitoring of the project and a lack of monitoring by the supervisory authorities. The Board of Directors did not hold regular meetings to discuss this strategic project, did not respond to the alert messages from the audit committee, and was satisfied with the information it was provided with, without taking any corrective measures. The company did not have the structure to execute a project of this scale: the concept of «architectural designer» concealed a confusion between the respective functions of the client and of the project manager. Until 2015, the project was not managed by a bona fide project team. The contractual relationship aggravated the weakness of the technical management of the project since the contracts did not include, on their signing, either the vagaries - which were foreseeable given the «pilot» status of the reactor - nor the incentives that would have encouraged acknowledgment of the incomplete nature of the design. Eleven out of the 12 main Flamanville EPR contracts were thus subject to cost increases of between 100% and 700%. The company was late in organising itself to financially coordinate this project: it was only after 2015 that it followed up the expenses and then assessed the construction cost on completion, now estimated in 2015 at an €12.4 billion expressed in euros.

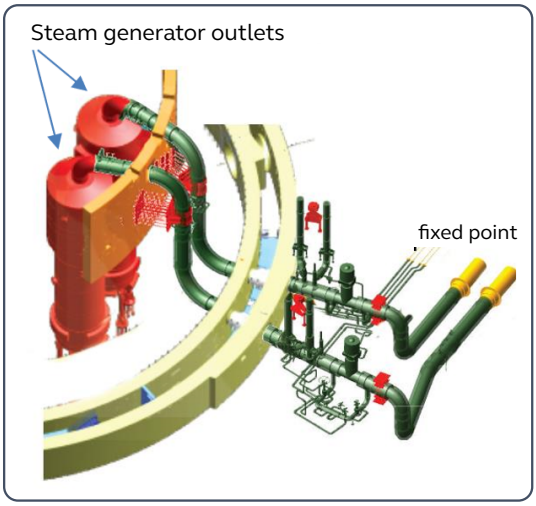
Furthermore, the administrative authorities in question have not performed their roles properly. While the initial estimates of the construction time and of the cost of Flamanville 3 EPR were clearly underestimated, they did not conduct either an assessment of the project's socio-economic profitability or a specific analysis of the impact of the successive problems encountered during its execution. Nor did they alert ministers to the importance of the vagaries of the Olkiluoto 3 and Flamanville 3 construction yards and their consequences. The Government was forced to embark on a costly restructuring of the nuclear sector, without the alarm signals having been sent in due time.

The loss of technical skills and quality culture in the nuclear industry has today been admitted and highlighted to explain the EPRs' construction problems. But actors were not aware of this at the start of the 2000s and this diagnosis was only made late, in the face of difficulties, and this notwithstanding the gap of fifteen years between the launches of the projects Civaux 2 (most recently built French reactor in service) and Flamanville 3. In December 2019 EDF announced the implementation of an action plan aiming to re-establish the necessary technical skills level and quality culture. This examination was therefore not carried out before the decision was taken to launch the construction of a new type of reactor.

EDF decided to design certain components of the reactor in a so-called failure exclusion process, which involves strengthening the technical requirements in the design, manufacture and in-service monitoring of this equipment in order to make it

extremely unlikely to fail. The former Areva NP and its subcontractors were not able to execute a number of parts and welds adhering to these high requirements. EDF did not inform the nuclear safety authority of the existence of a deviation from the failure exclusion standard for crossing welds until 2017, while it had known about them since October 2013. The delayed sending of this key safety information to the safety authority reflects a lack of smooth interaction between the sector's stakeholders and their safety authority.

Piping components covered by the failure exclusion



Source: IRSN.
Note: the double wall that figures on the diagram is that of the reactor building

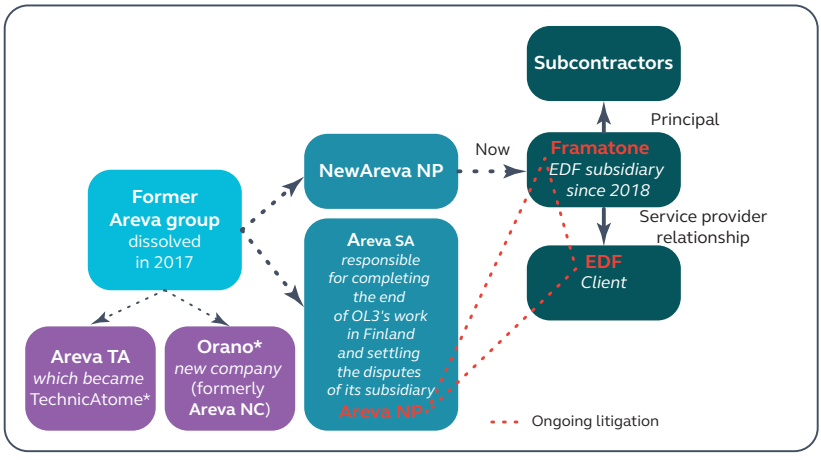
The financial impacts of these technical and organisational inadequacies are high. The repair of the crossing welds alone leads to additional building costs of around €1.5 billion 2015. The time spent by EDF, between 2015 and 2019, trying to convince the nuclear safety authority that the discrepancies between the technical requirements and what had been achieved could be considered acceptable, led to the suspension of the project, which added to its cost.

Serious consequences for the entire sector

Risks weigh in on the financial situation of certain companies which have recently benefited from a recapitalisation by the public authorities. The state raised €4.5 billion to provide capital to Areva SA (€2 billion) and Orano (€2.5 billion) following Areva's restructuring. EDF received a capital injection of €3 billion which enabled it to take control of the reactor business of the former Areva NP, now Framotome.

Due to the magnitude of EDF's current or potential claims against Areva SA, the risk of financial failure of this 100% state-owned company cannot be completely ruled out. The risks of litigation brought by EDF against its subsidiary Framatome are also likely to weaken this company. The state must therefore closely follow the results of the current or future litigation processes between these companies, of which it is the main shareholder. The strategy of the state shareholder in this sector needs to be confirmed.

Relationship between the industrial stakeholders in the sector involved in the litigation process



Source: Cour des comptes, April 2020
**Companies outside of the scope of the relationship.*
Note: The capital distribution of the different companies is as follows:
- For Framatome: the capital is 75% held by EDF, 19.5 % by Mitsubishi Heavy Industries (MHI), and 5 % by Assystem
- For Areva SA: the capital is 100 % held by the state
- For EDF: the capital is 83.6 % held by the state, 12.9 % by institutional shareholders, 2 % by individual shareholders and 1.3 % by employee shareholders (the remainder in treasury shares).

Serious consequences for the entire sector

The consequences of these deviations obviously impact the costs and profitability of the Flamanville EPR. Its construction cost is estimated by EDF at €12.4 billion2015, to which additional costs will be added which could reach nearly €6.7 billion2015 on the commissioning of the reactor, still being scheduled for mid 2023, including around €4.2 billion in financial costs. Under these conditions, it is regrettable that neither EDF nor the public authorities concerned calculated the profitability forecast of the Flamanville 3 EPR, apparently considering it normal that it should be absorbed into the average profitability of all electronuclear reactors. In the absence of data produced by the company, the Cour has estimated, based on hypotheses set out in the report, that the cost of the electricity produced by the Flamanville EPR could be between €110 and €120 / MWh.

Evolution of the building cost of Flamanville 3 between 2006 and 2019 (billions of €2015)

Source: Cour des comptes based on EDF data

An international strategy that cannot be continued under the same conditions

The Olkiluoto project, in Finland, was launched in 2005 by Areva, with its commissioning scheduled for 2009. It experienced setbacks, delays and additional costs which contributed to the disappearance of the former Areva group. The provisional acceptance of the project was, in March 2020, scheduled for the end of May 2021, but uncertainty lingers and is, according to a recent announcement by the electrical engineering company TVO, the plant's purchaser, added to by the probable impact of the covid-19 health crisis on the works still necessary. The construction cost would amount to €8.2 billion (in current euro) for the part insured by Areva, without taking into account that of the turbine (€684 billion), according to the information provided by Areva SA, i.e. nearly 4 times the amount planned in the initial contract (€2.28 billion for the consortium formed by Areva and Siemens).

The EDF's investments in the United Kingdom and the Hinkley Point project are high-risk operations. EDF has disbursed €15.7 billion for the acquisition of British Energy and will have to disburse €16 to 17 billion for the construction of the two Hinkley Point C reactors (HPC), if there are no further deviations from costs. Risks remain after the announcement of a £3bn increase in construction costs and of longer reactor construction times in 2019. The profitability of the Hinkley Point project has been revised downward several times since the launch of the project. Financing is provided by EDF, in the amount of its participation in the project company's capital, which has had a huge impact on its financial situation.

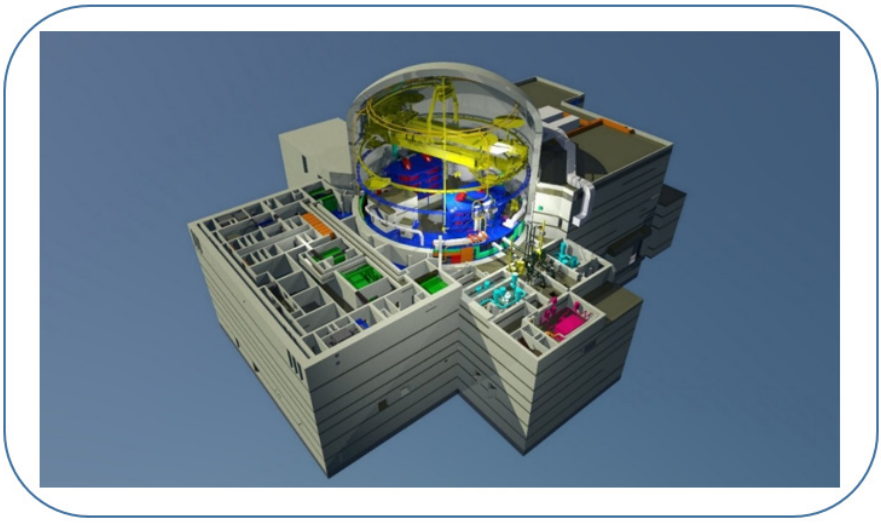
The Taishan 1 and Taishan 2 reactors were successfully commissioned in China in 2018 and 2019, but five years late with respect to the schedule laid out in the order, and with an additional cost of 60% compared to the estimated budget. Questions remain regarding the setting of the purchase price of the electricity produced by these reactors and the project's profitability for EDF.

The other EPR export projects are full of uncertainties. Despite EDF's marketing efforts and those made by the French government to offer India very favourable financial conditions, the negotiations, which began a long time ago, are making little progress. As for the EPR reactor construction projects in Sizewell in the United Kingdom, their execution is subject to guaranteeing their financing, EDF no longer having sufficient capacity to do so.

The construction of a series of EPR2 in France: a technological, economic and energy policy choice

Drawing lessons from the difficulties encountered in building the EPR reactors, but comforted by the fact that those at Taishan are working well, which validates this technological choice, EDF offers the ASN and the administrative authorities a new EPR model, called «EPR2» presented as simpler and cheaper to build.

Three-dimensional representation of the EPR 2 nuclear island



Source: EDF

The construction of a series of EPR2 in France: a technological, economic and energy policy choice

By making this choice, EDF moved away from the process of optimising the EPR technology based on reaping the benefits from the lessons learned. The Olkiluoto 3 and Flamanville 3 projects have shown that prioritising innovation over accumulated experience entails risks and that the cost of this innovation should not be underestimated. However, it is impossible to determine with any reasonable degree of certainty that the savings in building future EPR2s compared to the cost of building Flamanville-type EPRs will materialise. However, the only hypothesis currently being studied by the public authorities in terms of new nuclear energy is that of building six EPR2 type reactors, in pairs.

The financial stake is major: the cost of building three pairs of EPR2 is estimated at €46 billion2018. The decision as to whether or not to build future EPRs will have consequences through to the 22nd century. It must therefore be taken on the basis of a feedback process that is not only carried out internally at EDF, but involves all of the players involved in the building of all the EPR reactors built or in the process of being built, so that all stakeholders learn the same lessons from the way the EPR construction projects have unfolded.

In this scenario, electronuclear financing methods must be implemented. EDF cannot finance the construction of new reactors by itself and can no longer engage itself without guarantees on the revenue generated by them. No new project can be launched without a form of public guarantee, whatever the mechanism adopted. However, the burden thus transferred to the consumer or to the taxpayer would only be justified if the electricity produced by the new nuclear power reactors proved sufficiently competitive with respect to other modes of electricity production, renewable in particular, or if other considerations justified keeping nuclear power in the electricity mix.

This is why a complete analysis of the electricity mix by 2050, presenting challenges and solutions regarding the assurance of supply, adaptation of electricity transport and distribution networks, management of radioactive waste, dismantling of plants currently in operation, and of course the cost of operation of the electricity system, which must be conducted before any decision is made concerning the development of a new fleet of electronuclear reactors.

This decision having been put off by the Government to beyond the commissioning of the Flamanville 3 reactor, i.e. mid 2023 at the earliest, it is possible to draw up, by then, both the complete lessons learned about the building of the EPRs and the long-term planning of the electricity mix recommended by the Cour.

Recommendations

Recommendations on the execution of large-scale projects

1. Reconsider the concept of architectural designer by separating the functions of client and project manager *(EDF, 2020)*.

2. Incorporate in contracts provisions sharing the construction risk between the client and the contractors and others, engaging them in the management of the works execution schedule *(EDF, 2020)*.

3. Carry out a six-monthly review of the strategic projects and the risks associated with them, at meetings of the EDF board of directors *(EDF, MTES, MEF, 2020)*.

4. Make sure that the managers of large-scale projects have authority over the resources, especially the engineering resources, required for their execution (*EDF, 2020)*.

5. List in a shared reference document the terms of application of the failure exclusion in order clarify the industrial consequences of the specifications in question *(EDF, Framatome, immédiat)*.

Recommendations concerning the preparation of forthcoming decisions

6. Calculate the provisional profitability of the Flamanville 3 reactor and of the EPR2 and follow it up *(EDF, 2020)*.

7. Define, before engaging in international projects, their risk level and expected profitability and their financing conditions, and keep to them *(APE, DG Trésor, EDF, 2020)*.

8. Conduct a complete lesson learned exercise on all the EPRs built or being built in France and abroad, with all the stakeholders concerned, before launching any new electronuclear reactor project *(EDF, MTES, MEF, 2020)*.

9. Extend the planning of the electricity mix through to 2050, before taking the decision to launch any new electronuclear reactor project*(EDF, RTE, MTES, MEF, 2020)*.

Guest Post | George Millins:

Sizewell Nuclear Reptiles

Text and images posted on WAR ON WILDLFE on March 8, 2021 by Charlie Moores

Guest post by George Millins. ***George is 82 and a retired engineer. He is a keen nature conservationist based in West Suffolk who surveys for wildlife, including reptiles, and encourages land owners to establish habitats. He monitors the fate of many locations where translocation has taken place following housing and industrial development but where long term safeguards of the interest has often been abandoned.***

Delicate meadows and water tables in a Site of Special Scientific Interest are under threat,with Friends of the Earth research exposing much of the uncertainty in recent years.

In the following post George delivers stinging rebukes to EDF Energy and to the authorities charged with protecting wildlife at Sizewell in Suffolk, where development plans to build twin fission reactors appear to be ignoring legislation and established ecological best-practices. It's a sad but timely story that raises serious concerns about planning permissions and law enforcement in 21st century Britain.

Plans to build twin fission reactors at Sizewell in Suffolk are a monstrous insult to the Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB). Already a broad range of objections relates to how construction plans with thousands of workers will swamp this fragile place. There are safety [1] concerns and plans for a permanent uranium isotope storage dump on the side of the beach. This lies next to a coastal sandbank that was formed by a storm surge in 1953 that has halved in size since 1995. The idea that the station will form an island in the sea is a distinct possibility [2], not a guess or a worst-case scenario.

The effects of new roads and road traffic is a particularly nasty way in which wildlife is fragmented and then depleted in a landscape.
Under Sizewell C (SZC) plans, a new road will cleave the entire AONB in half from east to west, forming a congested rat-run to the narrow A12 and Yoxford village, clogging its already narrow and parked-up high street. Hideous, poorly screened, large and out of character car parks and roundabouts will make this fragile part of Suffolk more like the trading areas around Ipswich and Lowestoft.

The coastal landscape from Southwold south to Bawdsey offers reptiles, birds and other wildlife a rare opportunity to remain and sometimes to flourish. Walberswick south of the Blyth river gives way to Dunwich Heath and RSPB Minsmere. Land to the south of Minsmere is under threat not just from new roads but effects from the massive SZC construction village.

But I am going to dwell on one aspect of the nuclear threats that is close to my heart; reptile life. AONBs are supposed to be special and immune from degradation. The Suffolk Coast has precious little heathland and undisturbed coast left and this area is the home to our snakes and lizards that often struggle inland due to intensive farming. Parts of the sandy nuclear reactor platform has colonised with gorse and scrub, and it is now a paradise for reptiles.

The sand and shingle beach that stretches in front of the existing and proposed reactor site was recovered after the construction of Sizewell (SZ) 'A' in 1966 and SZ 'B' in 1995, having been extensively dug up. The beach was re-formed and re-planted, but not recovered as the bird and insect rich paradise remembered by locals. Nevertheless, patches of hundreds of Harebells flourish, lichen dune heath has slowly formed and terns try to nest. But also, the four species of reptile (two snake and two lizard species) reach very good numbers and they are protected by law. Thousands of reptiles now live in and around where the nuclear development will destroy.

So what is the EDFE plan to re-home them?

The areas to be destroyed for reactors and roads is huge
So huge that the proposers EDFE (Électricité de France Energy) have begun to try to return surrounding arable land back to grassland and heath.

Yet little attention has been paid to proper habitat reconstruction methods. The approach has been the subject of a substantial complaint by a local resident, ecological consultant Tom Langton. He happens to be a leading amphibian and reptile conservation expert, with huge experience in reptile translocation and habitat restoration. He is also an expert on the impact of roads on wildlife and road impact mitigation. He wrote to EDFE during an emergency (5th) EDFE consultation just before Christmas on missing information in the nuclear build proposals. Government agencies also say environmental proposals are still not clear [3] enough, with EDFE's plans due to be examined by the Planning Inspectorate (PINS) this spring and summer.

Land needs to be de-compacted and stripped of fertilizers in a careful way.

Farmed land needs to be nurtured back to nature; de-compacted and stripped of fertilizers in a careful way, as done by conservation bodies in recent decades. It takes many years before wildlife return in good numbers. But all I am told that has been done is to spread a bit of grass seed, and digging of long trenches and filling them with wood debris. Dropping large hay bales on top for good measure. This is also supposed to be good for Marsh Harriers but can only remain a parched lifeless prairie.

A hard-baked desert. Compacted, nutrient-soaked arable land without any suitable and measured heathlandhabitat restoration.

The reptiles have not moved in naturally after several years, and the land is in no fit state for their release. It won't be, to any serious extent, without starting again with use of crops to strip the nutrients. And old, valued habitats such as wetlands that could have been improved for amphibians (as previously apparently agreed) have been lost to over-deepening. In woodland areas, trees have been cleared but rich topsoil left in place, making for brambles and rapid regrow. It will never make manageable reptile habitat. It seems like a comedy of errors, but this is serious

Worse than this comes news that EDFE is being advised to use a misconstrued reference ‘displacement’ of reptiles from Defra’s online notes [4] (what we call in the trade a ‘cowboy’ substitute for the practice of careful capture) with translocation to properly[5]recovered habitat. Just before Christmas, the 100-year-old Coronation Wood was cut down near the new reactor site.

Coronation wood with a bat roost tree left exposed to the winter east winds, ice and snow. The ground smothered with chipping. Has EDF been cruel towards bats, snakes and lizards?

EDFE now plan to dig up flooded and frozen reptiles in March 2021 – for their funerals?

No effort was made to capture the reptiles yet heavy machinery was used with ecologists watching the ground. How so? With x-ray eyes to follow the mammal runs where reptiles often hide? The planning authority looked away when incomplete and out of date survey was used (contrary to CIEEM guidelines) and as revealed when local resident Joan Girling[6], with the support of local NGO ‘Together Against Sizewell C’, took East Suffolk Council to the High Court over partisan planning decisions. The Suffolk Wildlife Trust’s

objections to treating reptiles this way have also been ignored by the Strategic Planning Committee of East Suffolk.

Now Suffolk Constabulary seem to have walked away too. EDFE who refuse to consult or talk about their corner-cutting plans with relevant experts intends to try to dig up reptiles in March 2021, further breaching best practice guidelines in what may be criminal conduct. The freshly exposed tree stumps that remain have been waterlogged and frozen this winter and the ground smothered in wood chipping suffocating it. It is a disgraceful act that should be stopped by the police. Bats used some of the trees and this matter too is under investigation with Natural England refusing and then issuing a bat licence based on what was found when the trees were cut down with someone checking one side of the tree from a cherry picker for a couple of minutes only. It was licensed on the basis that if bats did/do die, something will be done to make it better.

Do the police now follow a political agenda with wildlife crime?

I say all this with hard experience. A County Wildlife Site in Sudbury was part-cleared with machinery last June when the planning authority omitted a suitable planning condition. This should never have happened, and a member of the Suffolk Rural & Wildlife Policing Team refused my request to stop the work on Day 1. It took the mangled dead bodies of slow-worms to be found for another officer to do the right thing on Day 2. What is going wrong with our wildlife enforcement these days, I ask? (see –Suffolk police and the Wildlife & Countryside Act)

The police declined to fully investigate, something that I understand is happening at Coronation wood at Sizewell, just a few months later. Finally, however, after I was forced to pay for legal representation the police lawyers admitted the correct reading of the law. At Sizewell even the Council ecologist had objected [7] to the reptile removal methods proposed, yet this was ignored. This seems to be the worrying trend these days as Natural England dumbs down the essential components of mitigation in development control in the hope of a robust offsetting system that they have comprehensively failed to deliver.

Established wildlife protection approaches have been wrongly cast as over-burdensome in recent years by vested interests and their servants in high places. The political nature of policing these days makes me shudder in terms of what we now see and are facing. What we have built up over the last 40 years is being pulled down, nest by nest, burrow by burrow, den by den, sett by sett.

A dead lizard, crushed at Sizewell in autumn 2020

EDFE to trash the AONB on the Suffolk coast?

Yes, with dangerous roads with inadequate crossing points for wildlife and sterile habitat creation. Present on paper but with a clear ***net loss*** of wildlife, both in quantity and quality. No ***net gain*** at all. Badging the whole effort as re-wilding in recent weeks is just another deception in 'fake news' handouts posted to local people?

So called 'off site' compensation, away from the AONB is just more tinkering, that at best will split up current value and leave multiple eyesores in a remote landscape. Ruining it for a proportion of the fragile birds and other species on and off internationally important sites.

If you love Minsmere[8], join in the protest now or regret it forever. Once covid restrictions are lifted please come down to Sizewell and make your feelings known. The RSBP and Suffolk Wildlife Trust, who I am told have tried to work closely with EDFE, are now conflicted by the dreadful proposals and lack of information.

How can this be allowed? If other nuclear sites such as at Wylfa Newyyd [9] in Wales are stopped by the planning inspectorate because of their impact on the environment, how is it even possible for Sizewell to be considered? With EDFE's tarnished approaches before the project even has permission? To carry on in 2021 the same way that they started this winter?

To sum up, in reality the questions are; why are the planners failing in their legal duties, why is wildlife law being broken, and why are the police are increasingly hesitant?

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Together Against Sizewell C:
Written Representation to the Sizewell C Planning Application Inquiry

A Paper by Jonathon Porritt:

N E T Z E R O

W I T H O U T

N U C L E A R

THE CASE AGAINST NUCLEAR POWER

April 2021

Net Zero Without Nuclear is a personally-authored report, and the views expressed within it are the view of the author alone, and not those of Forum for the Future or any other organisation with which the organisation is associated.

NET ZERO WITHOUT NUCLEAR

NET ZERO WITHOUT NUCLEAR

A: KEEPING AN OPEN MIND

1. I've been 'anti-nuclear' since 1974 – ever since I joined the Green Party. My basic position hasn't changed much during that time. Not because I decided back then that nuclear power was an inherently 'wicked' technology that must be avoided at all costs. I can genuinely claim that I've been waiting more than 45 years for someone to prove me wrong about nuclear power, to falsify my working hypothesis that it's simply 'the wrong technology at the wrong time' for sorting out all the challenges that we face.

2. As Director of Friends of the Earth back in 1986, I invited James Lovelock to deliver our set-piece annual event, the John Preedy Memorial Lecture. Our Local Groups were instantly up in arms at the prospect of providing a platform for such an outspoken nuclear enthusiast. Supported by our Board, we weathered the storm, on the grounds that genuinely open minds should never be afraid of hearing diametrically opposed voices.

3. Which is the same reason why Friends of the Earth did <u>not</u> oppose the use of public money to fund research into different nuclear technologies. Yes, we were uncompromisingly opposed to the whole nuclear establishment at that time (Windscale – now Sellafield – Sizewell B, nuclear waste policies and so on), but we also said that if this 'misbegotten child of the nuclear weapons establishment' could demonstrate a genuinely 'fit for purpose' strategy, on what grounds would we then oppose it? This positioning was confirmed by FoE in 2014: 'We do not oppose research into potentially safer forms of nuclear power, but our current assessment is that we are unlikely to need them in the future.'

4. I hold to that view today. I'm still relatively relaxed about the government of the day deploying taxpayers' money to find answers to the currently overwhelming barriers the nuclear industry still faces – more than 50 years on from the time when the nation embraced nuclear power as a potential source of 'clean energy' that would, at some point in the future, be 'too cheap to meter'. That may well have been a reasonable aspiration in those days, but the industry's record speaks to an endless litany of disappointments and failures.

5. So I'm not anti-nuclear because I've had a closed mind since 1974. I'm anti-nuclear because my mind is still hungrily open, constantly evaluating the 'case for nuclear power' when weighed in the scales with 'the case against nuclear power'. If and when 'the facts change' in the future (nobody can re-write the factual history of this industry or ignore the continuing liabilities of that history), people should legitimately expect me to change my mind accordingly.

6. As Chair of the Sustainable Development Commission, this open-mindedness was severely tested in January 2008, when Prime Minister Tony Blair decided that 'the evidence in support of new nuclear power stations is compelling', having bombastically announced in May 2006 that nuclear power was 'back with a vengeance'. I shall return to that critical turning point later.

7. Five years later, at their Annual Conference in 2013, the Liberal Democrats reversed their historical opposition to nuclear power to fall in line with their Coalition partners in the Conservative Party. Ed Davey, Leader of the Lib Dems today, was Energy Secretary of State at that time, and assiduous in peddling a transparently dishonest fudge by asserting that their support was conditional on there being 'no public subsidy' – knowing full well that no nuclear power station, anywhere in the world, has ever been built without some form of public subsidy.

8. **All three major UK parties are still pro-nuclear today. Which leaves me more than a little baffled. As I hope to demonstrate in this paper, the case against nuclear power is stronger now than it's ever been before; over the last 15 years, many of 'the facts' regarding nuclear power really have changed, further disadvantaging nuclear power when compared with other options. At the same time pro-nuclear advocacy in the public domain, and targeted lobbying within government circles, has significantly ramped up. And is undeniably having some effect, as we'll see.**

9. Even more baffling, there would appear to be a growing number of environmentalists ready to cut the nuclear industry some slack. The principal reason for this is, of course, their wholly justified fears about accelerating climate change and about the yawning gap between what the scientists are telling us about the Climate Emergency and the still largely inadequate political response to that Emergency. As we'll see, advocates for nuclear power are vociferously intent on demonstrating that it's now an essential tool in the toolkit for getting that gap narrowed – and for getting us to that distant prospect of 'a Net Zero carbon economy'.

10. Nothing could be further from the truth.

11. The overwhelming impression I've taken away from doing the research for this Report is that this is an industry dominated by its rear-view mirror.

12. For all the turbocharged rhetoric and boosterish projections, there's little on offer that's genuinely new and innovative. EDF's reactor design for Hinkley Point and Sizewell C, the EPR, was first approved more than 20 years ago, and has only been upgraded since then to take account either of excessive cost issues or new safety features required by regulators after the Fukushima disaster in 2011. For all the new-found excitement about Small Modular Reactors (SMRs – see page 24), there is as yet no new design here in the UK for regulators to approve, even after 65 years of deploying small reactors in nuclear submarines, however different a design challenge that may be. Even fusion is back in the mix (see page 25), recycling the same promises and unsubstantiated claims that were first minted back in the 1970s.

13. **In other words, it's a massive re-tread operation, an industry repurposed to align yesterday's over-hyped promises and broken business models with a policy context now dominated by concerns about accelerating climate change and the need to get to a Net Zero economy by 2050. And given the industry's customary reliance on an army of lobbyists and PR specialists, they're doing as good a job as might be expected in terms of prettifying what is in effect a zombie proposition.**

14. In fact, as we'll see, almost all the innovation that is going to make a material difference to our Net Zero carbon future is to be found elsewhere – in solar, wind, storage, demand management, EVs, heat pumps, eco-efficient design, micro-grids, AI-enabled Big Data, and green hydrogen (see page 25). And this is as much about systems innovation as it is about technological innovation, with much greater integration between generating and distributing electricity, at both national and local level. Ironically, the UK is seen by many other countries as something of a market leader in terms of more efficient and competitive energy systems, providing us with a stable foundation on which to develop much more innovative, low-carbon solutions.

15. What should most concern environmentalists today is that the astonishing synergistic potential of these mutually-reinforcing breakthroughs will be so negatively impacted by people hanging on to the idea that we have to keep nuclear power in the Net Zero mix.

16. Hanging on to these recycled nuclear illusions is not just irrelevant and misguided – now that we understand just how fast we have to move on our decarbonisation strategy, it is positively prejudicial to our prospects of securing a Net Zero carbon economy.

B: THE CASE AGAINST NUCLEAR POWER

1. For years, the case against nuclear power has focused on eight principal concerns. They remain as problematic for advocates of nuclear power today as they have ever been.

B1. Cost

2. There was a time when it was difficult to talk authoritatively about the cost of nuclear power. Secrecy, obfuscation and deliberate deception were the watchwords of the old nationalised industry under the Central Electricity Generating Board. These days, it's rather harder to conceal the true cost of nuclear power (although every effort is still made to do exactly that), and there is now no serious debate about the fact that nuclear power is an extraordinarily and perversely expensive way of generating electricity.

3. Every year, the investment bank Lazard produces a comparison of generation costs on what is known as a 'LCOE' methodology – Levelized Cost of Energy. Its 2020 estimates for relative costs per megawatt hour (MWh) of electricity produced were as follows:[1]

Large-scale solar	£27
Onshore wind	£30
Combined cycle gas turbines	£44
Offshore wind	£63
Coal	£83
Nuclear	£121

4. All such comparisons are controversial, but there is no-one out there today making the case for nuclear on the basis either of its advantageous economics or on its CO_2 abatement potential (as in cost per tonne of CO_2e abated) – an equally critical comparison.

5. And consideration must also be given to movement in costs over time. On a more historical basis, 'LCOE analysis shows that between 2009 and 2019, utility-scale solar costs came down 89%, and wind power by 70%, while new nuclear costs increased by 26%. The gap has continued to widen between 2018 and 2019.'[2] Nuclear continues to get more expensive, while renewables continue to get cheaper. For instance, that Lazard figure for offshore wind quoted above looks very high in comparison to the UK Government's latest assessment[3] of £47/MWh when one projects through to 2030, and it's certain that this year's auction for offshore wind will see bids at no more than £40/MWh. Just five years ago, the Government's projection was £103/MWh.

6. **This report from BEIS (*Electricity Generation Costs*), in August 2020, is a remarkable document, showing just how dramatically the Government has had to slash its forecasts for wind and solar energy over the last four years. Intriguingly, however, it does not include any cost comparisons for nuclear power!**

7. In terms of future impact on electricity consumers in the UK, the focus now is on Hinkley Point C and Sizewell C, where discussions with Government have been ongoing for the last few years. Électricité de France (EDF) argues that it will be able to keep costs down on the basis of the two reactors proposed for Sizewell C being the same as those at Hinkley Point C – widely recognised as the most costly power plant that has ever been constructed. Hinkley Point C's price tag currently stands at around £23bn – and that's in 2015 prices, which means no account of inflation since then is included in this estimate.

8. **By guaranteeing EDF a price of £92.50/MWh (at 2012 prices – which amounts to around £102/MWh in today's prices) for the first 35 years of output from Hinkley Point C, it's been estimated by the**

National Audit Office that EDF will be subsidised to the tune of anywhere between £30bn and £100bn during that time, adding somewhere between £10 and £15 to consumers' electricity bills every year.

9. As the National Audit Office put it in its report in 2017: 'The Government has committed electricity consumers and taxpayers to a high-cost and risky deal in a changing energy marketplace. Time will tell whether the deal represents value for money, but we cannot say the Government has maximised the chances that it will be.' [4]

10. There is no-one outside of EDF who believes that we've seen the last of delays and cost hikes at Hinkley Point. These could still prove terminal. That £23bn estimate for Hinkley (which does not include the cost of capital), translates into a direct £15.5bn cost to EDF, with the rest falling to its Chinese partner, CGN. The French Court of Audit has already commented that Hinkley Point 'weighs heavily' on EDF's balance sheet, an issue that led to the resignation of EDF's former Finance Director in 2016. At the moment, city analysts accept that Hinkley Point is 'too big a project to be allowed to fail', but further delays and cost overruns, as with EDF's reactors in France and Finland, could easily change those dynamics.

11. Its power station at Flamanville began construction in 2007, with plans to be online by 2012. It now seems that 2023 is the earliest possible start for commercial operation. Costs have risen from a projected €3.3bn to at least €10bn, and significant additional costs will be incurred at a later date to meet further regulatory demands. The power station at Olkiluoto in Finland began construction even earlier, in 2005, with plans for it to be online in 2009. It now seems unlikely it will be operating commercially until 2022. The initial budget of €3.2bn has tripled since 2005.

12. Looking ahead, no-one believes EDF's projected costs for Sizewell C (which it still claims to be around £20bn) to be anything other than the usual grotesque underestimate. Apart from the fact that lessons are rarely learned from one nuclear project to the next, as EDF claims, the principal reason for this is the cost of capital (with nuclear power stations taking so long to build before producing any income-generating electricity), which is not included in that £20bn estimate.

13. Despite the Government's assertions in its Energy White Paper in December last year, the funding for Sizewell C is by no means secured. EDF only survives as a quasi-commercial entity because it is 84% owned by the French Government, but it cannot possibly find such a huge sum from its own (largely fictitious) balance sheet. It is also facing massive additional costs to extend the life of many of its existing reactors in France and to start decommissioning the rest.

14. The UK Treasury has remained steadfast in its refusal to provide direct subsidies to enable construction to proceed. An undisclosed contribution may be available from the Chinese company CGN (wholly owned by the Chinese Government), as is currently the case with Hinkley Point C. But third party investors (including both Aviva and Legal & General, two key players in this area), have already declined to step into this particular breach, given EDF's lamentable track record with its EPR reactor.

15. The Government's favoured solution at the moment is to make use of a device called the 'Regulated Asset Base' (RAB), which means that consumers in the UK will pay up front for an as yet unspecified percentage of the construction costs. This could amount to as much as a £40 per annum surcharge on consumers' bills, for at least five years. Once construction is completed (notionally in 2035), consumers will then have to pay all over again for the still highly expensive electricity that Sizewell C will be generating. As Tom Burke, Chairman of the think tank E3G, puts it: 'We are being subject to a confidence trick which uses financial engineering as cover for the failure of nuclear engineering to reduce costs.'[5]

16. **At the moment, the principal question for Ministers seems to be whether there's any reasonable expectation of getting away with such a monstrous boondoggle.**

B2. Build Rate

17. EDF's new power station at Hinkley Point C epitomises the difficulties faced by companies involved in nuclear construction projects. After lengthy discussions with EDF from 2010 onwards, the UK Government finally approved the project in September 2016, and work got under way in 2018. In January this year, EDF announced that the earliest date for Hinkley Point C generating any electricity would be June 2026. Further delays are considered inevitable.

18. As recently as 2018, the Government was still talking of a further four nuclear power stations over and above Hinkley Point C and Sizewell C. In 2018, however, Toshiba finally gave up on its plans for the Moorside site near Sellafield in Cumbria. In September 2020, for similar financial reasons, Hitachi pulled back from its involvement in both Wylfa and Oldbury, and confirmed that it was pulling out altogether in February 2021, blaming the UK Government for not coming up with sufficient financial support. That just leaves Bradwell B, where plans for a majority-owned Chinese power station (using CGN's own reactor design) seem more and more implausible at a time when any Chinese investments in the UK are coming under ever-greater scrutiny (see page 9).

19. Beyond that, there has recently been a huge surge of interest in what are called Small Modular Reactors. I shall look further at this later in the Report – see page 24.

20. Essentially, it's the ludicrously uncompetitive nature of nuclear power that has led to such a profound collapse of confidence in the idea of new nuclear power stations for the UK – and much of this can be attributed to construction risk: the fact that new plants take so long to build, ramping up huge capital costs before any financial payback. As we've seen, the cost of capital is correspondingly punitive. These days, it's only China that can demonstrate any kind of track record in completing new nuclear power stations (more or less) on time, although it too saw significant delays (of up to five years) with the two EPRs that it has built. Extended overruns are standard, as detailed every year by the World Nuclear Industry Status Report.

21. This has a huge impact on the contribution that new nuclear can make to any country hoping to achieve a Net Zero carbon target. With Sizewell C, for example, EDF has acknowledged that its carbon payback period (the number of years of low-carbon electricity generation required to 'pay back' the huge amounts of CO_2 embedded in all the construction materials, particularly steel and concrete) will be at least six years, assuming that it comes online in 2034, which itself is highly unlikely.[6]

22. **In other words, even if it goes ahead, Sizewell C will make only a marginal contribution to the UK's target of becoming Net Zero by 2050.**

23. Environmentalists will also be acutely aware of the opportunity costs here. By persevering with its 'we need all of the above' strategy, the UK Government is actually undermining our Net Zero prospects through its continuing ambiguity on a 100% renewables-efficiency-storage-smart grids option – as I'll explain in the next section. It's crucial that all those now focused on Net Zero strategies should get much smarter about the relative 'climate effectiveness' of different generation options; the bottom line here is that high-cost options save less CO_2 per pound invested than low-cost options. As US energy guru Amory Lovins says, such muddled thinking 'distorts prices, crowds out competitors, slows innovation, reduces transparency, rewards undue influence, introduces bias, picks winners, invites corruption, and even threatens to destroy competitive power markets where renewables and efficiency win. These are high prices to pay for small or negative benefits.'[7]

B3. Waste

24. It's rare to hear nuclear enthusiasts acknowledge the fact that nuclear power produces significant and problematic volumes of nuclear waste, let alone the even more inconvenient fact that the industry has failed to come up with a viable long-term strategy for dealing with that nuclear waste over more than 50 years. The highly influential 1976 report from the Royal Commission on Environmental Pollution (the so-called Flowers Report) made the following recommendation:

> 'There should be no commitment to a large programme of nuclear fission power until it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of long-lived, highly radioactive waste for the indefinite future.'[8]

25. The consequence of ignoring this recommendation is a jumble of more-or-less unsatisfactory 'meanwhile' fixes pending that long-term solution through some kind of Geological Disposal Facility. Spent nuclear fuel (removed from the reactor core) is stored in cooling ponds on site and then in dry casks (usually steel cylinders) before being transferred to Sellafield (around 80% of nuclear waste in the UK is located in Sellafield). All the spent fuel from Magnox reactors is now consolidated at Sellafield for reprocessing – a temporary arrangement as reprocessing at Sellafield is due to end later this year. What is left will be transferred into dry storage facilities, as will the waste from Sizewell B. The High-Level Waste generated as a by-product from the reprocessing undergoes an additional process called 'vitrification', and is then stored in stainless steel containers until such time as a Geological Disposal Facility becomes available – which could still be decades away.

26. **There are still <u>many</u> issues to be resolved in this regard, not least the decision as to where any such facility will be located. The Government (through the Nuclear Decommissioning Authority) is currently involved in a fourth consultation exercise with possible 'host communities', dangling the incentive/bribe of £2.5m per annum for local initiatives. Notwithstanding such largesse, even the Government acknowledges that such a Facility will not be fully operational (for dealing with High-Level Waste) until 2075.**

27. Intermediate-level waste is compacted and stored in stainless steel containers at Sellafield's Interim Storage Facility. Most low-level waste is now disposed of in metal containers before being stacked in engineered vaults in the UK's Low Level Waste Repository at Drigg in Cumbria. A small amount is incinerated or recycled.

28. As the industry correctly claims, this is certainly 'manageable', even if a high price has to be paid to meet stringent safety standards. But the lack of a long-term strategy remains highly problematic, and Sellafield itself is a site riddled with problems and hazards of every conceivable kind, including a stockpile of 140 tonnes of plutonium (the largest stockpile in the world), much of which will need to be completely 'repackaged' and transferred into new storage facilities over the course of the next decade, at a cost of many billions of pounds.

B4. Decommissioning

29. At the end of their operating life, all nuclear reactors have to be decommissioned, an extended process which takes many decades. Here in the UK, the Nuclear Decommissioning Authority (NDA) is responsible for 17 sites, including Sellafield, Dounreay and all 12 Magnox stations, with an annual budget of around £3.5bn.

30. **An extremely critical report from the Public Accounts Committee in November 2020 highlighted the 'astronomical sums' that taxpayers are having to stump up to deal with the costs of decommissioning.[9] According to the NDA, it will cost current and future generations of taxpayers**

£132bn to decommission all civil nuclear sites in the UK, with the work not being completed for at least another 85 years, and possibly 120 years! The same report indicated that it will require £8.7bn just to get the 11 closed Magnox stations into the 'care and maintenance' stage of the whole decommissioning process.

31. It is often asserted that the future costs of decommissioning the UK's Advanced Gas Reactors (AGRs), and the one Pressurised Water Reactor (PWR) at Sizewell B, will be covered by regular contributions from the operator of those reactors to the Nuclear Liabilities Fund, which now stands at around £14.5bn. But the 'accounting' behind this claim is highly tendentious. Any shortfall beyond that (and you can absolutely guarantee there will be shortfalls) will have to be covered by future contributions from taxpayers.

32. Apart from the occasional investigation by the Public Accounts Committee, or independent commentators, UK taxpayers never get to hear about these massive sums of money, stretching forward decades into the future. It's just one of the many hidden costs of the whole nuclear lifecycle. This lack of transparency is not unexpected, but it is highly regrettable. A Government that inflicted a decade of austerity on its citizens on the grounds that it would be morally wrong to pass on to our children the debts accrued in dealing with the financial crash in 2008, should be rather more focused on this particular intergenerational immorality.

B5. Proliferation

33. The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) came into force in 1970 in order to prevent the spread of nuclear weapons – but also 'to promote cooperation in the peaceful uses of nuclear energy'. And there's the rub: it's hard to promote nuclear energy without running the risk of those 'nuclear nations' developing nuclear weapons. Four of them (India, Pakistan, Israel and North Korea) have done precisely that since 1970, joining the Big Five nuclear weapons states of the USA, Russia, China, France and the UK. South Africa used its uranium enrichment facility to build a nuclear bomb, but chose not to become a nuclear power. There are continuing concerns that other nations are intent on joining that nuclear weapons club, including the two most bitter rivals in the Middle East, Iran and Saudi Arabia.

34. With the US company Westinghouse struggling to find buyers for its AP1000 reactor, and France (through EDF/Framatome) having more than enough on its plate, that just leaves Russia, China and South Korea seeking new international orders. In March 2020, South Korea's KEPCO completed the first of four planned reactors in Abu Dhabi, in full compliance with the strict non-proliferation standards enforced through the NPT. But neither Russia nor China would appear to have any such scruples.

35. The prospect of a massive expansion of nuclear power to help decarbonise electricity supply around the world fills me with dread. One has only to think of the massive challenge that the International Atomic Energy Agency has faced (and still faces) in terms of regulating Iran's nuclear industry, with all the geopolitical fallout this has caused, to baulk at any further expansion elsewhere in the world.

36. **The only fail-safe way of ensuring that the technologies necessary to create a civil nuclear industry do not simultaneously facilitate a nuclear weapons capability is to stop building nuclear power stations.**

37. **And the only fail-safe way of ensuring that the materials required for the production of so-called 'dirty bombs' (plutonium or enriched uranium) do not become available to terrorist organisations is to stop building nuclear power stations anywhere in the world.**

B6. Safety

38. Advocates of nuclear energy feel aggrieved that critics continue to characterise nuclear power as 'inherently unsafe'. And with some justification. Setting aside the accident at Three Mile Island in Pennsylvania in 1979, the Chernobyl disaster in 1986, and the Fukushima disaster in 2011, the industry can claim to have a reasonable safety record. It is certainly responsible for far fewer deaths per unit of energy generated than coal, oil, and gas. Over the course of roughly 20,000 'reactor years' since the 1970s, regulators and operators have, for the most part, maintained high safety standards, satisfactorily managed tens of thousands of 'minor incidents', and adequately protected their workforces from both low-level and high-level risks.

39. And it's always worth remembering that this is an industry that employs tens of thousands of utterly dedicated nuclear engineers and blue-collar workers intent on 'keeping the lights on' in as safe and reliable a way as can be secured.

40. **It was for this reason that I strongly opposed the decision taken by Germany after the Fukushima disaster in 2011 to take all its nuclear reactors off-grid by 2022 – well before the end of their scheduled operating life. Germany has some of the most reliable nuclear power plants anywhere in the world. The inevitable consequence of this was that Germany's increasingly desperate coal industry was immediately given a pretext to 'stay in the game', effectively slowing the transformation to renewables and efficiency that was under way. Germany will still be burning coal in 2038 – an utterly ludicrous state of affairs.**

41. However, as both Chernobyl and Fukushima (and, to a lesser extent, the disaster at Three Mile Island in the USA back in 1979) demonstrate, the nuclear industry is peculiarly vulnerable to 'high-impact, low-probability' events, with devastating consequences. Although the official death toll for Chernobyl remains low (with 31 immediate deaths and up to 4,000 deaths estimated from direct exposure to radiation, although it's important to point out that UNSCEAR (the United Nations Scientific Committee on the Effects of Atomic Radiation) has challenged the validity of the models used to produce that figure), this masks a much more persistent health crisis. The National Research Centre for Radiation Medicine in Kiev, Ukraine, describes Chernobyl as 'the largest anthropogenic disaster in the history of humankind', with millions of people suffering adverse health consequences of different kinds. 1.8 million people in Ukraine have official status as victims of the disaster, with benefits still being paid, 35 years on, to 36,525 widows.

42. Far fewer people were affected by the disaster at Fukushima, but there are still grave concerns about the impact of radiation on many thousands of people, and growing anger about proposals to dispose of billions of tonnes of contaminated water in the Pacific. Moreover, the financial costs are staggering, with the Government itself acknowledging that the final clean-up bill will exceed $200bn. Independent experts (such as the Japan Center for Economic Research) estimate that the final figure will be between $470bn and $660bn. Some believe that the combination of direct and indirect costs will top $1tn, making it by far the most costly disaster in human history.

43. We have to be mindful of these 'worst-ever' impacts when appraising the industry's indisputable (though increasingly irrelevant) argument that nuclear power has killed far fewer people than the coal industry. And we also have to take into account the nuclear industry's entire life cycle, including the highly significant health and environmental impacts caused by the mining and processing of uranium.

B7. Radiation

44. The health impacts of different levels of exposure to radiation remains a highly contested area of medical science. On balance, it's fair to say (as argued persuasively by Trade Unions representing

workers in the industry) that the risks to workers and surrounding communities from low-level radiation can be managed, and, for the most part, are properly managed. For example, the radiation-induced cancer risks to nuclear workers have been compensated fairly quickly and generously via automatic compensation schemes like that pioneered at Sellafield by the GMB and other unions in 1984.

45. However, there have been far too many examples of poor management practices over the last 50 years, and such reassurances from the industry will never allay the wholly legitimate concerns of anti-nuclear campaigners. There are many studies that reinforce those concerns. Back in 2008, for instance, a highly authoritative report analysed the incidence of childhood cancer in the vicinity of Germany's 16 nuclear power stations, revealing a 60% increase in childhood cancers and a 120% increase in leukaemia amongst children living within five kilometres of those power stations.[10] Similar findings have subsequently emerged from studies in France, Switzerland and the UK.

B8. Security/Cybersecurity

46. Although industry leaders are (perhaps understandably) reluctant to talk about security issues, any assessment of the potential contribution from nuclear power to a Net Zero economy has to take into account both physical security and cybersecurity.

B8.1 Physical security

47. By definition, all nuclear reactors and associated facilities are vulnerable to terrorist attacks, necessitating correspondingly high levels of protection, both in terms of deterring ground-based attacks and securing no-fly zones around nuclear reactors to prevent '9/11-type' attacks, given that most existing nuclear power plants were not designed to withstand that kind of impact. There are additional concerns about spent fuel ponds being subjected to such attacks. (It is often forgotten that al-Qaeda originally planned to include a nuclear power plant in its 2001 attack in the USA.)

48. It remains all but impossible to ascertain the true costs associated with these combined security operations, but they are clearly material.

B8.2 Cybersecurity

49. It's now more than ten years since the USA and Israel managed to introduce a 'computer worm' into some critical operating systems in Iran's uranium enrichment plant, causing safety devices to be switched off. The 'Stuxnet attack' ushered in a decade of increasingly intense cyberwarfare, often involving critical energy infrastructure assets. In 2014, South Korea's nuclear plant operator (KHNP) was subjected to an extensive hacking operation. Russia attacked Ukraine's power grid in both 2015 and 2016, and is constantly trying to hack the US power grid (including some of its nuclear power plants), just as the National Security Agency in the USA is constantly trying to hack Russia's power grid.

50. **2020 ended with a particularly telling example of the escalating risks in this area. A private cybersecurity firm, FireEye, alerted the US Cyber Command of a massive hack coordinated by Russia's SVR (previously known as the KGB) that had been going on since March – entirely undetected by the National Security Agency. Huge numbers of multinational companies and government agencies were breached, including the Los Alamos and Sandia National Laboratories (where nuclear weapons are developed), as well as the National Nuclear Security Administration, which maintains the US nuclear stockpile.**

51. So is it, as some security experts believe, only 'a matter of time' before a nuclear power plant or other facility is subject to a full-on terrorist-inspired cyberattack? I don't know. Such a prospect is certainly right up there in the list of high-impact, low probability events that I mentioned before. All I do

know is that reassurances from industry leaders that their 'stand-alone' operating systems, with multiple, notionally 'unbreachable' firewalls providing ample protection against even the most sophisticated cyberattack, sound increasingly implausible.

52. Here in the UK, we have a very particular cybersecurity issue to address – caused by the involvement of the Chinese in our nuclear industry. In the aftermath of the Huawei debacle regarding the rollout of 5G, there's now much greater scrutiny of CGN's involvement as a co-investor in both Hinkley Point C and (potentially) Sizewell C – with Iain Duncan Smith referring to CGN as 'the next Huawei'. The Chancellor, Rishi Sunak, has hinted at a change of heart in referring to the need for an 'eyes wide open relationship with China', which many have read as an implicit 'pack your bags' message to CGN regarding its proposals for a 100% designed, constructed and operated Chinese reactor at Bradwell. In February this year, CGN announced that all current work on Bradwell would be 'paused', and that engagement with local authorities and regulators 'will begin again in future years'. I rather doubt it.

ALL IN ALL …

53. The case against nuclear power remains very strong. As the annual World Nuclear Industry Status Report demonstrates, this explains why the nuclear industry is slowly declining. There were still 400 nuclear reactors online in July 2020, nine fewer than in July 2019 – which happens to be exactly the same number as in 1988. Even in China, where nuclear power contributes around 4% of the overall generation mix, wind energy in 2019 provided more power than nuclear (406 TWh versus 330 TWh), with solar power (at 224 TWh) growing much faster than nuclear. Both wind and solar provide more electricity in India than nuclear. Nuclear capacity in the USA is rapidly shrinking. In the EU, wind power increased by 14% and solar by 7% in 2019, while nuclear declined by 1%. And EDF's continuing problems with its EPR reactors at Flamanville makes it extremely unlikely that any new reactors will be commissioned in France for a long time to come, despite their being historical plans for a further six EPRs.

54. The bottom line here, for environmentalists in particular, couldn't be simpler. The UK's 'Net Zero by 2050' commitment demands a profound rethink of every aspect of our energy strategy – a challenge which the Government's 2020 White Paper manifestly failed to deliver. The nuclear industry has itself acknowledged that it has nothing new to add to the need for accelerating decarbonisation over the next decade, and that any contribution it can eventually make (over and above the 10% of low-carbon electricity from Sizewell B and Hinkley Point C combined – see next page) will not kick in until after 2050. Too late!

55. **There are a number of EU countries which still harbour hopes of building new reactors, but the UK Government stands pretty much alone in its unbridled enthusiasm for new nuclear power stations, even as it has witnessed its hugely ambitious dream of a 'nuclear renaissance' fade away over the last 15 years. But no-one can accuse the industry of a lack of effort in promoting its own interests against such an unfavourable backdrop.**

C: 'YES, BUT WE STILL NEED IT!'

1. There's not much that advocates for a nuclear option can do to gainsay the full extent of these problems. All the statistics I've used in Section B are in the public domain, and all my more speculative observations (on security matters, for instance) fall well within the bounds of probability. Which leaves those advocates falling back on two relatively new-found 'yes, but' arguments.

C1. 'Yes, but it's impossible for the UK to achieve Net Zero without new nuclear power.'

2. I'm putting the emphasis on new nuclear power simply because there will already be a significant contribution to UK electricity supply from nuclear power through to at least 2050. The PWR at Sizewell B (which provides 3% of the UK's electricity) is scheduled to continue generating until 2035, but there's a strong likelihood that its lifetime may be extended through to 2050, assuming it meets rigorous safety checks. If and when Hinkley Point C is finished (providing 7% of UK electricity), it will still be generating low-carbon electricity well into the second half of the century – all being well. So we can assume a combined contribution from 2030 to 2050 of around 10% from those two nuclear plants.

3. What Net Zero means is that all emissions of greenhouse gases (across the entire economy) must be either eliminated or brought down as close to zero as possible, with all residual emissions compensated for by an equivalent removal of CO_2 from the atmosphere. Net Zero includes all emissions from transport, heating, manufacturing and refining, farming and land use, as well as from shipping and aviation (which are currently not included in the UK Government's Carbon Budgets). In effect, that means we first have to electrify pretty much everything we can, and then ensure that all that electricity is itself low or zero carbon.

4. This is indeed a massive challenge. Advocates for nuclear power argue that it cannot be achieved without a significant percentage of that total electricity demand being met by new nuclear power – in effect, countering the argument that a combination of energy efficiency, renewables, storage and grid redesign is all that is required. Tom Greatrex, Chief Executive of the Nuclear Industry Association, continues to argue that nobody in the industry has 'ever heard anybody, serious or credible, suggesting that there is any way you're going to get to Net Zero without nuclear being part of it.' This is the nub of the 'Net Zero needs nuclear' case.

5. Having once argued that nuclear power should be the principal source of generating low-carbon electricity, constantly disparaging and misrepresenting the potential contribution from renewables, the industry has had to fall back a long way from that aggressive positioning, relying instead on the somewhat less ambitious claim that 'we need every low-carbon tool in the toolkit' in order to address the Climate Emergency. And though it is never spelled out as such, there is an implicit assumption behind this 'all of the above' argument that all of the different options are somehow equal in terms of their low-carbon credentials.

6. **The first thing to be said is that it is very misleading to make out that renewables and nuclear are equivalently low-carbon – and even more misleading to describe nuclear energy as zero-carbon, as a regrettably significant number of politicians (including BEIS Ministers) and industry representatives (including EDF's egregiously saccharine TV ads claiming that it is 'the biggest producer of carbon-free electricity' in the UK) continue to do. Many of them in the full knowledge that they are lying.**

7. In 2008, the journal *Energy Policy* published an article by Benjamin Sovacool (now Professor of Energy Policy at the Science Policy and Research Unit at Sussex University) analysing 103 lifecycle studies of greenhouse gas-equivalent emissions for nuclear power plants. It calculated that the mean value is 66g of CO_2e/KWh. This compares to 9g of CO_2e/KWh for offshore wind and 32g of CO_2e/KWh for solar PV.[11]

8. According to Mark Jacobson, Professor of Civil and Environmental Engineering at Stanford University, when the full life cycle of nuclear is taken into account – from mining, milling and enriching the uranium that provides the fuel, through to fabricating and transporting that fuel, and then on to managing and eventually disposing of the radioactive waste and decommissioning the reactors – emissions from nuclear power are between 10 to 18 times greater than emissions from renewable energy technologies.[12] And all those emissions are over and above the huge embodied carbon costs of construction that I've already referred to.

9. Having dismissed that myth, let's examine the case for a 100% 'nuclear-free Net Zero' ambition.

C1.1 Efficiency

10. I've put this first because it's so often (and so frustratingly!) left out of the discussion about Net Zero, or relegated to some also-ran status. Whether nuclear is in the mix or not, it is absolutely critical that we should put efficiency at the heart of our Net Zero ambition: the lower the total amount of energy required, the easier it becomes to meet that demand. And the fact that some environmental organisations, climate campaigners, anti-poverty campaigners and trade unionists continue to treat energy efficiency (and fuel poverty in particular) as a secondary concern tells me they haven't begun to understand the true nature of our Net Zero challenge.

11. **Indeed, if there's one thing that keeps the nuclear industry alive today apart from the continuing interdependencies between nuclear weapons and nuclear power (which I'll address later), it's the continuing complacency of so many campaigning organisations as to the preconditional importance of energy efficiency. It's not just Dominic Cummings, Boris Johnson's former Svengali, who finds energy efficiency 'boring' – despite the fact that the energy efficiency sector was responsible for 114,000 full-time equivalent jobs in 2018, according to the Office for National Statistics, compared with around 50,000 in renewables and a paltry 12,400 in nuclear. (That figure does not include all the jobs involved in decommissioning.)**

12. It's knee-jerk nonsense from the likes of Dominic Cummings that continues to undermine the case for energy efficiency – and not just here in the UK. The International Energy Agency's 'Energy Efficiency 2020' report in August last year predicted that overall investment in energy efficiency improvements would be down by around 9% in 2020, the slowest rate in a decade.[13] But the UK has been particularly badly affected by this institutional bias against prioritising energy efficiency – a pattern compounded by the Conservative Party's deep-seated antipathy to using regulation to drive behaviour change. A report from the Energy and Climate Intelligence Unit in February last year demonstrated how the Conservative Government's axing of the Zero Carbon Homes initiative in 2016 (together with the Code for Sustainable Homes) will drive up energy bills in the UK by around £200 a year for all new homes purchased since 2019.[14]

13. And without the EU's focus on efficiency and appliances (through the Ecodesign Directive and other measures), it's doubtful that we would have seen anything like the same efficiency gains here in the UK. The latest ecodesign laws, which come into force in April this year, will require manufacturers of fridges, freezers, washing machines, dryers, dishwashers, TVs, monitors and lighting products not only to make their appliances easier to repair or recycle – but even more energy efficient. The UK will still be bound by these new standards (which were agreed back in January 2019), but one wonders what will happen in future now that we're out of the EU? It's critical that Ministers continue to drive down energy demand through further initiatives of this kind, ensuring that 'demand management' is as high a priority in policy terms as new generation.

14. Beyond that, it's the built environment where the biggest efficiency gains are to be made – not just in terms of new-build but existing buildings. And in particular, existing housing. Household emissions

from heating and hot water (roughly 20% of the UK's emissions) must reduce by a massive 95% if the UK is to achieve its Net Zero target by 2050. According to the Committee on Climate Change, that will require up to 20,000 homes and other buildings to be retrofitted every week. For the next 30 years. The Committee has also pointed out that the number of homes being insulated today has dropped by over 90% since 2012, owing mostly to the Government's axing of Labour's tried and tested retrofit initiatives.

15. Relative to the cost of gas, electricity is very expensive, making the imperative of 'decarbonising heating systems' (by massively reducing the use of gas) all the more problematic. But the Government's response to this is nothing short of pathetic. Despite endless calls from business and NGOs to put a homes retrofit programme at the heart of its 'Build Back Better' strategy, even the patently inadequate Green Homes Scheme promising grants to individual homeowners was terminated in March after failing to meet any of its targets. This represents a colossal policy failure.

16. What we've ended up with is the usual 'targetry without delivery': 600,000 heat pumps a year by 2028; 2.2 million homes in the social housing sector to be improved, with a promise in the 2019 Election Manifesto of £6.3bn to help make this happen; no more gas boilers to be installed in new homes from 2025 onwards; a new Low-Carbon Heat Support Scheme from April 2022, etc etc. This on/off approach, with a drib here and a drab there, shows this Government's contempt for addressing fuel poverty strategically – as they're now doing so effectively in Scotland through the 'Warmer Homes Scotland' initiative.

17. What's needed is a multi-year programme for the whole UK, taking us through to 2030, 2040 and then 2050, focused both on the 'willing and able to pay' and on the social housing sector, as originally called for by the Green New Deal group – and now supported by the Lib Dems and by Labour.

18. This will indeed cost billions of pounds. But as a general rule of thumb, 'buying efficiency' costs a lot less than 'buying new electrons', wherever they come from. And a retrofit programme of this kind will cost so much less than the utterly nonsensical ideas about a new hydrogen-based gas grid, apparently entailing the installation of millions of new hydrogen-ready boilers, with that notionally 'green hydrogen' being produced from nuclear-generated electricity. This is just the latest in a long line of the nuclear industry opportunistically jumping on a temporarily over-hyped bandwagon in order to strengthen its rapidly diminishing credentials (see page 25).

C1.2 Renewables

19. Let's assume we get smart in putting energy efficiency first in policy terms. And that we drive that energy efficiency programme hard throughout the next 30 years. In such circumstances, it's reasonable to assume that we could then halve total energy consumption in the UK from around 1,700 TWh/year today to around 850 TWh/year by 2050. Decarbonising total energy use in the UK means all but eliminating the use of oil in transportation, and massively reducing the use of gas for providing heat and hot water. Most scenarios assume this will mean a doubling in the amount of electricity we need to generate by 2050: the Committee on Climate Change's so-called 'Balanced Pathway' scenario suggests electricity could rise to around 677 TWh/year by 2050.

20. As much as possible of that remaining 677 TWh/year will need to come from a combination of renewables backed by storage. According to Government figures, 42% of our electricity in 2019 came from renewables – that's the equivalent of about 120 TWh/year. So we have to get from 120 TWh (from current electricity) to 677 TWh over the next 30 years. And that's the gap that Tom Greatrex does not believe can be filled without new nuclear-generated electricity, carefully curating his own reading list to avoid various authoritative '100% renewable energy scenarios' from the Centre for Alternative Technology[15] and other international NGOs, from independent experts like Keith Barnham, or even from the International Energy Agency itself. An IEA report in 2019 demonstrated that offshore wind could

theoretically provide enough electricity to meet total global electricity demand, predicting that offshore wind will grow 15-fold to become a $1tn industry over the next 20 years.[16] (To be fair, the IEA is not actually recommending this scenario!)

21. Suffice it to say that those who believe the gap can be filled are getting more and more bullish by the year, with continuing improvements in technology, continuing reductions in costs, year on year, and continuing confidence in reconfiguring distribution systems.

22. Just a couple of additional points here: for once, Boris Johnson's resort to hyperbole was justified when he laid out his ambition for the UK to become 'the Saudi Arabia of windpower':

- In July last year, analysts at Imperial College crunched the numbers to demonstrate that when the latest offshore wind farms come on stream over the next few years (at a contracted price of £40/MWh), this is likely to be below wholesale prices at that point.[17] Their report suggested that wind farm operators would then have to pay back the difference between the contracted price and wholesale price, with those savings passed on in the form of lower energy bills for businesses and households. This raises the very real possibility that all future offshore wind contracts will be completely subsidy-free from the middle of the decade. A full ten years before the first (and still massively subsidised) electrons are due to be generated at Sizewell C.

  These figures relate to turbines limited to relatively shallow water with a depth of less than 60 metres. Floating wind turbines have already been deployed in a number of demonstration projects, and as the size of each individual turbine increases, there's no doubt that cost curves will start coming down at the same rate as happened with conventional offshore turbines. And turbines will continue to get bigger: in January, GE secured a contract to build a 14MW turbine at the Dogger Bank Wind Farm; Vestas has just started work on a 15MW offshore turbine – enough to power 20,000 households on its own!

- According to the Government's own figures, large-scale solar will be the cheapest generating technology by 2025 (at half the cost of combined-cycle gas turbines), and will get cheaper still through to 2040 where costs could fall as low as £28/MWh[18]. Which may explain why BEIS called for new evidence at the end of last year as to the potential contribution of large-scale solar to our Net Zero target, and why even the Solar Trade Association's call for a tripling of existing solar by 2030 seems modest.

23. **The simple and most important point is this: the Government itself recognises that renewables can be scaled quickly and cost effectively. We've seen the impact of that over the last five years, even before a recognition of the full extent of the Climate Emergency in which we now find ourselves. So imagine that we started to do that scaling with that Emergency in mind.**

24. And all this (in my opinion) before the Government eventually bites the bullet and commits to significant investment in tidal energy on the Severn Estuary, either through tidal lagoons or a full-blown barrage, generating totally predictable, near-zero-carbon electricity for up to 100 years – and simultaneously protecting the whole Severn Estuary from the extreme disruption which will inevitably be caused by rising sea levels.

25. It's true that the UK is particularly well endowed with renewable energy resources, but similar '100% renewable' scenarios are becoming more robust every year. Mark Jacobson and his team at Stanford University have argued that 100% of all global energy can come from renewable sources (with biomass excluded) by 2050.[19]

C1.3 Storage

26. **The astonishing potential of renewables can only be realised if massive new investment in batteries and other storage technologies can compensate for 'the intermittency challenge' – those times where 'the sun isn't shining and the wind isn't blowing', a phrase which is ritually trotted out by nuclear advocates in order to disparage the case for renewables. It will require significant breakthroughs in storage to ensure cost-effective integration of variable renewable electricity on to the grid, with the UK remaining dependent on fast-ramping natural gas plants for peak power generation until then.**

27. Like many environmentalists, I'm deeply concerned about the impact of this huge growth in demand for batteries on the environment – particularly in terms of the extraction of raw materials (lithium, cobalt and nickel) required, often sourced from countries such as the Democratic Republic of Congo which have a terrible record on human rights and environmental safeguards. It's imperative that governments act now both to address the supply chain challenges, and to mandate the strictest 'circular economy' conditions to ensure that batteries can easily be disassembled and recycled to limit demand for virgin raw materials.

28. The cost of lithium-ion batteries has also been plummeting over the last few years as a consequence of growth in EV markets, down from $1,183/KWh in 2010 to $156/KWh in 2019, according to data from Bloomberg New Energy Finance. And BNEF is predicting $100/KWh by 2024 (the price point at which EVs reach cost parity with petrol and diesel vehicles) and an astonishing $60/KWh by 2030. These improvements will come through further incremental innovation in battery chemistry and significant economies of scale.

29. These reductions in the cost of batteries will ensure that the so-called 'balancing cost' entailed in integrating much larger amounts of variable renewable electricity onto the grid will also reduce – adding somewhere between £10/MWh and £15/MWh to the overall cost of the renewables + storage option. Here in the UK, there's growing recognition of the importance of large-scale storage through the Government's Capacity Market, and the inclusion of storage schemes within the new Contracts for Difference auctions. In February, RenewableUK published its analysis of just how quickly the UK's battery storage pipeline is growing – up 50% over the last year or so – with bigger schemes able to get planning permission much more easily. 'There is now more than 16GW of battery storage projects operating, under construction, or being planned here in the UK.'[20]

30. Unfortunately, this is something which BEIS currently can't get its head around, with its archaic belief in centralised dispatch based on large power stations – including nuclear. According to Michael Liebreich of Bloomberg New Energy Finance:

> 'There are plenty of ways of managing intermittency in renewables without resorting to expensive back-up power. First, you improve your resource forecasting. Second, by interconnecting the grid over larger areas, much of the variability of renewable energy can be evened out. Third, just when an increased proportion of renewable energy means you start losing control over supply, the introduction of digitally controlled smart grids gives you better control of demand. Finally, there is power storage, currently mainly in the form of pumped hydroelectric power, but, in the future, most likely in the form of batteries for electric vehicles. The cost of each of these techniques is coming down just as rapidly as the cost of renewable energy.'[21]

31. Beyond that, we shouldn't underestimate the potential for pumped storage from hydroelectric schemes. When renewable electricity is plentiful and cheap, it can be used to pump water uphill from a

lower reservoir to a higher one. When power is needed, the water is released and passes through turbines to generate electricity. The UK has four such schemes at the moment, but Scotland is now actively exploring proposals from both SSE and Drax that would significantly increase overall capacity. SSE's scheme at Coire Glas in the Highlands would be the UK's largest pumped storage scheme with a capacity of 1,500MW at a cost of around £1.5bn.

32. And there are now plans for smaller, high-intensity hydro projects across the UK. It's estimated that there could be as many as 700 sites with no more than a 200m 'lift' between two small-scale reservoirs, possibly providing as much as 7GW of storage. These are early days, but if we unleash the power of innovation here as much as on mechanical, battery-powered storage, we could see a far more environment-friendly solution emerge.

33. This all relates to short-term storage, where a combination of improved storage technologies and effective demand management (both for industry and households) shows great promise. What's more, as the number of EVs starts ramping up (reinforced by the Government's very welcome decision to ban the sale of new petrol and diesel vehicles by 2030), even more cost-effective storage and trading opportunities will kick in with 'V2G' (Vehicle-to-Grid) systems. According to the Committee on Climate Change, there could be as many as 25 million electric vehicles on our streets by 2035. V2G technology will enable plug-in vehicles to act as a form of distributed energy storage by providing demand response services to the power grid, with electricity flowing from cars to grid, and vice versa, based on demand needs at any given time.

34. Long-term storage (ie taking account of the big variations in renewable electricity from season to season) will require different approaches, especially when it's a question of needing to store surplus electricity from wind and solar power. Green hydrogen may have an important role to play here.

35. **The storage challenge is very much one of those areas where steep learning curves yield rapid and substantial efficiency and financial benefits – exactly the opposite of what has happened with nuclear power over the last few decades. It's also the key to freeing ourselves of our current dependency on baseload thinking.**

C2. 'Yes, but only nuclear can provide the low-carbon baseload on which the grid depends'

C2.1 Baseload: time to move on

36. This is the second of the two 'yes, but' arguments used by the nuclear industry. Indeed, as all other arguments in favour of nuclear power fall away under properly rigorous scrutiny, this is now the last redoubt in defence of the case for nuclear power. And it would indeed be a very compelling argument were it not for the fact that the very idea of baseload generation is itself seen as increasingly redundant. Back in 2015, the then Chief Executive of National Grid, Steve Holliday, spelled out the writing on the wall for those still looking backwards rather than forwards in terms of energy systems: 'The idea of large power stations for baseload is outdated.'

37. This has become increasingly apparent since then as the costs of highly inflexible baseload become more apparent. As more and more variable renewable electricity becomes available, there are inevitably more instances where there is much more electricity available than is needed – meaning that operators of those wind farms and solar installations have to be paid to switch them off. Because nuclear power can't be switched on and off, the National Grid's historical distribution systems is based on an 'always on' assumption for nuclear – when it's available, which is a lot less than people imagine with so many of our ageing reactors closed for long periods of time for maintenance or repair, or for weeks at a time for refuelling. In 2019, the so-called 'plant load factor' for nuclear power stations in the UK was just 63% of their theoretical generating capacity.[22] Some offshore wind farms are already achieving plant load

factors of 55%, and floating wind farms further out at sea will be able to achieve significantly higher yields than that. So much for nuclear's 'always on' comparative advantage.

38. As is increasingly argued by the International Energy Agency, power system flexibility is now an absolute priority if we are to reap the full benefits of more decentralised generation and demand management technologies. It's been convincingly demonstrated by the National Infrastructure Commission that large-scale nuclear power plants entrench more costly, inflexible distribution systems.

39. **I see this as a classic case of incumbent technology standing in the way of more innovative solutions to the challenge of achieving a Net Zero economy, locking in consumers and businesses to increasingly outmoded ways of providing energy services. Prospective innovations in the UK are indeed 'revolutionary', as we see three disconnected energy systems (electricity, gas for heat, and oil for transport) merging into one. One can only hope that BEIS gets its head around this with its emerging 'Smart Systems Plan' promised for Spring 2021.**

C2.2 Nuclear and renewables don't mix

40. There's one final problem about the 'let's have all of the above, with nuclear as baseload' rationale: nuclear and renewables don't mix.

41. A study in November last year from the University of Sussex Business School and International School of Management, published in Nature Energy, found that nuclear and renewable energy programmes do not coexist at all well in low-carbon energy systems.[23] Instead, they tend to crowd each other out.

42. Drawing on World Bank and IEA data from 123 countries over the last 20 years, researchers found that grid systems optimised for large-scale centralised power production (such as from nuclear power) make it much harder in terms of both money and time to introduce small-scale, distributed renewable electricity. Those systems where both financial markets and regulatory institutions are structured around centralised, large-scale power plants, with long lead times, are simply not agile enough to facilitate a much more diverse set of short-term, distributed initiatives. Especially where 'rapid, positive learning' can (and should) result in lower costs and improved performance. This is one further indication of the highly significant opportunity costs entailed in any long-term strategy that continues to favour nuclear power.

43. This was confirmed by an interesting report from Wärtsilä Energy in November last year, looking at ways of optimising the transition to 100% renewable energy for the UK by 2050:

> 'Renewables plus Nuclear would add £660 million per year to the cost of energy by 2030. As nuclear must run 24/7 to recoup its investment and its lack of flexibility means it continues generating during periods of high renewable output and low demand. It creates further potential costs to export power or curtailment charges to stop renewable generation. With a multi-decade lifecycle, this would significantly affect the UK's ability to achieve 100% renewable energy before 2050.'[24]

44. All of which means, for any Net Zero scenario by 2050, that the 'full renewables package' (renewables + energy efficiency + storage + new grids) will make a far more significant contribution than any amount of (realistically deliverable) nuclear energy. How ironic for pro-nuclear environmentalists that the principal consequence of hanging on in there for that relatively small nuclear element will be to jeopardise a wholly deliverable, non-nuclear Net Zero outcome.

D: WHAT'S MORE …

1. I said at the start that I have always set out to keep an open mind on the possibility that nuclear power might have a substantive contribution to make to a genuinely sustainable energy future. But given all of the above, I find it increasingly difficult to believe that environmentalists imagine that nuclear power should still be part of the overall generation mix.

2. **I recognise, however, that many environmentalists are so deeply concerned at the potential impacts of accelerating climate change, on countless millions of people, that even the remote possibility that nuclear might help mitigate that frightful prospect persuades them to keep options open. I'm not talking now about that tiny number of environmentalists who advocate vociferously in favour of nuclear power (who I shall return to in the final section), but those environmentalists who just can't bring themselves finally to close the door on a technology that might just, albeit in some currently unimaginable way, make a positive difference.**

3. So, for all such 'concerned and conflicted' greenies, I would just like to add a few final considerations.

D1. The impacts of climate change on nuclear power

4. Ironically, given that the principal reason for hanging in there with a nuclear option is environmentalists' profound concern about accelerating climate change, it's clear to me that they are still failing to take into account some of the already unavoidable impacts of climate change on nuclear power stations in the future.

5. As the nuclear expert Andy Blowers has commented: 'There is an exquisite paradox here. While nuclear power is hubristically presented as 'the solution' to climate change, the changing climate becomes its nemesis on the low-lying shores of Eastern England.'[25]

6. What he's referring to here are the risks to nuclear power stations in Suffolk and Essex (comprising the two decommissioned Magnox stations at Sizewell A and Bradwell A, the UK's sole operating PWR at Sizewell B, and the new reactors under consideration at Sizewell C and Bradwell B) from rising sea levels, storm surges and ever-worsening coastal erosion and flooding.

7. I've observed over the last couple of years that most environmentalists carry their awareness of rising sea levels at the back of their mind, a grim reckoning that lies ahead of us whatever we do. They need to foreground that awareness, as the situation is so much worse than most people realise.

8. In 2019, the Intergovernmental Panel on Climate Change published its 'Special Report on the Ocean and Cryosphere' (the cryosphere is made up of the many different kinds of frozen water on the planet), in which it assessed 'the likely range' of sea level rise by the end of the century to be between 43 and 84 centimetres, with 1.1 metres assessed as 'the upper likely range'. A rise of up to 2 metres 'could not be ruled out'. This assessment was recently challenged in a paper published in *Ocean Science*, where researchers from the University of Copenhagen used historical data to highlight discrepancies in the IPCC's estimates, suggesting that the upper likely range should be 1.35m.[26]

9. **Over the next couple of years, the IPCC will be publishing its sixth major Assessment Report – and it's already crystal clear that 'the likely range' of sea level rise by the end of the century will be significantly increased. To cut to the quick, it's now clear that the <u>minimum</u> average sea level rise by the end of the century will be no less than 1 metre – and possibly significantly higher. With further inexorable increases through into the 22nd century, even if we succeed in limiting the average temperature increase to no more than 2°C by the end of this century.**

10. About a quarter of the world's power stations are on coasts or estuaries, including Hinkley Point in Somerset and all the reactors on the UK's east coast. Sizewell B started generating electricity in 1995. Assuming an operational life expectancy of around 60 years, and a further 40 years for decommissioning and storage of spent fuel and other wastes, that takes us through to 2095.

11. If the proposal at Sizewell C goes ahead, and it starts generating electricity in 2035 (however improbable that start date may be), it will still be in operation at the end of the century, with much of its spent fuel needing to be stored on site (in cooling ponds) until the middle of the next century (ie 2250) before it can be moved to whatever Geological Disposal Facility will then be in operation.

12. At the moment, EDF is planning a protective embankment of 10 metres at Sizewell C, designed 'to protect the power station for a one in 10,000-year storm event'. This may sound adequate until one takes into account the profoundly unstable nature of that particular coastline and of the Sizewell foreshore in particular. Indeed, there are many (including experts in the Environment Agency) who believe that Sizewell C will effectively be cut off from the mainland within the next hundred years. Trying to assess the geological and financial implications of protecting such an exposed facility against rising sea levels and storm surges, through to 2250, seems completely futile. After everything we've learned from the disaster at Fukushima, the word 'hubris' seems peculiarly apposite.

13. Rising sea levels is just one of the many shocks that accelerating climate change has in store for us through the rest of this century. The nuclear industry will need to cope with much more than that. How will reactors in Pakistan or Abu Dhabi (or any new reactors in Saudi Arabia) be kept cool when temperatures exceed 50^{o}C, simultaneously raising the temperature of the seawater needed for cooling? How will inland nuclear plants be kept cool at times of prolonged drought, causing rivers to dry up – as has already happened on a number of occasions with the nuclear reactors located along the Loire in France? Multiple risk factors abound as more and more climate extremes kick in.

D2. A just transition?

14. One of the most profound shifts in the last couple of years in the debate about The Climate Emergency has been the recognition that the now inevitable transition away from fossil fuels towards a Net Zero carbon world has to be a <u>just</u> transition – ensuring that those already disadvantaged by the structural inequalities of today's model of neoliberal capitalism are not further disadvantaged as we exit the era of fossil fuels. Politicians disregard this imperative at their peril: President Macron has never quite recovered from his inept and insensitive imposition in 2018 of higher fuel prices on millions of people least able to cope with those higher costs, bringing les gilets jaunes onto the streets of many French cities and towns.

15. In that regard, it's encouraging that a new body has been set up here in the UK (the Getting to Zero Commission) to investigate ways of ensuring that no community 'should be left behind'. New research from a think tank called Onward has warned that up to 10 million jobs will need to be replaced or retrained as part of the Net Zero transition[27], even as 1.7 million new 'green collar' jobs could be created by 2030 if the Government implements the recommendations of the Climate Change Committee regarding its Sixth Carbon Budget.

16. It's mystifying to me why ministers remain so enthusiastic about supporting nuclear in this context. As is the case with fusion energy (see page 25), throw enough money at something (in that case, £87,500 per job created) and there will undoubtedly be some beneficial economic outcomes. The Government appears to be terminally muddled about this issue of low-carbon jobs: its support for offshore wind is very welcome, in terms of the new jobs that will be created, but its continuing refusal to seize hold of the most inclusive, job-intensive elements of a wider Green New Deal makes no sense at all (see below).

17. I honestly can't imagine how any caring, empathetic environmentalist could still see the nuclear option as still having any part to play in a genuinely just transition, for the following reasons.

D2.1 More expensive electricity

18. **Let me spell this out for environmental campaigners concerned about social justice: every kilowatt-hour of new nuclear-generated electricity delivered to consumers will be a more expensive kilowatt-hour than a kilowatt-hour delivered from renewables plus storage. That will obviously end up reflected in the prices consumers pay, including around 2.5 million households in England (roughly 10%) living in fuel poverty.**

19. Every time I hear people like Tom Greatrex assert that nuclear power should still be contributing around 20% of the UK's total electricity supply in the future, my first thought is that one-fifth of each and every consumer's electricity bill would at that time be costing them considerably more than it should. I find it particularly indefensible that this 'nuclear tax' would be borne by some of the most disadvantaged citizens in the UK today – without the first idea on their part as to why this injustice is allowed to continue.

20. It's important to return here to the actual methods for paying for new nuclear, either through the insane subsidies being provided for Hinkley Point C, or through the RAB proposal for Sizewell C (see page 4). The Government published a document on this alongside its Energy White Paper at the end of last year, which was wilfully opaque in indicating exactly how it will take forward negotiations with EDF. It also included the statement that 'cost overruns that were not excluded from the Regulated Asset Base would be shared between investors and consumers'. To all intents and purposes, this sounds like another blank cheque for EDF once the inevitable cost overruns kick in – and I say 'inevitable' as no nuclear power plant already constructed or under construction in the 20th century has avoided such penalties for additional costs through overruns.

D2.2 Fewer jobs

21. **Post-COVID, we're going into a period of high unemployment and prolonged economic hardship – especially for young people. From the point of view of a genuinely just transition, it's crucial that the route we choose to get to a Net Zero economy by 2050 maximises opportunities for good, properly remunerated work. In that regard, nuclear has relatively little to offer.**

22. As of now, the Government's principal response to the pandemic has been to protect existing jobs and businesses. Very little money has been forthcoming to create new jobs – even as unemployment inevitably starts ratcheting up. As laid out in Section C above, a multi-year programme to address the 20% of the UK's greenhouse gas emissions from existing buildings would be by far the most labour-intensive investment the Government could make, especially if it was done in conjunction with local authorities and the metro Mayors.

23. For instance, the UK100 Resilient Recovery Task Force, a group of 24 Mayors and local leaders, published a report with Siemens in July last year, showing how a pump priming from Government of £5bn could unlock £100bn in sustainable energy projects through to 2030, creating tens of thousands of jobs in the process.[28] As already mentioned, the most articulate analysis of the potential here has been advanced by the original Green New Deal group, with an emphasis on 'jobs in every constituency', and a potential to create up to 120,00 jobs over the next two/three years:

> 'A huge number and range of jobs are required to install, service and update this massive retrofitting programme. The roles needed include plumbers, electricians, carpenters, builders,

solar PV roof fitters, engineers, building scientists and researchers. To ensure local expertise, safety and community acceptability, the involvement of local authorities, unions and neighbourhood groups will be vital.'[29]

24. All this would obviously need to be accompanied by a national skills and training programme, coordinated through FE and technical colleges.

25. The Institute for Public Policy Research has analysed the potential for new jobs through to 2030 in its paper on 'Transforming the Economy after COVID-19'.[30] In the area of low-carbon housing, it estimates that energy efficiency retrofits of homes could generate 234,000 jobs, expansion of social housing through low-emission homes could generate 240,000 jobs, and investing in low-carbon heating could support 60,000 jobs during construction and 44,000 jobs in installation. This would have an especially beneficial impact in the North of England.

26. If Boris Johnson is serious about 'levelling up', it's hard to think of a more effective way of doing just that in a relatively short period of time. Instead of banging on about the notional 10,000 construction jobs that would theoretically be created at Sizewell C, in due course, with both good and bad impacts in one very particular local area (as has already been experienced in Somerset throughout the Hinkley C construction process), he seriously needs to raise his sights when thinking about 'Building Back Better'. Beyond the construction phase, it is estimated that there will be 900 long-term jobs at Sizewell C. With an investment of £20bn (and possibly a lot higher) that works out at £22m per job created.

27. **Anyone who examines these two scenarios (jobs via investment in nuclear versus jobs via investment in low-carbon housing) must come away astonished at the idea that 'nuclear power' and 'a just transition' could ever be uttered in the same sentence. Which makes the pro-nuclear advocacy of certain trade unions especially repugnant, as they self-interestedly protect the relatively small number of jobs of their relatively well-paid members in the nuclear industry at the expense of an infinitely fairer distribution of work and rewards that would benefit millions of people. Especially young people.**

D2.3 Waste: an intergenerational injustice

28. The vast majority of environmentalists I've known and worked with over 45 years are passionate about the concept of justice between generations as well as justice within each generation. We all hang on to that original definition of sustainable development in the 1987 Brundtland Report: 'Sustainable development is development which meets the needs of the present population without compromising the ability of future generations to meet their own needs'.

29. **However, the simple truth of it is that anyone who continues to support nuclear power has, in effect, set aside that concern about intergenerational justice. I've already itemised some of the massive costs associated with the processing and storage of nuclear waste, and the ongoing liabilities regarding the decommissioning of nuclear reactors, imposing legacy costs to the tune of countless billions of pounds. Young people today, as future taxpayers, will bear those costs, as well many generations in the future.**

30. From that perspective, hyperbolic claims that nuclear power has a significant role to play in meeting the Sustainable Development Goals, on a global basis, are particularly offensive.

D3. Nuclear power/nuclear weapons

31. The vast majority of people who describe themselves as 'environmentalists' also subscribe to the idea that the future of humankind would be more secure in a world without nuclear weapons than in

our world today, where those nations with nuclear weapons command between them a combined inventory of 13,000/14,000 nuclear warheads.

32. That does not necessarily mean environmentalists endorse the idea of 'unilateral disarmament' (as I do personally, as a member of CND for more than 40 years), but it does mean they would like to see our Government actively engaged in multinational initiatives to rid the world of the threat of nuclear war – initiated either by intent or through miscalculation or accident.

33. Such sentiments have been reinforced by the new Treaty on the Prohibition of Nuclear Weapons, brokered by the UN over the last three and a half years. In January this year, the Treaty entered into force after ratification by 50 member countries. The Treaty proscribes any activities designed to 'develop, test, produce, acquire, possess, stockpile, use or threaten to use nuclear weapons', with the ultimate goal of eliminating all nuclear weapons. Regrettably, no nuclear-armed country has expressed support for the Treaty, and both the USA and Russia have explicitly opposed it, with the UK and France also declining to have any involvement on the grounds that the Treaty was 'incompatible with the policy of nuclear deterrent'.

34. Whatever one's views about this, some environmentalists may still be taken aback to discover that 'the case for nuclear power in the UK' is in fact underwritten by the need to maintain the UK's nuclear weapons capability. Taken aback, simply because the nuclear industry in the UK has spent decades trying both to disavow its origins (in the production of plutonium in the UK's first nuclear power station at Calder Hall), and subsequently to deny any continuing interdependencies between the UK's nuclear weapons capability and our current civilian nuclear energy programme. Any suggestion that there is a continuing and inseparable link has been forcefully rejected over the last 50 years.

35. Interestingly, that is not the position of the nuclear industry in either the USA ('a strong domestic supply chain is needed to provide for nuclear Navy requirements. This supply chain has an inherent and very strong overlap with the commercial nuclear energy.' Ernest Moniz, former Energy Secretary, 2017) or indeed in France, where politicians have explicitly and consistently acknowledged these interdependencies. President Macron was enthusiastically emphasising the critical strategic links between France's nuclear deterrent and its nuclear power industry as recently as December last year ('to oppose civilian nuclear and military nuclear in terms of production and research, does not make sense for a country like ours. Without civilian nuclear, no military nuclear; without military nuclear, no civilian nuclear.' Emmanuel Macron, December 2020.)

36. In reality, those links are just as strong here in the UK as they are in France and the USA. Indeed, as a matter of record, they've been publicly acknowledged by the defence industry, even as the nuclear energy industry has strained every sinew to deny any such interdependency. One might almost conclude that there's a conspiracy of silence on this. Only very rarely do Ministers break ranks as with this statement from Richard Harrington, Under-Secretary of State at BEIS in 2018: 'I want to include the Ministry of Defence more in everything we do … it is time that the artificial distinction (between civil and military nuclear) came to an end, and I will do my absolute best to bring that about.'

37. Given that the objective case for nuclear power in the UK is so weak, one is therefore encouraged to look to those interdependencies for our Government persisting so obstinately with nuclear power: the need to ensure a 'talent pool' of nuclear engineers; to support a supply chain of engineering companies capable of providing component parts for the nuclear industry, both civilian and military; to facilitate a network of investors still prepared to invest in generic 'nuclear skills and competencies', regardless of whether that serves military or civilian purposes.

38. All underpinned, of course, by the UK's increasingly desperate post-colonial determination to maintain its role in the world as a geopolitical power-broker, including our membership of the club of nuclear nations. Our exit from the EU will no doubt exacerbate these 'great power delusions'.

39. **The indefatigable work of Andy Stirling and Phil Johnstone at Sussex University's Science Policy Research Unit has established the depth and intensity of these interdependencies, demonstrating how the UK's military industrial base would become unaffordable in the absence of a nuclear energy programme. What this means is that our nuclear weapons programme is being significantly supported outside the defence budget without public scrutiny, and entirely off the public books.[31] The cost of these hidden subsidies fall on <u>all</u> UK nations, including Scotland, where nuclear power is strongly opposed.**

40. I only became properly aware of these symbiotic linkages as Chair of the Sustainable Development Commission between 2000 and 2009, reporting directly to the Prime Minister, Tony Blair. The Commission contributed substantively both to the 2003 White Paper ('Our Energy Future: Creating a Low-Carbon Economy') which deemed nuclear power to be 'unattractive', and to the consultation leading up to the 2007 White Paper ('Meeting the Energy Challenge'), which waxed lyrical about the idea of a 'nuclear renaissance'. From the point of view of energy policy, nothing in those intervening four years had changed in such a way as to justify such a complete about-face. From a defence perspective, however, the looming costs of having to renew Trident in order to maintain our 'continuous-at-sea-nuclear-deterrent' were already becoming a major concern to the Ministry of Defence.

41. Those concerns were well justified. In July 2016, the decision to renew the Trident programme was confirmed in Parliament, with the Government indicating likely costs of £30bn for four new submarines, £4.5bn for new warheads, and an additional £10bn for 'contingencies'. Subsequent analysis has indicated that at least £145bn will be required to operate that deterrent capability during its lifetime (including significant infrastructure upgrades), and a further £13bn for decommissioning the submarines at the end of their operational life. All in all, around £200bn – before taking into account the absolutely inevitable cost overruns – imposing an astonishing burden on UK taxpayers far into the future.

42. Even these estimates may now be understated. In March this year, the Government's 'Integrated Defence, Security and Foreign Policy Review' announced that the UK would be increasing its stockpile of nuclear warheads from 180 to 260, without presenting any evidence that might justify such a massively damaging decision.

43. One interesting point: the Review unequivocally confirms the interdependencies between civil and defence interests: 'We will work collaboratively across the defence and civil nuclear sectors to optimise the Defence Nuclear Enterprise for the future.'[32]

44. There's a particular irony at work here in the UK. Our national security depends, we are told, on maintaining our notionally 'independent' nuclear weapons programme – even though we are in fact entirely dependent on the USA. That programme depends, it is now clear, on continued investment in a nuclear power programme to maintain a generic nuclear skills base. That programme depends, as has become painfully apparent over the last few years, on collaboration with China through the wholly-owned CGN (see page 9). And there are many, in the defence and security establishment today, who see China as a highly significant threat to the UK's national security.

E: 'BUT WON'T NEW TECHNOLOGY SORT ALL THIS?'

E1. Small Modular Reactors

1. The energy/weapons linkage is particularly clear when it comes to the current spasm of excitement about Small Modular Reactors. Rolls-Royce is the most important private sector company involved in the consortium that came together last year to make the case for SMRs with Government Ministers and advisers. Back in 2017, Rolls-Royce issued a brochure with the following comment: 'The expansion of a nuclear capable skilled workforce, through a civil nuclear UK SMR programme, would relieve the Ministry of Defence of the burden of developing and retaining skills and capability.' Nothing like spelling it out!

2. Rolls-Royce is an iconic British company, and, along with the rest of the aviation sector, is in dire financial straits because of COVID. Keeping it afloat is a top priority for both BEIS and the Ministry of Defence – and punting around £250m into an SMR programme (as announced in the Prime Minister's Ten Point Plan in November 2020) is as good a way of doing this as any other. Rolls-Royce will get a fair slug of this £250m, simultaneously supporting it in the business of building reactors for future nuclear submarines.

3. In a way that has become standard for all 'nuclear renaissance' announcements, the level of hype around SMRs keeps on ratcheting up. We're now told that industry partners will be putting in around £300m alongside the Government's £250m; that a prototype will be ready by 2029, creating 6,000 jobs over the next five years; that this prototype will be delivered at a bargain basement cost of £2.2bn; that it will be the first of a programme of 16 SMRs rolling off a production line at two a year, delivering electricity at between £40/MWh and £60/MWh (quick time out here to remind readers that offshore wind is already at £39.50/MWh); that this will earn the UK economy more than £50bn, and will in time create a massive export potential of around £250bn, creating 40,000 jobs over 15 years.

4. Smoke and mirrors come to mind here! The <u>reality</u> is that there's no design available as yet, even though the Government has already invested £18m in producing such a design. There are no agreed sites for deployment. There's nothing on the order book, including from our own Government, for all its warm words. Without the Government guaranteeing an order book of up to 16 SMRs, it's highly unlikely that Rolls-Royce will even complete the design phase, let alone start investing in such an ambitious production line. And there's no recognition in these discussions that the economic case for SMRs only works if it's possible to use the waste heat from the electricity generation process – meaning that they would need to the sited near urban areas or industrial parks. Fat chance of that here in the UK.

5. This is now a rapidly evolving area of interest. The US company NuScale received design approval for its SMR design in September 2020, and earlier this year signed a Memorandum of Understanding with UK-based Shearwater Energy to develop a hybrid SMR/wind facility to produce green hydrogen (see below). However, it is still not licensed for construction after the US Nuclear Regulatory Commission identified a number of safety concerns – all this after an investment of nearly $1bn over the last two decades!

6. **Critics are increasingly challenging the deliberately manipulative use of the word 'Small'. Rolls-Royce's SMRs are <u>not</u> small. With a projected capacity of 440MW, they're actually bigger than our former Magnox reactors, which will make planning permission as complex and drawn out as planning for big reactors.**

7. No wonder the terminology is now gradually morphing into Advanced Nuclear Reactors (which will apparently use 'novel cooling systems and fuels') rather than Small Nuclear Reactors – with a further £170m promised by the Government for R&D in this area. But so much of the over-excited hype around

Advanced Nuclear Reactors has yet to be exposed to proper independent scrutiny. A preliminary analysis carried out by the Union of Concerned Scientists in March this year looked at safety, efficiency, waste generation and proliferation/terrorism issues, and came to the conclusion that the current designs under consideration 'do not offer obvious improvements significant enough to justify their many risks.'[33]

E2. Fusion

8. According to the UK Atomic Energy Authority, the Government invested roughly £350m in fusion technology in the decade leading up to 2019, creating 4,000 full-time equivalent jobs – at roughly £87,500 of public money per job created.

9. In the Government's new Energy White Paper ('Powering our Net Zero Future'), published in December last year, the Government affirmed what was initially an off-the-cuff, somewhat wild-eyed promise from Boris Johnson 'to build a commercially viable fusion plant by 2040', in the fond hope that the UK will become 'the first country in the world to commercialise fusion energy technology'. The price tag for this starts at £400m: £220m for the new STEP programme (STEP standing for 'Spherical Tokamak for Energy Production'), and a further £180m for new fusion facilities, infrastructure and apprenticeships.

10. Make what you will of this latest bold/foolhardy endeavour to track down the holy grail of nuclear technology: a fusion-inspired dream that has obsessed nuclear engineers since the 1950s.

E3. Green hydrogen

11. We see the same kind of hype around the idea of 'green hydrogen from nuclear power', using the electricity from next generation SMRs or AMRs to produce 'near-zero-carbon hydrogen' for use in our gas grid or in carbon-intensive, hard-to-abate sectors like steel production or shipping. Or even, in due course, aviation.

12. Like many environmentalists, I'm cautiously enthusiastic about green hydrogen, and warmly welcomed the Government's commitment in last year's Energy White Paper to support the UK's rapid expansion in the UK's hydrogen production capacity using electrolysis, with a commitment to generate 5GW of green hydrogen by 2030.

13. But to keep this in perspective, let's just remind ourselves that hydrogen as we know it today is the very opposite of a green fuel – despite the Government's efforts to badge it as a 'clean energy technology' in the 2020 Energy White Paper. 98% of the 115 million tonnes used globally (primarily in refining and chemicals) is either 'brown hydrogen' (from the gasification of coal) or 'grey hydrogen' from natural gas, between them emitting around 830 million tonnes of CO_2 – 2% of total global greenhouse gas emissions! As to the remaining 2%, there's a tiny amount of so-called 'blue hydrogen' – essentially grey hydrogen but with those CO_2 emissions captured and stored – with the rest made up of green hydrogen from electrolysing water, both of which are much more expensive than the climate-wrecking brown and grey hydrogen.

14. The gulf between that current reality (rarely mentioned by hydrogen enthusiasts) and the prospect of readily available and affordable green hydrogen is absolutely vast. We need to bear that in mind even as we welcome efforts to bridge that gulf, including the Hydrogen Council (which anticipates investment of around $300bn over the next decade) and the newly-launched, UN-backed Green Hydrogen Catapult (involving a number of big companies to halve production costs whilst massively increasing global production up to 25GW by 2026, with investment of more than $100bn), and the UK's 'Hydrogen

Strategy Now' consortium set up in November last year, with talk of pumping £3bn into a UK-wide hydrogen economy.

15. **Existing nuclear-generated electricity will self-evidently play no part in these so-called 'hydrogen moonshots' – other than through the contribution existing nuclear power makes to the current grid average. Given that any new nuclear electricity will <u>always</u> be significantly more expensive than electricity from renewables + storage, it's hard/impossible to see that <u>green hydrogen + nuclear</u> is some kind of match made in heaven. And the truth of it is that one needs a lot of electricity to produce not a lot of hydrogen – which makes pipe-dreams about substituting hydrogen for conventional gas in the UK's gas grid, or of producing millions of tonnes of blue hydrogen, look entirely insane.**

16. **Decarbonising shipping, steel production and the manufacture of cement should be the priorities for green hydrogen. In the meantime, hydrogen enthusiasts should be ruthlessly focused on decarbonising existing hydrogen production – and eliminating those 830 million tonnes of greenhouse gas emissions.**

F. TELL THE TRUTH

F1. Beware the 'repentant environmentalists'

1. As will be recognised by most environmentalists deeply concerned about climate change, 'Tell the Truth' was the mandate painted on the side of the boat used by Extinction Rebellion to blockade Oxford Circus in the first of their major protests in 2019. It correctly identified the problems caused by politicians (and even by some scientists) refusing to inform citizens of the true nature of the Climate Emergency.

2. But it's a mandate that should be extended to every single major player in the field of sustainable energy – and pre-eminently to the nuclear industry. Tracking all the way back to its origins in the 1950s, with the electricity it generated at that time nothing more than a by-product of the production of plutonium that justified those early investments, this is an industry that still finds telling the truth almost impossibly difficult. Few if any of the problems faced by the industry, as laid out in Section B, and few if any of the alternatives, as laid out in Section C, are ever mentioned by its representatives.

3. **They <u>never</u> provide accurate cost estimates. They <u>never</u> fess up to the problems they're facing until forced to by independent commentators. They <u>never</u> provide truthful accounts of the times when things go wrong. And they <u>never</u> acknowledge their continuing dependence on the UK's obsession with retaining its notionally independent nuclear deterrent capability.**

4. **So why, I keep asking myself, would any environmentalist concerned about the truth, in this inside-out world of fake news, vested interests, mainstream media manipulation and politicians hopelessly marooned in yesterday's received wisdom, give any credence whatsoever to the latest confection of hyperbole, half-truths, outright lies and amnesiac recollection on which the nuclear industry depends?**

5. But they do. And the nuclear industry loves them for it. They're particularly dependent on a motley consortium of pro-nuclear NGOs to do some of the heavy lifting in lobbying within the EU. Over the course of the next few months, the EU has to confirm whether or not it will permit subsidies for nuclear power as part of its low-carbon transition strategy – which many Member States are pushing for. Without those subsidies, the steady decline of the industry in the EU will continue inexorably.

6. In April, a group of 46 NGOs from 18 countries (27 of which are from within the EU) wrote to Ursula von der Leyen, President of the European Commission, calling for the inclusion of nuclear energy in the EU's so-called 'taxonomy' for sustainable investment. Many of these NGOs are simply a front for the industry itself, representing some classic astroturfing at its worst.

7. Judging by the websites of 'Greens for Nuclear' or 'Nuclear for Climate', by far the largest percentage of pro-nuclear Greens end up in that position, as I've already said, because they can't see any way of getting to a Net Zero world without it. They're in no doubt about the intensity and urgency of the Climate Emergency, and deeply critical of any residual shade of denialism or what is sometimes described as 'luke-warmism' – as in 'OK, you greenies may have been right all along about the science of climate change, but let's not get carried away and risk damaging the global economy by moving to address that state of affairs too quickly.'

8. It's clear to me that some pro-nuclear environmentalists have indeed done their homework, are simply not persuaded by the renewables/storage/efficiency/smart grids alternative paradigm, and have therefore come to the conclusion that nuclear simply has to be part of the mix – at whatever cost to consumers today and to future generations tomorrow. These are complicated, morally vexatious judgement calls, and one has to acknowledge the thoughtful and responsible approach that has moved some 'Greens for Nuclear' into that position.

9. However, beyond that, there are many who have not done their homework. Who clearly enjoy the mantle of 'the repentant environmentalist', as people emerging from the ideologically corrupted prejudices of the Environment Movement to stand in the bright light of a newly-revealed nuclear truth. Part of the deal for those 'moving over to the nuclear side' is to disparage all those benighted greenies still unsighted as to the wonders of nuclear power – as Zion Lights, the UK Director of an organisation called Environmental Progress (see below) so regularly does, seeking at every turn to discredit the work of Extinction Rebellion for whom she was briefly a member of its media team. These more impressionable and self-publicising converts are not too fussy about where the money comes from to support their new-found nuclear enthusiasm.

10. It's a short step from there to becoming a fully paid-up, pro-nuclear lobbyist, part or wholly funded by right-wing, climate-denying extremists, with the enthusiastic support of the Murdoch press or Fox News. In this regard, Michael Shellenberger remains 'primus inter pares', as founder of the Breakthrough Institute in 2007 and latterly of Environmental Progress – acting as the sales arm for his new book, 'Apocalypse Never: Why Environmental Alarmism Hurts Us All'. This book was launched in June last year, with a classic repentant's line: 'on behalf of all environmentalists, I apologise for the climate scare', offering further reassurance by arguing that 'the Netherlands became rich, not poor, while adapting to life below sea level'.

11. I find it hard to imagine what the well-meaning founders of Greens for Nuclear must make of this most extreme of all luke-warmists – now that he's recanted on his earlier outright denialism. And how they must react to Shellenberger's explicit enthusiasm for making the links between nuclear weapons and nuclear power. Back in 2018, Shellenberger argued that the world is in fact a much safer place because of nuclear weapons, and how it would be safer still if more nations had access to those weapons, even in the Middle East. And given that nuclear power programmes provide the best 'gateway technologies' to developing such weapons capabilities, he acknowledged that 'national security, having the weapons option, is often the most important factor in a state pursuing nuclear energy'. As if that pro-proliferation, nukes-for-all stance wasn't bad enough, he went on to rub it in further by asserting: 'After 60 years of national security driving nuclear power in the international system, we can now add 'preventing war' to this list of nuclear energy's superior characteristics'.

12. I wonder how members of the Green Party and other 'greens for nuclear', self-confessed 'reluctant converts' to nuclear power, feel about finding themselves in bed with such an extraordinary reincarnation of Dr Strangelove?

F2. Still keeping an open mind

13. **It's clear to me that there are some pretty 'dark arts' at work here, funding, mobilising and even coordinating a motley choir of pro-nuclear Greens in order to obscure the truth about nuclear power, to provide the media with plenty of 'mea culpa' testimonies from repentant environmentalists, and to help neutralise the growing opposition within political parties in the UK to the idea of new nuclear power stations. That's not a conspiracy theory; it's just the way the world works these days.**

14. Ultimately, however, they're working with some pretty recalcitrant raw material – in terms of today's failing nuclear technologies and declining market share. Ultimately, the truth will out. So I obviously hope that fewer environmentalists will fall for the current wave of pro-nuclear propaganda, and will weigh the endless hype about the future against the constantly underperforming record of the present.

15. It would therefore also be good to see the UK's Environment Movement much more on the front foot in combating the resurgent propaganda campaigns from the nuclear industry. Most of the heavy

lifting here is being done by a handful of under-resourced but extremely effective local groups: Stop Hinkley, which continues to hold EDF to account for every single aspect of the ongoing construction of Hinkley Point; TASC (Together Against Sizewell C), assiduously highlighting the lack of credibility in EDF's proposals for a new power station at Sizewell C, with the RSPB now lending its weight to the campaign; and the anti-Bradwell BANNG (Blackwater Against New Nuclear Group) , which has done a brilliant job in winning strong support from local authorities, communities and businesses. Local groups at Wylfa (People Against Wylfa-B) and Oldbury (Severnside Together Against Nuclear Development) have also been highly influential in resisting plans from the Horizon Consortium for new reactors, and have been greatly heartened by Hitachi's decision in February to wind down Horizon once and for all. (See further contact details in the Appendix.)

16. Above all, one thing I hope I've been able to demonstrate is that 'new nuclear' (both big nuclear power stations, as proposed at Sizewell C, as well as SMRs, AMRs or fusion) has either a zero or, at best, a minimal contribution to make to the UK's target of achieving a Net Zero economy by 2050. That's not in dispute. As already mentioned, EDF itself has acknowledged that if Sizewell C does come on stream in 2035 (which seems improbable given its current construction track record with the EPR reactor design), it will then take six years of generating low-carbon electricity to 'pay off' all the CO_2 emissions involved in its construction. The Government knows that. It also knows that the likelihood of a completely new generation of SMRs/AMRs being in commercial operation before 2050 is not impossible, but it is extremely unlikely.

17. **So shouldn't everyone in the environment movement just accept that reality, and double down on the only realistic strategy we still have for getting to Net Zero by 2050? And in so doing, celebrate the prospect of the enormous economic and social benefits that will flow from a policy and investment framework finally decluttered of any lingering nuclear fantasies.**

18. **In other words, Net Zero without nuclear.**

APPENDIX

LOCAL GROUPS/NATIONAL ORGANISATIONS

Blackwater Against Nuclear Group (BANNG)	www.banng.info/
Bradwell B Action Network (Bradwell BAN)	https://bradwellban.com/
Campaign for Nuclear Disarmament	https://cnduk.org/
Friends of the Earth (England, Wales and Northern Ireland)	https://friendsoftheearth.uk/
Friends of the Earth (Scotland)	https://foe.scot/
Greenpeace	https://www.greenpeace.org.uk/
No2NuclearPower	https://www.no2nuclearpower.org.uk/
People Against Wylfa-B (PAWB)	www.stop-wylfa.org/
Scottish CND	https://www.banthebomb.org/
Severnside Together Against Nuclear Development (STAND)	www.nuclearsevernside.co.uk/
Stop Hinkley	www.stophinkley.org
Together Against Sizewell C (TASC)	https://tasizewellc.org.uk/

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Andy Stirling
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Office for Nuclear Regulation

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Freedom of Information Request Reference No: FOI202102068

Thank you for your request for information received by us on 18 February 2021 and for your subsequent clarification received on 11 March 2021 following your telephone call with Shane Turner and Ian Hanley. Your enquiry is being dealt with under the terms of the Freedom of Information Act 2000 (FOIA).

You requested:

1. Demographics information, for example that used to determine the offsite emergency arrangements.

2. Map of the SZC site with grid references including the location of buildings. Map of site and grid references should include the Green and Blue Planning lines for the Eastern (North Sea) boundary if these are available (Historic and part of Sizewell B Planning consent). Original consent indicating green line https://community.magnoxsocioeconomic.com/wp-content/uploads/2014/10/EDF-Energy-SSG-Actions-Nov-2014-Attachment-No.-2-2014.pdf.

3. Information that explains how the site will be constructed, for example approximately what depth will be excavated, over what area, how will it be built back up before the nuclear structures are constructed and approximate foundation depth. This information may wish to include the existing flood defence features consented for Sizewell B which may be disturbed during construction of SZC.

4. A cross section(s) illustrating the geology on site under the key buildings or at key points on site.

5. Information on the cut-off wall.

6. Information on how the edge of the site will be constructed given it appears to be built up above the natural land, for example reinforcement around the edge of the site. Proposed Western boundary and northern site access currently obstructs or corrupts the main water course Leiston river. How this will be engineered in association with the reinforcement and avoid increased flood risk to Leiston town/sewage works and main site access road.

Background to concerns 3 and 6 relate to comments made at Hinkley C where the Site Manager is reported to have said he was only responsible for flood protection of HPC not the surrounding area. If EDF do not build SZC themselves this situation could arise at Sizewell.

Our response:

I can confirm that under Section 1[1] of the FOIA we do hold some of the information requested. Please find a response to each of your questions in turn below.

1. **Demographics information, for example that used to determine the offsite emergency arrangements.**

The information you requested is available on the March 2018 update to the Residential Layer on the National Population Database[2].

Details of how to access the database can be found on the Health and Safety Executive Science and Research Centre[3]. This data is still suitable for use in the subsequent Sizewell C (SZC) assessment.

2. **Map of the SZC site with grid references including the location of buildings. Map of site and grid references should include the Green and Blue Planning lines for the Eastern (North Sea) boundary if these are available (Historic and part of Sizewell B Planning consent)**

We do not currently hold a map of the SZC site with grid references and planning lines. However, we do hold a map of the proposed site with building locations that was provided as part of the Nuclear Site Licence application. Please see attachment 1 which is a drawing from section 6.3 of the licence application dossier.

3. **Information that explains how the site will be constructed, for example approximately what depth will be excavated, over what area, how will it be built back up before the nuclear structures are constructed and approximate foundation depth. This information may wish to include the existing flood defence features consented for Sizewell B which may be disturbed during construction of SZC.**

[1] https://www.legislation.gov.uk/ukpga/2000/36/section/1
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Information that explains how the site will be constructed

Firstly, it is important to note that the detailed design of SZC, including its civil engineering design, will continue past the point of any potential nuclear site licence grant. Therefore, some of the information that we currently hold is preliminary and will change. Post any potential nuclear site licence grant, there will be a number of regulatory “hold points” that prevent the licensee from starting certain construction activities without our agreement. This allows us to assess aspects of the detailed design when it is mature whilst still allowing work to continue in other areas.

At the current time, the focus of our ongoing civil engineering assessment for informing our nuclear site licensing decision is to ascertain whether the licensee sufficiently understands the geotechnical conditions of the site and presents a viable solution for the long term support of structures, systems and components, including a viable outline construction method to achieve this. This also includes consideration of the site size.

Site excavation depth and area

Our current understanding is that a cut-off wall will be constructed near the perimeter of the proposed nuclear licenced site boundary in reinforced concrete, with the function of forming a watertight box around the main construction area as well as performing an earth retaining function. The area within this cut off wall will be excavated to varying levels depending on the structures. Figure 1 shows the current theoretical bottom of the excavation area.

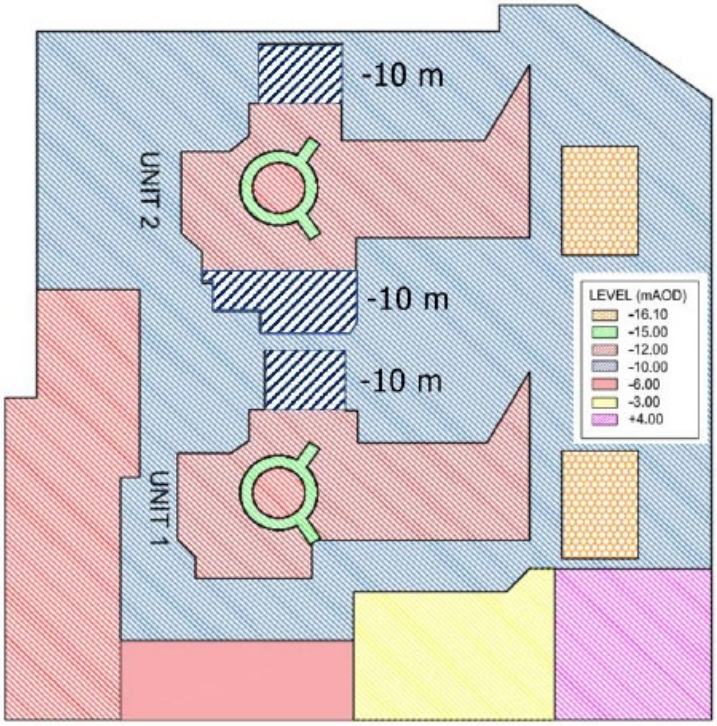


Figure 1. Theoretical bottom of excavation area (February 2021)

For most of the site, the excavation depth is -10mAOD[4]. The areas under the reactor buildings is -12mAOD (with some localised deeper excavation), pumping station -16.10m AOD, and areas of shallower depth excavation on the south side of the site. The aim of this excavation is to reach the more competent crag deposits beneath the site.

How will it be built back up and approximate foundation depth

The prospective licensee's current intention is to build up engineered fill from these levels to improve bearing capacity under structures (a proportion of which will be reclaimed excavated material) to foundation levels. Backfill material from foundation level to platform level (7.3mAOD) is expected to mostly be made up of excavated material. Final foundation depths for the structures have not yet been finalised and vary structure to structure. Figure 2 shows a simplified schematic of the backfill strategy, the excavation levels and how the site will be constructed. R1, R2 and R3 relate to the different type of engineered fill specified for construction.

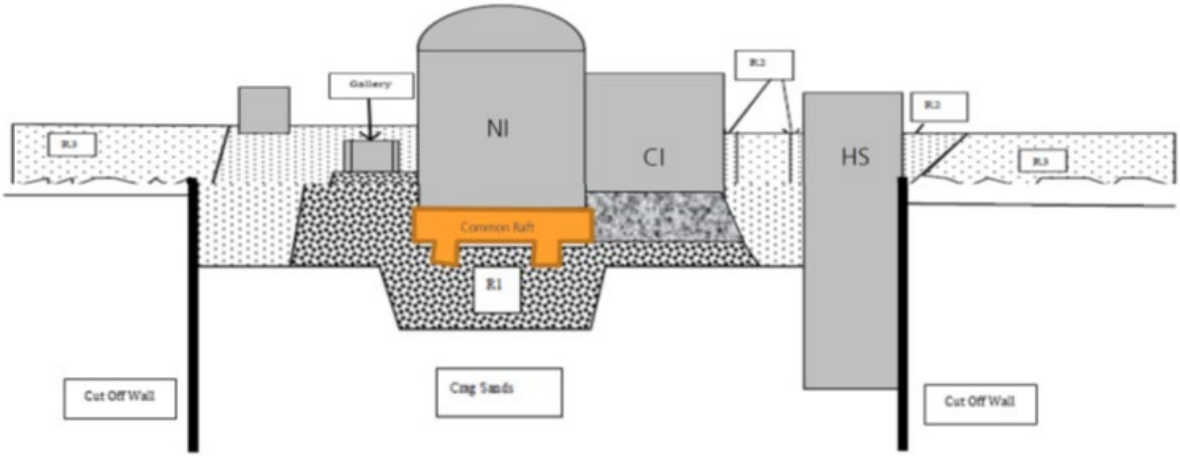


Figure 2. Schematic of the backfill strategy (May 2020)

Flood defence features for Sizewell B (SZB)

We do not hold any information regarding any potential impact on the Sizewell B (SZB) flood defences. As part of nuclear site licensing, NNB GenCo SZC's claim is that operations (including construction) on the SZC site will not adversely affect the ability to maintain an adequate safety case for the adjoining nuclear licensed site SZB. We are considering this claim as part of the nuclear site licensing assessment. Detailed construction information is not yet available for the SZC site. Prior to start of construction, we expect NNB GenCo (SZC) to consider the potential impact of construction on SZB, including, if relevant, on the existing SZB flood defence features.

[4] AOD relates to Above Ordnance Datum where Ordnance Datum relates to the mean sea-level height taken from a reference point (Newlyn, Cornwall for Great Britain) as a basis for national altitude heights by the ordnance survey.

4. **A cross section illustrating the geology on site under the key buildings or at key points on site.**

Please find attached three geotechnical cross sections (as the site currently exists) that illustrate the geology on site.

- Attachment 2 - SZC Cross-section C1. This is an east-west cross section passing through the proposed location of the Unit 1 nuclear island, conventional island and heat sink.
- Attachment 3 - SZC Cross-section C2 is an east-west cross section passing through the proposed location of the Unit 2 reactor building, conventional island and heat sink.
- Attachment 4 - SZC Cross section C4 is a north-south cross section passing through the proposed location of the Unit 1 and Unit 2 nuclear island buildings.

5. **Information on the cut-off wall.**

The cut-off wall design continues to be developed; the information we hold is relevant as of February 2021 and is subject to change. The detailed design of the cut off wall is not part of the nuclear site licensing assessment.

Our current understanding is that the cut-off wall will be constructed 1.5m thick in reinforced concrete. The plans indicate a depth of -48mAOD for the piles (minimum 3m into the Thames group layer – see geotechnical cross sections). This will allow dewatering of the site to -32mAOD. Figure 3 presents a position previously shared with us on the location of the cut off wall; however, it has been indicated that this work is ongoing, and the positioning may change. Our current understanding is that the cut off wall will remain in place after the plant is constructed.

6. **Information on how the edge of the site will be constructed given it appears to be built up above the natural land, for example reinforcement around the edge of the site. Proposed Western boundary and northern site access currently obstructs or corrupts the main water course Leiston river. How this will be engineered in association with the reinforcement and avoid increased flood risk to Leiston town/sewage works and main site access road?**

The information we hold indicates that the sloped edges of the site will be strengthened using a sheet pile wall prior to the downhill slope to natural ground level. We do not hold any information on potential impacts on Leiston river/drain.

This information is not necessary for nuclear site licensing, but may be considered in future assessments if foundations of any nearby structures rely upon the strengthening measure to provide stability.

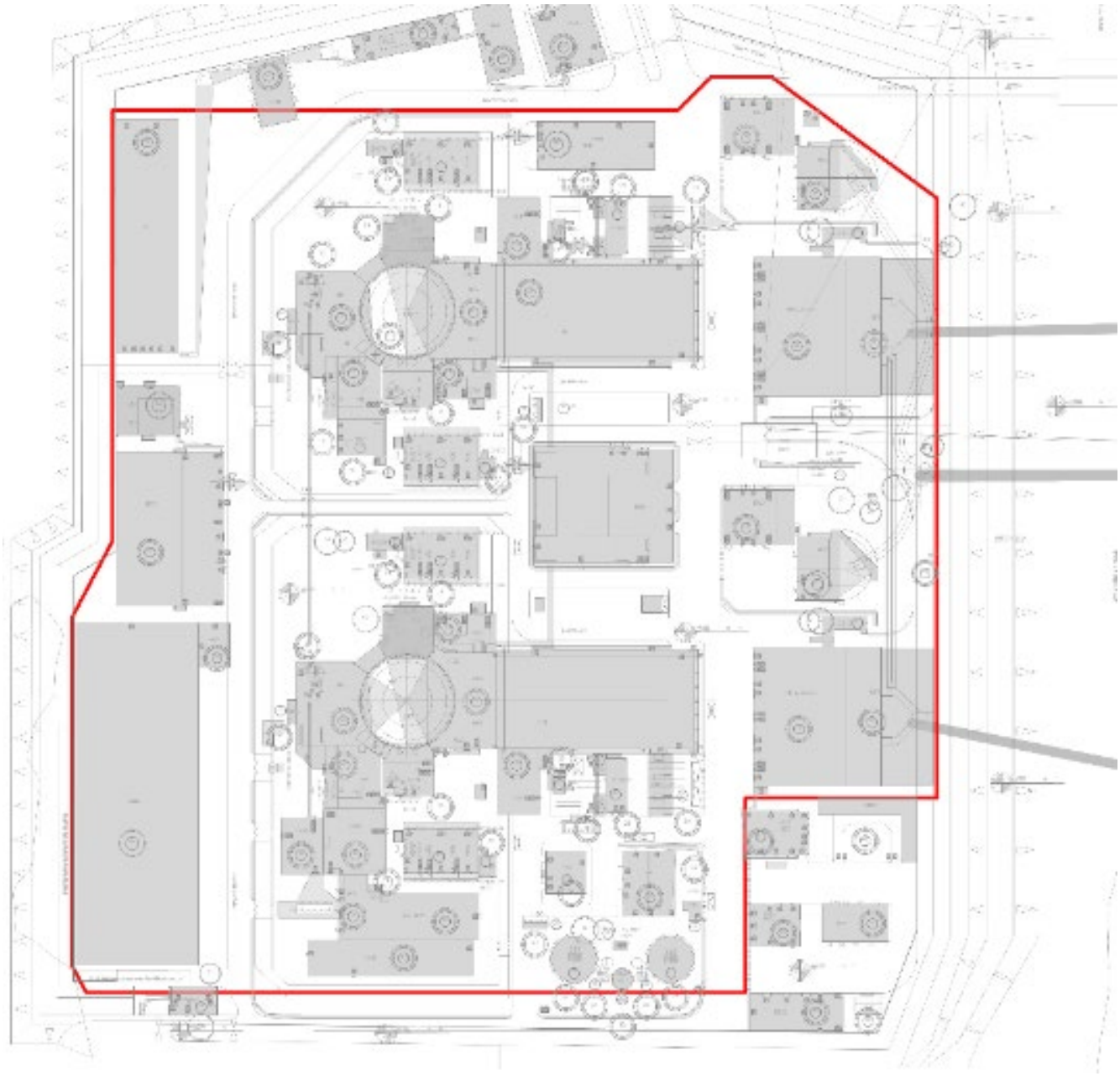


Figure 3. Location of the cut-off wall (May 2020)

Further Information:

We hope you find this information helpful however should you not be content with the above response you have the right to ask for an internal review to be conducted. This is done in writing and within two calendar months of this dated letter quoting the above reference.

If you are then not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision. The Information Commissioner can be contacted at:

Website: https://ico.org.uk/global/contact-us/

Yours sincerely

Louise Freeman
Policy and Communications Directorate

SIZEWELL NUCLEAR POWER STATIONS ANNUAL FISH IMPINGEMENT CALCULATIONS
BASED ON DATA TAKEN FROM SIZEWELL C DCO DOCUMENT 6.3 Vol 2 Chapter 22 Appendix 22D
(Appendix C : Predicted Sizewell B (SZB) Annual Impingement from 2009-2013 data)

Data from DCO document				TASC Calculations			
Common name	**Latin name**	**Protected Species**	**SZB Mean**	**% of total**	**cumulative %**	**Sizewell C (SZC) Estimate (*)**	**SZB +SZC 2035-2055**
Sprat	Sprattus sprattus		4,132,631	51.77%	51.77%	10,579,535	14,712,166
Herring	Clupea harengus	Blackwater Herring protected	968,431	12.13%	63.91%	2,479,183	3,447,614
Whiting	Merlangius merlangus		759,928	9.52%	73.43%	1,945,416	2,705,344
Bass	Dicentrarchus labrax	Protected	831,330	10.41%	83.84%	2,128,205	2,959,535
Goby, Sand	Pomatoschistus minutus		429,478	5.38%	89.22%	1,099,464	1,528,942
Sole, Dover	Solea solea		152,588	1.91%	91.13%	390,625	543,213
Dab	Limanda limanda		152,887	1.92%	93.05%	391,391	544,278
Anchovy	Engraulis encrasicolus		114,981	1.44%	94.49%	294,351	409,332
Mullet, Thin-lipped grey	Liza ramada		101,370	1.27%	95.76%	259,507	360,877
Pipefish, Nilsson's	Syngnathus rostellatus		47,202	0.59%	96.35%	120,837	168,039
Pout	Trisopterus luscus		61,610	0.77%	97.12%	157,722	219,332
Weever, lesser	Trachinus vipera		39,332	0.49%	97.61%	100,690	140,022
Rockling, 5-bearded	Ciliata mustela		16,766	0.21%	97.82%	42,921	59,687
Hooknose	Agonus cataphractus		16,881	0.21%	98.04%	43,215	60,096
Flounder	Platichthys flesus		14,451	0.18%	98.22%	36,995	51,446
Goby, Transparent	Aphia minuta		19,967	0.25%	98.47%	51,116	71,083
Plaice	Pleuronectes platessa		19,954	0.25%	98.72%	51,082	71,036
Cod	Gadus morhua		13,865	0.17%	98.89%	35,494	49,359
Smelt, Cucumber	Osmerus eperlanus		14,033	0.18%	99.07%	35,924	49,957
Sea snail, Common	Liparis liparis		4,843	0.06%	99.13%	12,398	17,241
Pilchard	Sardina pilchardus		7,925	0.10%	99.23%	20,288	28,213
Dragonet	Callionymus lyra		5,302	0.07%	99.29%	13,573	18,875
Dogfish, Lesser spotted	Scyliorhinus canicula		3,266	0.04%	99.33%	8,361	11,627
Gurnard, Tub	Trigla lucerna		3,382	0.04%	99.38%	8,658	12,040
Ray, Thornback	Raja clavata		3,154	0.04%	99.42%	8,074	11,228
Pipefish, Greater	Syngnathus acus		3,902	0.05%	99.46%	9,989	13,891
Stickleback, 3-spined	Gasterosteus aculeatus		4,448	0.06%	99.52%	11,387	15,835
Starry smooth-hound	Mustelus asterias		2,683	0.03%	99.55%	6,868	9,551
Witch	Glyptocephalus cynoglossus		4,287	0.05%	99.61%	10,975	15,262
Sandeel, Common	Ammodytes tobianus		3,714	0.05%	99.65%	9,508	13,222
Scaldfish	Arnoglossus laterna		1,740	0.02%	99.68%	4,454	6,194
Goby, Black	Gobius niger		2,184	0.03%	99.70%	5,591	7,775
Eel	Anguilla anguilla	Protected	1,469	0.02%	99.72%	3,761	5,230
Sandeel, Greater	Hyperoplus lanceolatus		1,256	0.02%	99.74%	3,215	4,471
Scad	Trachurus trachurus		3,013	0.04%	99.78%	7,713	10,726
Shad, Twaite	Alosa fallax	Protected	1,435	0.02%	99.79%	3,674	5,109
Lamprey, River	Lampetra fluviatalis	Protected	1,162	0.01%	99.81%	2,975	4,137
Pipefish, Snake	Entelurus aequoreus		2,618	0.03%	99.84%	6,702	9,320
Bullrout	Myoxocephalus scorpius		1,085	0.01%	99.85%	2,778	3,863
Brill	Scophthalmus rhombus		1,267	0.02%	99.87%	3,244	4,511
Goby, Rock	Gobius paganellus		2,019	0.03%	99.90%	5,169	7,188
Smelt, Sand	Atherina boyeri		705	0.01%	99.90%	1,805	2,510
Mackerel	Scomber scombrus		530	0.01%	99.91%	1,357	1,887
Solenette	Buglossidium luteum		600	0.01%	99.92%	1,536	2,136
Blenny, Tompot	Blennius gattorugine		1,012	0.01%	99.93%	2,591	3,603
Sole, Lemon	Microstomus kitt		576	0.01%	99.94%	1,475	2,051
Sea scorpion, long-spined	Taurulus bubalis		395	0.00%	99.94%	1,011	1,406
Goby, Painted	Pomatoschistus pictus		815	0.01%	99.95%	2,086	2,901
Butterfish	Pholis gunnellus		194	0.00%	99.96%	497	691
Mullet, Red	Mullus surmuletus		333	0.00%	99.96%	852	1,185
Viviparous blenny	Zoarces viviparus		397	0.00%	99.97%	1,016	1,413
Poor cod	Trisopterus minutus		342	0.00%	99.97%	876	1,218
Garfish	Belone belone		269	0.00%	99.97%	689	958
Gurnard, Grey	Eutrigla gurnardus		251	0.00%	99.98%	643	894
Wrasse, Corkwing	Crenilabrus melops		234	0.00%	99.98%	599	833
Sea snail, Montagu's	Liparis montagui		282	0.00%	99.98%	722	1,004
Rockling, Northern	Ciliata septentrionalis		156	0.00%	99.98%	399	555
Tadpolefish	Raniceps raninus		156	0.00%	99.99%	399	555
Saithe	Pollachius virens		156	0.00%	99.99%	399	555
John Dory	Zeus faber		78	0.00%	99.99%	200	278
Turbot	Psetta maxima		109	0.00%	99.99%	279	388
Wrasse, Ballan	Labrus bergylta		118	0.00%	99.99%	302	420
Lumpsucker	Cyclopterus lumpus		97	0.00%	99.99%	248	345
Mullet, Thick-lipped grey	Crenimugil labrosus		91	0.00%	99.99%	233	324
Sea bream, Black	Spondyliosoma cantharus		74	0.00%	100.00%	189	263
Norway bullhead	Micrenophrys lilljeborgii		53	0.00%	100.00%	136	189
Wrasse, Cuckoo	Labrus mixtus		67	0.00%	100.00%	172	239
Rockling, 4-bearded	Enchelyopus cimbrius		39	0.00%	100.00%	100	139
Pipefish, Deep-snouted	Syngnathus typhle		41	0.00%	100.00%	105	146
Rockling, Bigeye	Gaidropsarus macrophthalmus		23	0.00%	100.00%	59	82
Sea Trout	Salmo trutta		30	0.00%	100.00%	77	107
Rockling, Shore	Gaidropsarus mediterraneus		28	0.00%	100.00%	72	100
Pout, Norway	Trisopterus esmarkii		26	0.00%	100.00%	67	93
Goby, Crystal	Crystallogobius linearis		14	0.00%	100.00%	36	50
Sand sole	Pegusa lascaris		13	0.00%	100.00%	33	46
Pollack	Pollachius pollachius		13	0.00%	100.00%	33	46
Shad, Allis	Alosa alosa	Protected	11	0.00%	100.00%	28	39
Totals			7,982,167			20,434,349	28,416,516

(*) Based on a muliplier of 2.56 which has been calculated as follows:-
Sizewell B cooling water intake 51.5 cumecs
Sizewell C cooling water intake 131.86 cumecs
Sizewell C's intake is therefore 2.56 (131.86/51.5) times greater than Sizewell B

ALL FIGURES IN THIS TABLE REPRESENT ANNUAL IMPINGEMENT FIGURES. THE 28,416,516 TOTAL FOR COMBINED SZB AND SZC MUST THEREFORE BE MULTIPLED BY 20 TO ARRIVE AT THE ESTIMATED GROSS NUMBER OF FISH IMPINGEMENTS WHILE BOTH PLANTS ARE EXPECTED TO OPERATING AT THE SAME TIME (2035-2055) = 568,330,320

Hinkley Point C Stakeholder Reference Group

The implications of Hinkley Point C for Wales' environment and its people

A report to the Welsh Government

16 March 2021

Contents

Foreword

Wales uniquely has a Well-being of Future Generations Act. In short, the act requires the government and public services in Wales to take account of current and future generations in their decision-making. Decision-makers must think preventatively, long-term, to integrate goals in their decision-making, to involve those about whom decisions are being made and to collaborate to achieve better outcomes.

The act mandates delivery on seven goals, linked to the UN Sustainable Development Goals, which include specific reference to acting on climate change, to living within our environmental limits and to enhancing biodiversity. In the act, prosperity is defined as innovative and low carbon, and public service organisations are required to look upstream to ensure, for example, that the causes of ill health are acted upon. This is a very different approach to the usual target setting; the specific outcomes sought by governments in short political cycles. In the year in which the world will debate the extraordinary level of action that that will be needed to tackle the climate and biodiversity crises, the act provides a very important values framework through which to make decisions.

When the stakeholder group on Hinkley Point C was first formed, we determined to frame our activity according to delivering on the ambition of the Well-being of Future Generations Act (2015) and Wales' Environment Act (2016). We felt this was useful framework through which to assess the environmental impacts of this specific large infrastructure development on Wales; when the structure itself is not in Wales, but where Welsh laws may impact on decisions taken by developers and regulators. We hope that in doing so, we will set a framework for best practice on how the Welsh Government and Wales' public services will be able to better address future large infrastructure developments, irrespective of technology, whether they are in Wales or on its borders.

We agreed a very strong principle at the outset that our enquiry would be evidence-led, and that a strong evidence base would guide our advice to the First Minister. In this report you will find the expert conclusions of the stakeholder members on the basis of the evidence they have been given from key contributors: key players, external advisors and campaigners. Where we believe the evidence is not strong enough to justify decisions made, we say so. You will be able to scrutinise the full minutes of each of our meetings, including the input of those who contributed to our thinking in the interests of full transparency.

There are two points to note which are worthy of further consideration. In the case of Hinkley Point C, this group was not able to influence how the project was developed from the beginning before the first permissions were granted or the first spade was put in the ground as those discussions commenced in 2011. The Group notes that for major projects, in practical terms, governance decisions generally stretch across a number of years, from initial planning permission though subsequent revisions and on to a variety of regulatory decisions that are required to take the project from drawing board to operations. That being the case, the group would advise that there be a presumption that any applications must show that they will deliver at least the same level of environmental protection as that stipulated in the original decision and ideally improve upon it. Perhaps, in the context of future large, cross-border infrastructure projects a group such as ours should be convened, prior to the initial government decisions, in order to influence the conditions under which very large sums of public and private money should be spent –

not just in the interests of the specific outcome of the project, but to ensure that all the relevant legislation and commitments both sides of a legislative border are taken into account.

The second area is the relationship between planning and regulatory control. The Group notes that although this is supposed to be mutually reinforcing, in practical terms the granting of planning permission and the commencement of activity on the ground in effect creates momentum to proceed in a specific direction that can compromise the range of viable regulatory decisions that can be taken thereafter. To this end, it is crucial that for large/sensitive projects, planning and pollution control issues should be addressed in a more integrated manner from the outset.

As chair, I want to thank all the group members and the secretariat for their considerable time and expertise. This has been a very short inquiry as we determined to report to the First Minister while the Senedd is in session and prior to the 2021 Welsh General Election. I hope that our deliberations will help generate a wider understanding of the consequences of the effects of processes which have not yet been designed to interrelate effectively with each other, particularly in the context of cross-border relations. I would also hope that all those reading this report who have a part to play in tackling these important issues for the people of Wales will do so.

Jane Davidson, Chair of the Hinkley Point C Stakeholder Reference Group

March 2021

Introduction

The Hinkley Point C Stakeholder Reference Group ("the Group") was established in July 2020 and tasked with providing the Welsh Ministers with stakeholder views on issues arising from the Hinkley Point C project relevant to Wales and the people of Wales.

The Group met once a month from its inception and committed from an early stage to produce a comprehensive report summarising stakeholder views and providing evidence-based advice.

This report is the culmination of the Group's inquiries and research over an eight month period, during which time it heard from a range of stakeholders and met with experts in the field to gain a deep understanding of the Hinkley Point C project and its implications for Wales. The Group places on record its sincere gratitude to all the individuals and organisations that facilitated and supported its work, and to everyone who made their time available to the Group.

Ways of working

The Group published Terms of Reference and a statement of its working methods, which set the ambitions of the Well-being of Future Generations Act at its core. To demonstrate the Group's transparency and to secure cooperation and insight from all key stakeholders, the Group published short summaries of its meetings on its website. As this report is the conclusion of the Group's work, it is accompanied by the full meeting notes and the collated correspondence it sent and received, so that everyone can see the full breadth of the inquiries made by the Group.

The Group's lifetime coincided with the Covid-19 pandemic which meant it conducted all its meetings and inquiries remotely. This way of working offered clear benefits, including ensuring the Group attracted and retained members with real expertise in their fields, and that it reached key personnel within stakeholder organisations. No member of the Group received any remuneration for their contribution.

The Group adopted a strictly evidence-based approach to its reporting. In each chapter of this report, the Group has sought to summarise the issues that were raised and focus on elements that constituted ***evidence***, rather than opinion or conjecture.

Stakeholders

The Group's objective was to understand, assess and reflect on stakeholder views on the implications of the Hinkley Point C project on Wales. Some stakeholders approached the Group directly to share their views and evidence, while others were invited by the Group to engage in the process via written evidence or by joining the Group's meetings.

Some of the main stakeholders engaged in the Group's inquiries were (in alphabetical order):

- Cefas
- Crown Estate
- Devon and Severn Inshore Fisheries and Conservation Authority
- EDF (and its subsidiary NNB GenCo)
- Environment Agency
- Geiger Bay
- Marine Management Organisation
- Natural Resources Wales

- Office for Nuclear Regulation
- Somerset County Council
- Welsh Government
- Welsh Local Government Association

The Group also received representations from a number of individuals, and it exchanged correspondence with researchers and regulatory bodies such as the Planning Inspectorate. A record of the Group's formal correspondence is included in Annex 2 of this report.

Structure of the Report

This report contains six substantive chapters, each addressing matters of significant importance in the context of the Hinkley Point C project and its implications for Wales. The six chapters emerged over the course of the Group's inquiries, and in each area, a range of stakeholders have provided evidence, contributing to the Group's conclusions. A seventh chapter compiles the primary advice from the six substantive chapters in one place.

The chapters are:

1. Resilience of the Severn Estuary Ecosystem
2. Cross-border relationships and arrangements
3. Radioactive content of Hinkley Point sediments and their assessment for disposal at sea
4. Modelling Studies and Cardiff Grounds Disposal Site
5. Emergency planning for nuclear operations at Hinkley Point
6. Use of powers by the Welsh Government and its agencies in the context of the Hinkley Point C sediment disposal at Cardiff Grounds
7. Advice

Each chapter provides a background and contextual information, and outlines the concerns expressed by stakeholders and identified by the Group in the course of its inquiries. The views of stakeholders and the evidence gathered by the Group is discussed, followed by the Group's conclusions and advice to the Welsh Government.

There are extensive references within each chapter, and every effort has been made to acknowledge these in full. The Report is accompanied by annexes: Annex 1 contains the Group's terms of reference, working methods, full biographies of the Group's members and full meeting notes; Annex 2 sets out the formal correspondence between the Group and stakeholders it engaged. Any publicly available documents referred to in this report can be provided on request by contacting hinkleygroup@gov.wales

Using this report

Advice contained within this report is provided directly to the Welsh Government, as the body that established the Group and set its objectives. The advice combines actions that

the Welsh Government can take unilaterally, and matters where it is suggested it could use its influence to prompt important changes in the wider process.

The Group's hope is that this report will prompt relevant agencies to assess and review their own roles in the Hinkley Point C project and consider whether they have done, and continue to do, everything they reasonably could to safeguard and enhance the environment, and to maximise the multiple benefits that can be accrued from the project. Governments have the ability to legislate and set policies that deliver change, but more immediate impacts can occur when stakeholders take proactive measures to develop and improve their operations.

The Group fully recognises that planning and delivering a new nuclear power station – or any major infrastructure project - is by necessity a complex exercise, and the scope to simplify the consenting and regulatory processes is limited. The Group also recognises that agencies cooperate effectively in many areas to ensure extensive public and environmental protection. We do however identify measures in this report – some of which are quite simple – that could provide the public with greater confidence, particularly in a cross-border context where legislation in relation to environmental matters and to public health and well-being, differs on each side of the Welsh/English border.

By publishing and presenting this report to the Welsh Government, the Group has fulfilled its obligations. It is not a statutory body and it has no powers to formally monitor progress by the Welsh Government and other stakeholders in acting on its advice. Group members have, however, indicated a willingness to reconvene the Group on an ad hoc basis should the next Welsh Government, following the May 2021 Senedd election, wish for it to continue its work.

The Group's membership

The membership was drawn from a balance of disciplines with no one discipline outweighing any other. It reflected a sectoral balance between academia, industry and regulation. Members were appointed as individuals and because of their particular expertise, and not as representatives of organisations. Brief biographies are set out here, with full details provided in annex 1

Chair – Jane Davidson

Jane Davidson is Pro Vice-Chancellor Emeritus at the University of Wales Trinity Saint David. From 2000 - 2011, Jane was Minister for Education, then Minister for Environment and Sustainability in the Welsh Government, where she proposed legislation to make sustainability the central organising principle; the Wellbeing of Future Generations (Wales) Act came into law in 2015. As Environment Minister, she held ministerial responsibility for the Welsh input to the Marine and Coastal Access Act (2009). She introduced the first plastic bag charge in the UK, and her recycling regulations took Wales to among the best in the world. She created a Climate Change Commission for Wales, the post of Sustainable Futures Commissioner, and the Wales Coast Path.

Dr Rhoda Ballinger

Rhoda Ballinger is Reader in the School of Earth and Ocean Sciences, Cardiff University. As a member of the Marine and Coastal Environment research group, Rhoda has engaged in a quest for model institutional and policy frameworks to deliver Integrated Coastal Management. She has undertaken a variety of research projects on aspects of coastal and estuary management for UK government agencies and some of

her projects, notably those for the Countryside Council for Wales, have been benchmark reviews and analyses of the state of coastal management.

Dr Huw Brunt / Dr Sarah Jones

Huw Brunt has worked in the field of environmental public health for over 20 years, in a variety of roles across local and central government, and the NHS in Wales. Huw previously headed up a team in Public Health Wales with responsibilities to assess and manage risks from acute chemical incidents and other environmental hazards. He has a PhD in air quality and public health; his studies focused on integrating public health and local air quality management policy and practice.

Sarah Jones is Consultant in Environmental Public Health with Public Health Wales.

Sarah replaced Huw as a member of the Group in January 2021 when Huw left Public Health Wales and started working for the Welsh Government

Prof Roger Falconer

Roger Falconer is Emeritus Professor in the School of Engineering, Cardiff University. He is a Fellow of the Royal Academy of Engineering, a Foreign Member of the Chinese Academy of Engineering and a Fellow of the Learned Society of Wales. At Cardiff he founded the Hydro-environmental Research Centre and managed the Department of Civil Engineering at his previous university. He has published extensively in the field of computational hydro-environmental modelling and has delivered numerous keynote and external lectures world-wide. He has worked extensively on providing specialist advice, to industry and government departments, on a wide range of water environmental impact assessment (EIA) projects, both in the UK and overseas.

Dr Justin Gwynn

Justin Gwynn is a senior scientist with the Norwegian Radiation and Nuclear Safety Authority (DSA) at the Fram Centre in Tromsø with a focus on marine radioecology. He has held the position of Programme Manager for the Nordic Nuclear Safety Research's (NKS) emergency preparedness and radioecology programme and has chaired the OSPAR Commission's Radioactive Substances Committee since 2010. His current research activities include the use of radioactive tracers to understand ocean circulation and transport pathways of contaminants, the status and fate of dumped nuclear submarines and radioactive waste in the Arctic and the radioecology of discharges of naturally occurring radionuclides in produced water from oil and gas platforms.

Prof Karen Morrow

Karen Morrow has been Professor of Environmental Law at Swansea University since 2007. Her research interests focus on theoretical and practical aspects of public participation in environmental law and policy and on gender and the environment. Karen was founding co-editor of the IUCN Academy of Environmental Law e-journal and the Journal of Human Rights and the Environment. She serves on the editorial boards of the Journal of Human Rights and the Environment, the Environmental Law Review, and the University of Western Australia Law Review.

She is a founder member of the Global Network for the Study of Human Rights and the Environment (GNHRE) and is a member of the United Kingdom Environmental Law Association (UKELA). Karen was also a founding member of the Environmental and Planning Law Association of Northern Ireland (EPLANI).

Karen joined the Group in February 2021

Dr James Robinson

James Robinson is the Director of Conservation for the Wildfowl & Wetlands Trust (WWT) and has over 20 years of experience in the nature conservation sector. He currently leads a large team of wetland conservationists and is based at Slimbridge, situated on the banks of the River Severn in Gloucestershire. He has had previous roles as the Royal Society for the Protection of Birds' (RSPB) Director for Eastern England, Head of Nature Policy, Director for Northern Ireland, and Conservation Manager for Northern Ireland, at WWT as Head of Wetland Biodiversity Unit, and as Research Assistant at the University of Durham. James is also a member of the IUCN UK Executive Committee, the Board of Greener UK, and the Management Working Group and Scientific and Technical Review Panel of the Ramsar Convention on Wetlands.

Rachel Sharp

Rachel Sharp has worked for the Wildlife Trusts for 25 years and became the CEO of Wildlife Trusts Wales in 2011. Her previous roles include Head of Biodiversity at Avon Wildlife Trust and CEO of both Hereford and Brecknock Wildlife Trusts. She is now a leading advocate for nature recovery in Wales. She is an external advisor on Welsh Waters Independent Environment Advisory Panel and Welsh Governments European Advisory Group. She is also a trustee of the Wales Environment Link and a member of the Wales Marine Action and Advisory Group.

Chapter 1

The Resilience of the Severn Estuary Ecosystem

This chapter examines the development activities at Hinkley Point C (HPC) concerning potential impacts on the ecosystem resilience of the Severn Estuary European Marine Site (EMS) and its implications for Welsh interests. This assessment examines if the principles and aims of the Well-Being of Future Generations (Wales) Act[1] (WFG Act) and the Environment (Wales) Act[2] are being met both now and in the future. The review is based on the evidence and communications received by the Group as well as other additional sources. It examines concerns raised by stakeholders, with particular reference to evidence from the Environment Agency (EA) and Natural Resources Wales (NRW). Advice from the Group is given based on the review of the evidence.

1.1 Background

The Severn Estuary is globally recognised for its ecological importance and receives protection as an EMS[3], comprising areas designated as Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site and a suite of Sites of Special Scientific Interest (SSSI) on the Welsh and English sides of the estuary. These designations are covered in detail in Table I(a) in appendix I. Designated sites are protected from development or activities causing harm. Conservation Objectives, as referred to in the Conservation of Habitats and Species Regulations 2017[4] (as amended from time to time), provide a framework which should inform any Habitats Regulations Assessments (HRAs) that a Competent Authority may be required to make in relation to the EMS. In addition, they can be used to inform any measures necessary to conserve or restore sites designated within the EMS and/or to prevent the deterioration or significant disturbance of their qualifying features, complementing advice on operations. Those areas notified SSSI come with a list of activities requiring consent from statutory nature conservation organisations in England and Wales. NRW and Natural England (NE) aim to ensure these sites are maintained or enhanced to meet their Conservation Objectives and steer landowners on appropriate management, taking further action if required. The ultimate aim is for all sites to be in favourable condition. For cross-border sites like the Severn Estuary, close collaboration between these bodies is essential if favourable condition is to be achieved. The Group's view on these arrangements is covered in Chapter 2.

The WFG Act's Resilient Wales Goal requires 'a nation that maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change'. The legislation requires action to be long-term and integrated with involvement, collaboration and prevention; known as the five ways of working in the Act.

The Environment (Wales) Act requires the sustainable management of natural resources, which ensures that the way in which they are used and the impacts of human activity on our natural resources does not result in their long term decline. As the new nuclear power plant at HPC is already approved, the Group can only examine these requirements in

[1] https://www.futuregenerations.wales/wp-content/uploads/2017/01/WFGAct-English.pdf

[2] https://www.legislation.gov.uk/anaw/2016/3/enacted

[3] http://publications.naturalengland.org.uk/publication/3184206?category=3229185

[4] https://www.legislation.gov.uk/uksi/2017/1012/made

terms of the present construction and future operation of the plant. However, although the plant is being built in England, it does and will continue to affect Welsh interests and therefore needs to meet the legislative requirements of both countries.

1.2 The Seven Estuary ecosystem

The health of an ecosystem is measured, in part, by its resilience, that is, its ability to maintain key functions and processes when stresses or pressures are placed upon it. Most of the features of interest within the designated areas, particularly the qualifying fish features, are currently in unfavourable condition (detailed in Table 1.1 below). This means that the Severn Estuary's marine ecosystem is not presently resilient and needs support to adapt to the considerable pressure that it already receives from human activities.

Table 1.1. Summary of indicative condition assessments for Severn Estuary/Môr Hafren SAC (NRW, 2018).

Designated features	Indicative condition assessment	Confidence in assessment
Estuaries	Unfavourable	Medium
Mudflats and sandflats not covered by seawater at low tide	Unfavourable	Medium
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Unfavourable	Medium
Sandbanks which are slightly covered by seawater all the time	Favourable	Low
Reefs	Unknown	Not Applicable
Sea lamprey (*Petromyzon marinus*)	Unfavourable	High
River lamprey (*Lampetra fluviatilis*)	Unfavourable	High
Twaite shad (*Alosa fallax*)	Unfavourable	High

The threats and pressures placed on the Severn Estuary SAC and SPA, and the active management needed is considered in site improvement plan and are listed in Table 1.2 below. As most site features of the SAC are in unfavourable condition, any additional pressure could further reduce their ability to resist and adapt to any future stressors such as climate change. Further stress, therefore, compromises the restoration of key habitats and species communities in the estuary and their long term viability.

The Severn Estuary SAC and SPA form part of the UK's commitment to a number of international agreements on Marine Protected Areas (MPAs) including the establishment of an ecologically coherent network (ECN) of MPAs. Active management and condition improvement of MPAs within Wales is currently under review and development by NRW through the Marine Area Statement. The UK network will act as a contribution to wider European network, in partnership with neighbouring countries, based on OSPAR Convention, World Summit on Sustainable Development and Convention on Biological Diversity. However, substantial resources are needed to meet the necessary criteria to restore and enhance these sites.

Table 1.2. The threats and proposed management measures for the features shown in Table 1.1 (IPENS, 2015).

Pressure/threat	Proposed management measures
Public Access/Disturbance	Identify/reduce impacts of disturbance to birds, and damage to habitats
Physical modification	Reduce, remove (where possible), and prevent barriers to migratory species
Impacts of development	Inform strategic planning decisions to minimise impact of development
Coastal squeeze	Limit coastal squeeze, provide sustainable coastal defences, improve existing structures, deliver compensatory habitat
Change in land management	Maintain appropriate levels and timing of grazing, and management of intertidal saltmarsh habitat
Changes in species distributions	Understand/prepare for changes in species distribution (caused by climate change/other events)
Water Pollution	Identify any existing issues and prevent/reduce the decline in water and sediment quality (applying relevant measures to all relevant tributaries in England and Wales)
Air Pollution: impact of atmospheric nitrogen deposition	Develop a Site Nitrogen Action Plan
Marine consents and permits: minerals and waste	Ensure in combination/cumulative impacts from aggregate extraction, maintenance dredging and disposal are fully considered
Fisheries: Recreational marine and estuarine	Establish levels and location of the activity (recreational bait digging and recreational fishing/angling) and potential for impact
Fisheries: Commercial marine and estuarine	Identify any threats to site features and habitats from commercial fisheries activity, and establish and ensure compliance with any necessary management measures
Invasive species	Assess the risks from, and control the spread of invasive non-native species
Marine litter	Investigate sources of marine litter and implement actions for removal/ shoreline clean up
Marine pollution incidents	Minimise impact from marine pollution incidents and clean up response

1.3 Hinkley Point C development

In 2011, NNB Generation Company (NNB GenCo - a subsidiary of EDF) submitted an application to the UK Infrastructure Planning Commission for a third nuclear power plant at Hinkley Point in Somerset known as HPC. The plant is spread over a 230 acre site and is expected to be completed in 2023 and be operational for 60 years.

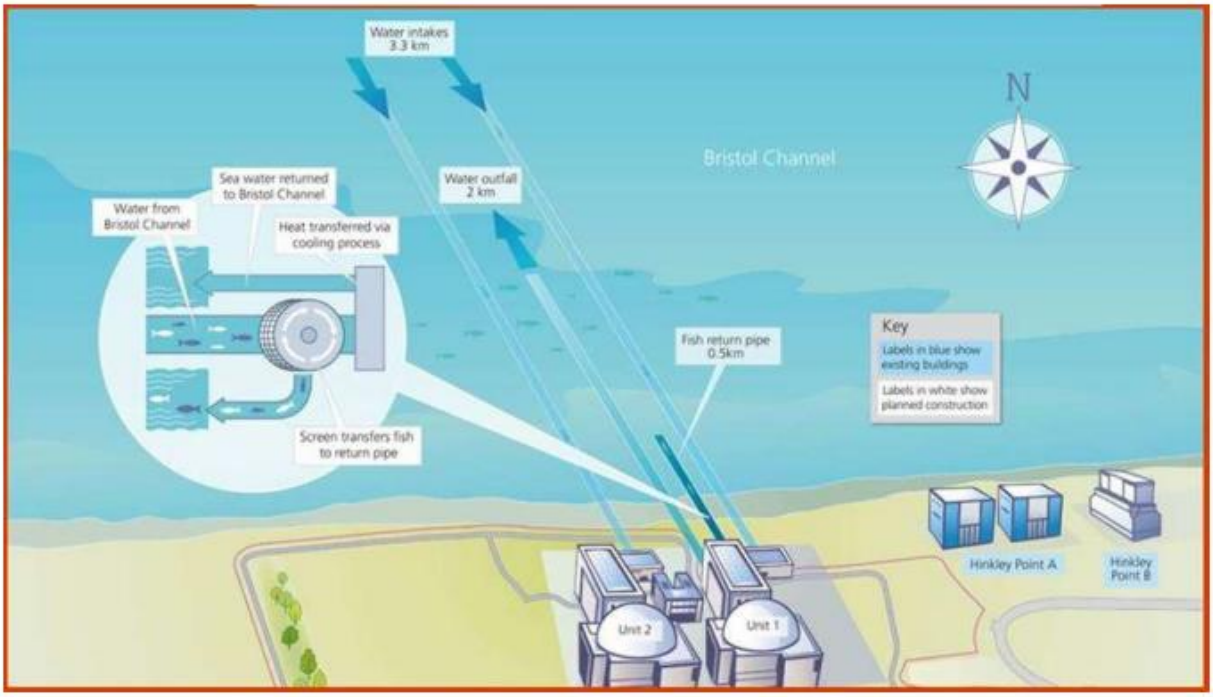
HPC is within and adjacent to European sites (SAC and SPA) and therefore required a HRA. This considered the individual impact of activities of the development at HPC, the combined impact of the development at HPC, and other pressures, such as other planned developments, upon the feature interests and other designated sites that could be affected. The HRA process revealed a number of detrimental impacts which would occur without mitigation; therefore, several permit conditions were applied through a Development Consent Order (DCO)[5]. The main area of concern was the abstraction of cooling water directly from the Severn Estuary. As this abstraction will suck in biota, most notably fish, the Water Discharge Activity environmental permit[6] (as part of the DCO) required a combined system with three fish mitigation measures. This incorporated Best Available Technology (BAT) as proposed by the EA, of a Fish Recovery and Return (FRR) System, an Acoustic Fish Deterrent (AFD) system and Low-Velocity Side Entry (LVSE) intake heads.

The Group concentrated its work on the examination of the direct cooling water system (see Figure 1.1), which extends 3km into the Severn Estuary. The seawater is sucked into the system along with any biota (living organisms) into the intake tunnels and will then pass through a series of screens onto which any organisms (mostly fish) larger than the mesh size will become impinged (trapped) and returned to the estuary via a FRR System including an Archimedes Screw. Any living organisms smaller than the mesh size will become entrained within the system and will be returned to the estuary via the cooling water discharge. To reduce the number of fish entering into the intake system, the EA concluded that a behavioural deterrent was needed in the form of an AFD system to audibly alert fragile hearing-specialist fish species to the danger and allow them to avoid the intake, as they are less likely to survive the FRR. In addition, Low-Velocity Side Entry (LVSE) intake heads were added to the design to reduce the flow of the intake water to stimulate avoidance behaviour (enable fish to swim away).

[5] https://www.legislation.gov.uk/uksi/2013/648/contents/made

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291296/LIT_7947_e754c0.pdf

Figure 1.1. Summary of HPC cooling water abstraction and FRR system (taken from EA 2020).



1.2 Concerns

1.2.1 Potential impacts on fish populations

The Severn Estuary is home to many fish species, including those that are common, rare and migratory. Different fish species live at different depths, and have different behaviours, abilities to hear, and life cycles. Therefore, different fish species need to be deterred from entering the intake pipes using different methods. Although there is often a focus on ensuring rarer species are not impacted by human development, when examining the possible impact on the resilience of the ecosystem, consideration of common species is just as important, not least because they provide food sources for other species. The Severn Estuary is also an important destination for migratory species at key times of their lifecycle, such as the globally critically endangered European Eel *Anguilla anguilla*. Therefore, there are serious concerns surrounding the proposed removal of the AFD requirement from a WDA environmental permit issued in 2013 (and any subsequent variations to the DCO and marine licence) at HPC. These concerns have been brought forward by a wide range of stakeholders to the Group and through written evidence to associated consultations. The most pertinent concerns are listed here:

- The Hinkley Point C (Nuclear Generating Station) Order was made by the Secretary of State in 2013. The intake pipe design accepted for this DCO included three elements: the LVSE, FRR and AFD to work in collaboration. The concern is that the removal of one element means that the combination of measures will no longer provide the mitigation impact that is required to ensure the EMS features will not significantly be impacted by the direct cooling water system. Fish Guidance Systems Ltd have pointed out that NNB GenCo's own analysis shows that the removal of the AFD will result in an estimated loss of an additional 37 tonnes annually (as Equivalent Adult Values) of fish from the Severn Estuary's fish assemblage (including SAC features of interest: such as Twaite Shad) and that these losses may be exacerbated by the impacts of climate change. This value has

been contested as an underestimation by several stakeholders, one of whom, Dr Peter Henderson, who has been involved in impingement research at Hinkley Point B (HPB), has calculated that the estimated annual capture rate (impingement) of the system will be over 182 million fish, and it is likely that many of these will not survive.

- EDF has stated that they do not think that an AFD is needed as its removal would have a negligible impact on the fish populations in the Severn Estuary, with the other two fish protection measures in place. It is suggested there are technological and logistical difficulties that mean an AFD is not a viable option. However, AFD technology has seen significant developments since EDF's original proposal, through Active Pressure Compensation Systems for the Sound Projectors, new Power and Communication Hubs, and improved software and hardware providing greater monitoring and control over the systems, which Fish Guidance Systems suggest could now be considered by NBB GenCo to mitigate impacts. This has raised the question with the Group, that if the technology was not viable at the time of the WDA permit approval, then why was its use considered BAT, and why have other options such as a closed system not been considered as alternatives?
- The original reasoning behind designing a direct intake system has been questioned because this type of system is no longer used in other countries due to the damaging impact it has on fish populations, and therefore consideration of a redesign to an indirect cooling plant, or another alternative technology, should be considered.

The Cefas assessment report TR456, submitted by EDF as evidence of "*negligible impact on fish populations*", provides their rationale for removing the AFD. However, the removal of the AFD from the intake design was questioned by other stakeholders, and some have also questioned the evidence provided in the TR456 report, with the following concerns:

- The impacts of the reduction in the size of the mesh screen from 10mm to 5mm have been significantly underestimated, given the likely impingement and mortality for some fish species. The Group understand that Cefas has not used data available from entrainment studies at HPB to estimate the number of fish that presently penetrate the 10mm mesh and become entrained;
- Assumptions have been made that the LVSE is sufficient to mitigate the removal of the AFD but this has not taken into account the impacts of the unusually high suspended sediment levels in the Severn Estuary;
- The assessment of the impact of the 'capping system' on reducing impingement mortality is likely to be flawed, not least because capped systems do not reduce impingement rates for all fish species, and the exemplars provided within the report are not comparable to the site at HPC;
- Screen orientation relative to tidal flows may not reduce impingement mortality as predicted;
- The assumption that screen impingement has a linear relationship with water flow is incorrect and underestimates impingement and mortality rates considerably;
- The use of ICES stock assessments is considered to be inappropriate due to the large geographical area used by these assessments and the lack of consideration of the dynamics of the fish populations within the Severn Estuary ecosystem leading to an underestimation of mortality;

- There is an absence of data on the impact on fish populations from entrainment that will lead to an underestimation of mortality and overall impact;
- There is an inadequate reference to current and relevant research on fish populations within the Severn Estuary;
- There is a lack of consideration of changes to the fish assemblage due to climate change leading to an underestimation of impact;
- Data used from the monitoring programme at HPB have been extrapolated for the assessments, but there is no consideration of the different location of the intake pipes, and the full data set has not been used, leading to an underestimation of impact;
- The assessment assumes that the removal of fish by a direct intake system is comparable to any other fishing activity within the area, which is regulated and adjusted through adaptive measures process; and
- There is no contingency plan if the AFD is not included together with the FRR nor any suggestion of other mitigation measures that could be used in its place.

1.2.2 Sediment dredging and disposal

Chapter 3 examines the composition of dredged material; this chapter examines if the disposal of dredged material at Cardiff Grounds could impact the local ecology. The underlining principle is that if sediments are dredged within a SAC, that this material is re-deposited elsewhere within the same system to ensure no sediment loss within the system. The Severn Estuary is an extremely dynamic system both in terms of tidal range but also the outflows of several major rivers. Modelling is, therefore, the best method to try and predict any negative impacts, such as the smothering of key ecological habitats by deposited material. Chapter 4 highlights that what little modelling there is, is not conclusive and the Group discussed the need for further modelling. Towards the end of the consultation, EDF has sought a licence to dispose of dredged materials at Portishead. In view of the Group's commitment to report before the Senedd elections, there is a lack of information and time for the Group to consider any additional evidence particularly pertaining to potential ecological impacts.

1.2.3 Thermal properties of Hinkley Point C water discharge

Concerns were raised by stakeholders over the thermal impacts of the discharge waters. A predicted discharge, of up to 11.6 million cubic metres, of cooling water, will be returned at a maximum of 12.5°C above the ambient seawater temperature. This could impact the ecological community surrounding the outflow, particularly any non-mobile species. Although this impact will be temporary and will only occur for the lifetime of the operations (~60 years), considerations of the short and medium-term impacts on the directly affected habitats and associated species are needed. One concern is that there may be an influx of warmer water species, including non-natives, which could establish populations out-competing existing native species. There is also a concern that higher temperatures could impact local thermally-sensitive species and habitats.

1.2.4 Chemical properties of Hinkley Point C water discharge

Issues raised included concerns about:

- Toxicity of biocides (used to control biofouling) and their residual toxicity, including the rate that these chemicals degrade and disperse in the environment. Specific

concerns were raised regarding their impact on important food species such as the macroinvertebrates (e.g. *Macoma balthica*) within the sediment.

- The use of chlorination to remove biofouling within the intake system and the potential bioaccumulative impacts of the chemicals used on the immediate and wider marine ecosystem. NNB GenCo documentation states that the use of chlorine could kill 0.05% of the Inner Channel phytoplankton (the basis of the food web), and there could be cumulative impacts over the life of the operation (~60 years).

1.2.5 Further habitat considerations

Wider issues of ecological concern were discussed, and these included:

- The damage to the nationally important *Corallina sp.* pools on the foreshore at Hinkley Point after impacts of a Wave Walker, used to set pylons during the construction for a jetty, were underestimated. Since the damage, EDF has been maintaining artificial bunds to preserve the original environmental conditions.
- Ensuring no damage to the saltmarsh habitat that has been recently created close to Hinkley Point. This habitat has become an important juvenile and nursery habitat for various fish species and so needs to be protected.
- The need to consider climate change and the likely increase in sea levels that will result in coastal squeeze, which could mean a more significant proportion of fish eggs and young within the Severn Estuary being pushed towards the development site.
- The lack of evidence that an ecosystem-based approach has been considered, with a lack of assessment of the cumulative ecological impacts of the development.
- Issue of unexploded ordnance (~150 items) in the area to be dredged was raised by the MMO. Further assessment is needed in regards to how this ordnance will be removed. If this includes on-site detonation, then the direct and indirect effects (sound/vibration) on EMS features need to be assessed.

1.3 Review of evidence

1.3.1 Will the intake pipes cause fish deaths?

The impacts of cooling water abstraction on wildlife arise because fish and other species are unintentionally drawn into the power station along with the cooling water. The proposed development and construction of HPC and its associated cooling water system was assessed by the EA through a Habitats Regulation Assessment (HRA). This process is to ensure that there is no adverse effect on the integrity of the Severn Estuary EMS, and other relevant designated sites (see Annex II, Table 1c). The HRA DCO was determined in 2013 and requires a complementary set of mitigation measures needed to approve a direct cooling system. The combination approved was for a LVSE, FRR and AFD and was based on the EA's Best Available Techniques device[7],[8]. The awarded DCO requires that this combined system is in place for the operation of HPC.

[7] Environment Agency 2005. Screening for Intake and Outfalls: a best practice guide. Environment Agency Science Report SC030231/SR3.

[8] Environment Agency 2010 Cooling Water Options for the New Generation of Nuclear Power Stations in the UK SC070015/SR3..

However, in 2018 NNB GenCo submitted a request to the Secretary of State for the removal of the AFD from the permit requirements due to predicted technical difficulties in installation and maintenance. The EA reviewed technical report TR456 (2018, Edition 2) submitted by Cefas as evidence to support their conclusion that the 'absence of an AFD system at HPC will not give rise to significant effects associated with the impingement and entrainment of fish'. Neither the EA, NRW, nor NE, nor Devon and Severn Inshore Fisheries Conservation Agency (D&S IFCA) support this conclusion. To determine the level of impact that this would have on the integrity of the Severn Estuary EMS, the EA began to undertake a new HRA and, during the initial stages, EDF determined that their request would not be successful and subsequently launched an appeal to the Secretary of State. The appeal is now being overseen by the Planning Inspectorate (PINS). In the meanwhile, the EA concluded that the HRA would still require an AFD, however the final decision will now be determined by PINS. The decision by PINS cannot be appealed but may be challenged through a Judicial Review process.

PINS are consulting on the appeal and the EA completed the HRA process and through this have responded by stating that

> "*insufficient information has been presented to consider effects against the conservation objectives*" and "*insufficient information is available to consider the robustness of the predicted impingement figures*" and have stated that they "*unable to advise that adverse effects to the integrity of the SAC/Ramsar/SPA sites would be avoided*", a view that they confirm is also held by NE.

The EA, in their response to questions posed by the Group, explained that the LVSE intake heads need to work in combination with a behavioural cue, such as an AFD, to deter more fragile hearing-specialist fish species that are unlikely to survive the journey through the FRR and that the removal of the behavioural cue of the AFD "*greatly reduces the benefit of the LVSE as a mitigation measure for those hearing species*". The FRR alone provides no mitigation for fragile species without a behavioural cue, and the LVSE will only allow those species with the swimming ability to avoid being drawn in to not enter the FRR.

Through discussions with agencies and other stakeholders, the Group has developed significant concerns over the potential impacts that a direct intake system, without adequate mitigation measures, would have on the already pressurised fish assemblage and, therefore, the resilience of the Severn Estuary ecosystem and its species. The EA concluded through the latest HRA process that they are "*unable to conclude, beyond scientific doubt, no adverse effect alone on-site integrity for Twaite shad, Allis shad, Atlantic salmon, migratory fish assemblage and assemblage of fish*". This concern extends to the legislative requirements of the WFG and Environment (Wales) Acts.

This means that if NNB GenCo is permitted by PINS to construct and operate the intake system without an AFD, there could be considerable impacts upon the resilience of fish populations in the Severn Estuary EMS and would be against the Welsh interests.

1.3.2 Will the dredged sediment disposal have any impacts on the ecology?

The development at HPC requires dredging of the surrounding seabed for the construction of the temporary jetty (now completed) and to allow for the drilling of six vertical shafts for the direct water intake cooling system. The dredged marine sediment from the site will need to be disposed of in an established designated disposal site. One site is known as LU110 Cardiff Grounds, and NNB GenCo was permitted to deposit sediments there in 2018, with further works planned for early 2021. A second disposal site at LU070 Portishead is now also under consideration. Both proposed operations are

undergoing Environmental Impact Assessments (EIA), and this topic is considered further in Chapter 4.

1.3.3 Is the temperature of water discharged warmer than sea temperatures and if so, is this of concern?

As seawater is used to cool the reactors at HPC this water is heated and so when returned to the estuary is warmer than the surrounding seawater. This creates a thermal plume (increased temperature) around the outflow pipe with the temperature of this water dissipating as it mixes with the surrounding seawater. Cefas responded that their modelling of the thermal plume has shown that it "*does not impact the Welsh coast either directly or due to its influence on dissolved oxygen levels*". However, Cefas did not provide further information on the potential impacts upon the area directly within the outflow, nor how any effect to this area could cause ecosystem changes (affect fish nursery grounds and/or specific species). No evidence was provided of consideration of how creating a temporary habitat (warm waters) may be suitable for species that cannot typically reside in the cooler waters of the estuary. The lack of clarity on this matter does raise concerns with the Group. This matter is considered in further detail in Chapter 4.

1.3.4 Could chemicals added to discharge water damage the ecology of the Severn Estuary?

Cefas and EDF have stated that prevailing environmental conditions at Hinkley Point mean that chlorination, to prevent biofouling, is not required. Despite this, assessment has been undertaken in case chlorination is required in the future. The Group inquired as to how the Total Residual Oxidants (TRO's) produced by the bromine-based chemicals if used would pose a threat to the ecology of the estuary. These chemicals have an initial rapid decay followed by a slower exponential decay. Cefas informed the Group that the half-life for clear water is given as ~13 minutes and stated that values derived for turbid conditions were used in assessments. However, these values have not been shared with the Group. The Group is therefore, unsure as to what the impacts would be for the feature interests of the EMS.

Cefas also responded that they have considered how contaminants bioaccumulate and persist in determining the biological effects of the individual contaminants in their assessments and that it is "*not standard practice in the UK to carry out ecotoxicology on particular sensitive species or ecosystems unless the risk of harm cannot be reasonably screened out*". They also explained that these assessments are based on ecotoxicological data from the US as they do not have the UK focused bioassay dataset. This is of concern to the Group as data relating to UK species is needed to ensure that assessments are relevant to local communities and environmental conditions.

1.3.5 Have other habitat impacts been considered?

Stakeholders raised concerns over the development at HPC and assessments undertaken, listed above in section 1.2.6. Whilst these were not discussed directly with the consultees, the understanding of the Group is that the HRA process strives to consider proposed impacts and the cumulative effects of the development and other projects within the vicinity. However, its assessments cannot predict the cumulative impacts upon the already pressurised ecosystem in the future especially from climate change. This underlines the importance of restoring the resilience of the Severn Estuary ecosystem.

1.4 Advice

The Severn Estuary ecosystem is one of the most highly protected ecosystems in the UK. In order to ensure that the resilience of the Severn Estuary is restored and enhanced for future generations, it is essential that the features recognised in the awarding of these designations are protected and, where necessary restored. Therefore, a failure of the process to uphold the original requirements of the DCO permissions will show how short-term policy decisions do not meet longer-term outcomes of the Well-Being of Future Generations (Wales) Act.

The evidence provided and responses to the Group lead to the conclusion that there remain considerable uncertainty and substantial evidence that the proposed removal of the AFD from the intake system at HPC would compromise existing best available technological advice and hasn't considered developments in AFD design (discussed above). The conclusions of the EA's HRA demonstrates that there could be an adverse impact upon the Severn Estuary ecosystem and its fish assemblage, which contradicts Welsh legislative and policy aims and would therefore be against the Welsh interest. Annex II provides a detailed examination of the evidence in the context of Welsh legislation and policy.

Advice 1: The original requirements of the Development Consent Order should be upheld to avoid any significant adverse short-term or long-term impact upon the features of the Severn Estuary European Marine Site. If the removal of the Acoustic Fish Deterrent is approved by the Planning Inspectorate, then we believe other mitigation measures must be considered and used to support the already pressurised fish community in this ecosystem and that Welsh bodies (Natural Resources Wales) be consulted on any mitigation measures to take Welsh legislation into consideration. If mitigation measures are ignored, the impacts upon the Severn Estuary would be felt in both the short and long-term.

If no suitable mitigation is available, we advise the development can then only be approved provided three tests required by the Conservation of Habitats and Species Regulations (2017) are met:

- There are no feasible alternative solutions to the plan which are less damaging.
- There are "imperative reasons of overriding public interest" for the plan to proceed.
- Compensatory measures are secured to ensure that the overall coherence of the network of European sites is maintained.

Advice 2: The deleterious impact of continuous abstraction of water raises the question of whether alternative water abstraction systems should be considered. Closed water cooling systems such as those using cooling pools are now considered best practice elsewhere and would considerably reduce the pressure on marine ecosystems. Our advice is that relevant stakeholders should be engaged in discussions on these steps, especially on alternatives and potential compensation measures, following the determination of the Planning Inspectorate. In the future, abstraction systems that affect protected waters should not be considered.

Advice 3: To further the resilience of the Severn Estuary, active management of all designated sites in the Estuary needs to be resourced, and should include measures to address impacts on features of interests. Also, wider management within the estuary should be considered such as the active management and restoration of fish movement pathways for migratory fish across the riparian network to counter built infrastructure

barriers to fish spawning grounds. Resources are needed to ensure that active management can be effective in restoring and enhancing the resilience of the ecosystem.

1.5 Future Considerations

To give current and future generations a good quality of life, Wales need to think about the long term impact of the decisions made. Therefore, proposals need to consider the long term and how they could compromise future generations.

Throughout the conversations with EDF, little consideration has been made about both the climate change and ecological crisis. As these crises deepen, consideration has to be made on how to stop the damaging activity and to mitigate any increased pressures. Policy and regulations provide evidence-based decisions that need to be viewed not as technical obstacles but in the spirit of enabling sustainable development.

Advice 4: If the Planning Inspectorate find in favour of the NNB GenCo request to the Secretary of State for the removal of the Acoustic Fish Deterrent, then an appeal cannot be raised. This then brings into question if the original ecological safeguards identified in the HRA are being upheld. The only further challenge would be through a Judicial Review. This is extremely costly, complex and time consuming and only considers if correct process is followed so limits the ability of an individual citizen to challenge the decision. This compromises the aims of the Aarhus Convention, which requires all citizens to have the right to participate in environmental decision-making and the right to review procedures to challenge public decisions.

Advice 5: Any future mitigation measures must include input from Welsh bodies to ensure the requirements of Welsh legislation are fulfilled. If the Planning Inspectorate determine in favour of EDF they may require mitigation measures for impacts on fish populations. These measures would be determined by the Environment Agency, who should then consult with Welsh bodies to ensure Welsh legislation is upheld.

Advice 7: Any future cross-border infrastructure projects need to consider Welsh legislation from a project concept stage. This would then enable a process that develops a project that follows the five ways of working principles in the Well-being of Future Generations Act and that all considerations to ensure sustainable development are made from the outset.

Appendix I: Summary of designations for Môr Hafren/ Severn Estuary European Marine Site

Table I(a). Features and designations of the Severn Estuary European Marine Site (taken from NE/CCW 2009).

Feature	Severn Estuary SAC	Severn Estuary SPA	Severn Estuary Ramsar Site	Severn Estuary SSSI	Bridgwater Bay National Nature Reserve	Bridgwater Bay SSSI
Estuary	Yes	Supporting habitat to designated bird interests	Yes	Yes	Yes	No
Subtidal sandbanks	Yes	No	No	No	Yes	Yes
Intertidal Mud and Sand	Yes	Supporting habitat to designated bird interests	Component of Ramsar "estuaries" feature and supporting habitat to designated bird interests	Yes	Yes	Yes
Atlantic salt meadow / salt marshes	Yes	Supporting habitat to designated bird interests	Component of Ramsar "estuaries" feature and supporting habitat to designated bird interests	Yes	Yes	Yes
Reefs	Yes	No	Intertidal Honeycomb worm (*Sabellaria)* reef contiguous with subtidal reefs is a component of the hard substrates sub-feature of the Ramsar "estuaries" feature	No	No	No
Migratory fish (river & sea lamprey & twaite shad)	Yes	No	Yes	Yes	No	No
Migratory fish (salmon, eel, sea trout and Allis Shad)	Part of notable species sub-feature of estuary feature	No	Yes	Yes	No	No
Assemblage of fish	Notable species sub-	No	Notable species sub-feature of estuary feature	Yes	No	No

species (>100 species)	feature of estuary feature					
Internationally important populations of migratory bird species	Notable species sub-feature of estuary feature	Yes (Bewick's swan, European white-fronted goose, dunlin, redshank, shelduck, gadwall, curlew, Northern pintail, ringed plover)	Yes Internationally important populations of waterfowl	Yes (curlew, dunlin, grey plover, redshank, ringed plover, shelduck)	Yes (shelduck, dunlin, teal, wigeon, curlew, grey plover, avocet, black-tailed godwit)	Yes (black-tailed godwit, curlew, dunlin, redshank, shelduck, snipe, teal, whimbrel, wigeon)
Internationally important populations of wintering bird species	Notable species sub-feature of estuary feature					
Assemblage of nationally important populations of waterfowl	Notable species sub-feature of estuary feature	Yes (as above plus wigeon, teal, pochard, tufted duck, grey plover, whimbrel, spotted redshank, lapwing, mallard, shoveler)	Yes	Yes	Yes	Yes
Hard substrate habitats (Rocky shores)	Notable species sub-feature of estuary feature	Supporting habitat to designated bird interests	Component of Ramsar "estuaries" feature and supporting habitat to designated bird interests	Yes	No	No
Freshwater grazing marsh / Neutral grassland	No	Supporting habitat to designated bird interests within SPA but outside European Marine Site		Yes (currently England only)	No	Yes

Table I(b). The features of Welsh designated sites considered through the HRA.

European Site	**Designation**	**Primary features (and qualifying features)**
River Wye/Afon Gwy	Special Area of Conservation	Sea lamprey Twaite shad Atlantic salmon (Allis shad)
River Usk/Afon Wysg	Special Area of Conservation	Sea Lamprey Twaite shad Atlantic salmon (Allis shad)

Appendix II: Welsh legislative context concerning the removal of AFD

Table II(a). Welsh legislative and policy context of the potential impact of permit changes on migratory fish assemblage and features.

Welsh legislation/policy		**Effect of removal of the mitigation measure (AFD)**
Well-being of Future Generations Act 2015	"*Sustainable development principle - must act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs*."	If there is an adverse impact upon fish assemblages, this could compromise the resilience of the Severn Estuary ecosystem, contrary to the aims of Goal 2. Also, future generations will not be able to enjoy the fishing culture of the Severn Estuary nor be sustained through its tourism potential.
Environment (Wales) Act 2016	To maintain and enhance the resilience of ecosystems and the benefits that they provide.	An adverse impact upon the fish community will have consequences for the rest of the food web, reducing its resilience to future pressures compromising principles of Sustainable Management of Natural Resources.
Marine and Coastal Access Act 2009 - UK Marine Policy Statement – Section 44	Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets.	The marine ecosystem of the Severn Estuary is current in unfavourable status and the potential of this impact would cause a further decline in its health would affect its ability to function.
UK Marine Strategy Regulations 2010 (Marine Strategy Framework Directive (MSFD))	Biological diversity is maintained; Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock; All elements of the marine food web, to the extent that they are known, occur at normal abundance and diversity levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.	The adverse impact upon the fish community would impact upon the biological diversity, particularly for commercially exploited fish and there could be considerable impacts upon the migratory species.

Conservation of Habitats and Species Regulations 2017	Special Areas of Conservation and Special Protection Areas	Features would be further impacted upon, and the marine food web could alter depending upon the severity of impact.
Wildlife and Countryside Act 1981	Designation of Sites of Special Scientific Interest and partial protection of Allis shad and Twaite shad under Schedule 5.	No adverse impact could not be concluded for both shad species that are already under pressure.
Ramsar	Assemblage of migratory fish species (sea lamprey, river lamprey, twaite shad, allis shad, salmon, sea trout and eel).	No adverse impact could not be determined for the assemblage of migratory fish species which are already under pressure.
Marine Area Statement	Building resilience of marine ecosystems theme	The unfavourable condition of the EMS means that the MPA network is not currently ecologically coherent, and any further pressures could make it harder to restore and enhance.
National Marine Plan for Wales	Fish species and habitats (ENV_07) – fish lifecycles and ecosystems on which they depend need to be sustained; Precautionary principle should be applied where there are reasonable grounds that human activities may bring about hazards to harm living resources and marine ecosystems; Adaptive management; Where benefit to public outweighs the damage to the environment, compensatory measures must be secured to ensure the overall coherence of the network.	The potential significant impacts on the mortality of fish species in the Severn Estuary could impact upon their life cycles, especially as HPC also has a smaller intake mesh screen than has been used at HPB. Adaptive management is implemented for fishing activities, but the activity of HPC would be indiscriminate and at this time, EDF has not suggested any compensatory measures.
Nature Recovery Action Plan for Wales	To recover nature we must build resilient ecological networks and mosaics across our whole land and seascape to safeguard species and habitats and the benefits they provide.	The potential of an adverse impact upon the fish assemblage would not allow the ecosystem to recover and would therefore not be a resilient seascape.

Chapter 2

Cross-border arrangements

2.1 Introduction: the need for cross-border arrangements

The shared natural system of the Inner Bristol Channel and Severn Estuary demands that appropriate cross-border arrangements are in place for managing this dynamic and complex environment. Many natural features and processes, including sediment and fish movements, operate at an estuary scale and wider, transgressing jurisdictional boundaries. There are also other cross-border implications which need to be taken into consideration in the context of Hinkley Point C (HPC), including transboundary and cumulative impacts of human interventions, and associated management measures including pollution control measures and marine licences. As a signatory to the Convention on Biological Diversity[9], UK Government is required to follow the ecosystem approach, a 'strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.' This approach also underpins the approach to the sustainable management of natural resources under The Environment (Wales) Act (2016)[10] and Welsh Government's approach to marine planning. However, actioning the ecosystem approach for cross-border areas is generally recognised as challenging, as a result of the complexity and fragmentation of roles and responsibilities[11].

Group concerns

The overarching aim at the start of the review was to understand:

- The adequacy of cross-border relationships for addressing transboundary and cumulative impacts across the Severn Estuary/Bristol Channel

In order to achieve this aim, the Group sought to clarify:

- The effectiveness of estuary-scale plans and strategies in providing a consistent and coherent strategic context for local decision-making on key environmental concerns related to Hinkley Point C
- The efficacy of cross-border arrangements associated with the granting of permissions, consents and licences for activities/works on either side of the estuary

The chapter commences with a brief overview of relevant plans and strategies (Section 2.2), informed by a desk-top, online study of relevant documents as well as written and verbal evidence received by the Group. Section 2.3 examines the cross-border arrangements associated with decision-making processes relating to the

[9] https://www.cbd.int/

[10] Welsh Government (2016) *Sustainable Management of Natural Resources*, Environment (Wales) Act 2016 Factsheet, 2pp., https://gov.wales/sites/default/files/publications/2019-05/environment-wales-act-2016-sustainable-management-natural-resources.pdf

[11] Gilliland, P.M. and Laffoley, D., 2008. Key elements and steps in the process of developing ecosystem-based marine spatial planning. *Marine Policy*, *32*(5), pp.787-796.

issuing of permits, consents and licences. It is largely based on verbal and written evidence received by the Group from a range of organisations including relevant government departments and agencies. Where further details regarding the adequacy of some of these arrangements occurs in other chapters, this is indicated.

2.2 Review of evidence

2.2.1 Estuary-scale plans and strategies

There are various estuary-wide plans and strategies relevant to the Severn Estuary and Inner Bristol Channel of relevance to Hinkley Point C. These provide the context for local decision-making on a range of matters including the issuing of consents for coastal and offshore activities, including Water Discharge Activity (WDA) Permits and Marine Licences. In the case of the Bristol Channel Standing Environment Group's Activation Plan (2018), the only plan which covers the entire Bristol Channel, this provides operational guidance and a framework to guide the group's activities in the event of a maritime pollution incident. This plan is discussed further in Chapter 5 and the key characteristics of this and other relevant plans are summarised in Table 1. Those deemed most relevant to the Group's remit, and providing the context for the discussion in Section 2.3, are discussed in the following sub-sections.

2.2.1.1. Severn Estuary Marine Site and the Single Management Scheme

As noted in Chapter 1, the Severn Estuary's protected area status is important to the overall management and integrity of the estuary's designated habitats and species. This has significant implications for marine licencing applications around the estuary as noted in Chapter 3, to the extent that the Hinkley Point C Development Consent Order (2013) included a condition (PW23) that the '*disposal of dredged material arising from the authorised project shall not be disposed of except within the Severn Estuary Special Area of Conservation*[12]'.

The importance of the Conservation of Habitats and Species Regulations (2017)[13] in providing 'a single legislative instrument' and maintaining consistency for cross-border sites was recently highlighted by the Economy, Skills and Natural Resources Department, Welsh Government[14]. This Explanatory Memorandum noted that '*a single set of regulations recognises wildlife knows no borders*.' In addition to this, Regulation 33 advice, Joint Conservation Advice for the entire Severn Estuary Site, was published by Natural England (NE) and the Countryside Council for Wales (now NRW) in June 2009. Recently, a pilot study between NRW and NE investigated the updating of the joint advice package, but it was agreed not to proceed with this and

[12] HM Government (2013) The Hinkley Point C (nuclear generating station) Order 2013, See: https://www.legislation.gov.uk/uksi/2013/648/contents/made

[13] And the *Habitat Regulations: the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019* *http://www.legislation.gov.uk/uksi/2019/579/contents/made*

[14] *Economy, Skills and Natural Resources Department, Welsh Government (2013)* Explanatory Memorandum to The Conservation of Habitats and Species Regulations, 5pp., *https://business.senedd.wales/documents/s68629/Paper%2013%20Explanatory%20Memorandum.pdf)*

so the 2009 document remains the current agreed advice for the Site. In this context it should be noted that NE and NRW have a duty to provide advice to Relevant Authorities on the Conservation Objectives for the Site, as well as advising on activities and pressures that might cause deterioration or disturbance to designated features. Such advice along with Conservation Objectives[15] has provided the context for the production of the ASERA Management Scheme[16] (Table 1), a single coordinated scheme of management for the entire site which guides Relevant Authorities in the exercise of their functions in relation to land or waters within or adjacent to that area or site. Whilst the Scheme provides a coordinated framework to aid decision-making across the estuary, discussions with Welsh Government Marine Team[17] suggested there may be a place for more specific guidance on 'threshold limits' associated with this Scheme. They noted that this might be appropriate for things such as fish deterrent systems. However, the practical challenges of developing and introducing such thresholds was recognised.

As mentioned in Chapter 1, following the UK's withdrawal from the EU, there is some uncertainty regarding cross-border negotiations associated with future appeals associated with trans-boundary sites. As noted, previously these would have been heard by the European Court of Justice, but post-Brexit, there are now separate assessment bodies in England and Wales (currently the interim Environmental Protection Assessor for Wales and the Interim Office for Environmental Protection, prior to their formal establishment under Welsh legislation and as part of the Environment Bill for England).

2.2.2.2 Marine plans

Marine plans inform and guide the regulation, protection and use of offshore areas and support the UK Government's vision for 'clean, healthy, safe, productive and biologically diverse oceans and seas.'[18] As statutory plans, public authorities have a statutory obligation to make decisions in accordance with these. Such decisions include those relating to planning consents, marine licensing and coastal operations to marine compliance and enforcement.[19] As these plans only apply to proposals for new developments and activities, they do not affect any previous licenses or decisions, although it is clear that they 'should be used for any changes or additions to existing developments or activities'[20] and so are very relevant to current applications related to HPC. As indicated in Table 2.1, there are two marine planning areas for the Severn Estuary/Inner Bristol Channel, with Welsh Government

[15] Including the Habitat Regulations: the Conservation of Habitats and Species (amendment) (EU Exit) Regulations 2019, See: *http://www.legislation.gov.uk/uksi/2019/579/contents/made*

[16] Association of Severn Estuary Relevant Authorities (ASERA) (2018) *Severn Estuary European Marine Site Management Scheme 2018 – 2023*, 63pp., https://asera.org.uk/wp-content/uploads/sites/3/2018/05/Severn-Estuary-EMS-Management-Scheme-2018-2023-May-2018-2.pdf

[17] Welsh Government (Marine Team), Verbal evidence: 01/03/21

[18] Marine and Coastal Access Act 2009; see: https://www.legislation.gov.uk/ukpga/2009/23/contents

[19] Marine Management Organisation (2015) *Marine plan: user guide;* see: https://www.gov.uk/government/publications/marine-plan-user-guide/marine-plan-user-guide

[20] *Op.cit.*

responsible for the development of the Wales National Marine Plan (2019)[21] and the Marine Management Organisation holding similar responsibilities for the marine plan for the South West, currently a consultation draft (MMO, 2020)[22].

With respect to the need for a coherent and coordinated marine planning system for the estuary, the Marine Policy Statement (2011)[23], prepared and adopted in relation to Section 44 of the Marine and Coastal Access Act 2009, is noteworthy. This provides high-level policy context for the preparation of all marine plans. Section 1.2.1 states that the UK Administrations are committed to the co-ordination of marine planning across administrative boundaries, noting that

> *'coordination will include planning for activities which extend across national or Marine Plan area boundaries, the sharing of data between plan authorities and the timing of the development of Marine Plans for any area. Concordats between UK administrations will enshrine the close cooperation and mutually beneficial approach to marine planning that is in place*.'

Whilst no such concordats appear currently publicly available, the Group received written and verbal evidence from Welsh Government (Marine Team) indicating a clear commitment to the co-ordination of marine planning across administrative boundaries. The evidence noted regular liaison between Welsh Government and the Marine Management Organisation to 'ensure coherence across marine planning approaches between England and Wales.' Such liaison ''*includes quarterly meetings, regular bilateral meetings during plan development and attendance at each other's stakeholder engagement events, in addition to the provision of written advice, feedback and comments on developing policies".*[24] It was also pointed out that the ''*MMO provide input to the Welsh Government Marine Planning Stakeholder Reference Group and Marine Planning Decision Makers Group, and that within such meetings cross-border issues are a regular agenda item.*[25]

The scrutiny of both the Welsh and emerging South West marine plans through Sustainability Appraisals (SAs) and Habitat Regulations Assessment (HRA) processes has revealed how important these assessment processes have been in highlighting potential transboundary issues and how these processes have led to the strengthening of policies to improve plan coherence.[26]

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[21] Welsh Government (2020) *Wales National Marine Plan*, 180 pp.

https://gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan-document_0.pdf

[22] Marine Management Organisation (2020) *South West Inshore and South West Offshore Marine Plan Draft for consultation* January 2020, 56pp.; see: https://www.gov.uk/government/publications/draft-south-west-marine-plan-documents

[23] HM Government Northern Ireland Executive Scottish Government Welsh Assembly Government (2011), *UK Marine Policy Statement*, 51pp., https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[24] Written evidence and verbal evidence (01/03/21) from Welsh Government (Marine Team)

[25] *Op. cit.*

[26] MMO (2019). *South West Inshore and Offshore Marine Plans Sustainability Appraisal Part 1*: Introduction and Methodology. Draft Report. A report produced for the Marine Management Organisation, MMO, September 2019, 45pp., see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/85

SAs for the WNMP have also highlighted the potential need for formal consideration of cross-border and cumulative effects of the WNMP both alone and in-combination with other plans and programmes (including the marine plans of surrounding administrations) through the plan's implementation and monitoring stages.[27] The SAs have also raised the possibility of the development of additional guidance to support cross-border marine planning[28], a point which was also raised in written evidence from Welsh Government[29] in which the intention to undertake further joint cross-border work with the MMO was stated (once the English adjoining marine plans have been finalised).[30]

As a result of active dialogue, the published WNMP[31] and the consultation draft of the South West Marine Plan[32] include clear policies relating to cross-border areas and express the need for consideration of trans-boundary impacts (Table 2.2). This is stressed in the SWMP Technical Annex[33] and in the WNMP Implementation Guidance (2020)[34] in advice to plans users, including proponents applying for an authorisation. It is also noteworthy that para. 1257 in the former suggests further consideration of estuary management plans could aid the management of cross-

7284/SW_SA_Report_Part_1.pdf; MMO (2019). *South West Inshore and Offshore Marine Plans Sustainability Appraisal. Part 2: Scoping Information*. Draft Report. A report produced for the Marine Management Organisation, August 2019, 101pp., see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/857285/SW_SA_Report_Part_2.pdf; Welsh Government (2019) *Sustainability Appraisal for WNMP* (Nov 2019), 281pp.; See: https://gov.wales/sites/default/files/publications/2019-11/wales-national-marine-plan-sustainability-appraisal.pdf; Welsh Government (2019) *Sustainability Appraisal Addendum* WNMP Nov 2019, 277pp. https://gov.wales/sites/default/files/publications/2019-11/wales-national-marine-plan-sustainability-appraisal-addendum.pdf; Welsh Government (2020) *Sustainability Appraisal: Post Adoption Statement* WNMP 2019, 41pp. See: https://gov.wales/sites/default/files/publications/2019-12/welsh-national-marine-plan-sustainability-appraisal-post-adoption-statement.pdf

[27] *Op. cit.*

[28] *Op. cit.*

[29] Written evidence and verbal evidence (01/03/21) from Welsh Government (Marine Team)

[30] *Op. cit*.

[31] Welsh Government (2020) *Wales National Marine Plan*, 180 pp., see:

https://gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan-document_0.pdf

[32] Marine Management Organisation (2020) *South West Inshore and South West Offshore Marine Plan*. *Draft for consultation* January 2020, 56pp.; see: https://www.gov.uk/government/publications/draft-south-west-marine-plan-documents

[33] Marine Management Organisation (2020) *South West Inshore and South West Offshore Marine Plan Technical Annex* - Draft for consultation January 2020, 311pp. See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/857300/DRAFT_SW_Tech_Annex.pdf

[34] Welsh Government (2020) *Welsh National Marine Plan Implementation Guidance*, 108pp., https://gov.wales/sites/default/files/publications/2020-06/welsh-national-marine-plan-implementation-guidance.pdf

border effects and opens the way for a possible joint (non-statutory) estuary plan to inform future marine plan policies in the adjoining administrations.

Table 2.2 also summarises policies relating to the disposal of sediments offshore as well as those associated with the protection of the Marine Site. As such, these provide context for the discussions in the remainder of this chapter.

2.3 Cross-border arrangements associated with the granting of permissions, consents and licences

In the context of permissions and decisions associated with HPC, there are various processes which operate at a UK national level which have had and continue to have implications for Wales, its environment and people, and are worthy of consideration. Within such processes, there is a need to review the extent to which Welsh interests are being represented and realised, as noted below. These include the provision of Development Consent Orders and the oversight of emergency planning. For details regarding the latter, reference to Chapter 5 should be made where the implications of the application of the Radiation Emergency Preparedness and Public Information Regulations (REPPIR) for Wales are considered.

In terms of the application for a Development Consent Order for HPC as a Nationally Significant Infrastructure Project, this was made under the Planning Act 2008 to the Planning Inspectorate (PINS). The Secretary of State granted the Hinkley Point C Development Consent Order (DCO) (2013) and, whilst prior to this Group's establishment, it is noteworthy that the Countryside Council for Wales (CCW) made contributions to the process, including a written submission to the Report on the Implications for European Sites (RIES: 2012). It is also noted that CCW has been recorded as being content with the sufficiency of the RIES at a hearing in August 2012 on Habitats Regulations Assessment matters[35].

The Group recognises the environmental considerations underpinning this DCO and, as such, considers that this DCO should provide the baseline for environmental standards, mitigation measures and planning obligations associated with the project. As a consequence, the Group has expressed some concern regarding the current appeal which is now lodged with PINS relating to modifications of the agreed plan, noting the contradictory views of Cefas and the conservation agencies on both sides of the estuary regarding the implications of the removal of the AFD from the project design. As highlighted in Chapter 1, there remain questions over how Welsh legislation and policy will be regarded within the PINS decision-making process. As noted, this could be a concern for Wales, if the decision contravenes the advice of NRW and the other conservation agencies. The Group also suggest that any departures from agreed plans could undermine the credibility of, and public trust in UK planning and infrastructure consenting systems. Whilst the decision of the Planning Inspector is outstanding at the time of writing of this report, the Group are keen that the outcome of this appeal should not lessen or weaken the commitments expected of the Developer under this DCO.

[35] https://infrastructure.planninginspectorate.gov.uk/projects/south-west/hinkley-point-c-new-nuclear-power-station/

Within the context of cross-border impacts, there is a need to consider the adequacy of cross-border relationships and agency liaison associated with permitting and licensing processes and decisions on either side of the estuary/Channel. In the context of Hinkley Point C, Water Discharge Activity (WDA) Permits from the Environment Agency (EA) as well as various marine licences have and are being sought. These include the original marine licence granted by the MMO in 2013 for works within the HPC Development Project site and several revisions of this licence, including Revision 3 (2017), permitting dredging disposal in MMO disposal grounds. However, it is the recent intentions of EDF to apply for offshore sediment disposal at two sites across the estuary which have been of concern to the Group, particularly given the jurisdictional divide across the estuary. Currently, EDF is separately and simultaneously seeking consents for the same dredged material from NRW and from MMO for marine licences at Cardiff Grounds Disposal Site (on the Welsh side of the estuary) and the Portishead Disposal Site (on the English side), respectively. It appears the decision over which site is preferable will rest with the developer rather than being a joint decision of the regulating bodies, or indeed one where the relative merits of each site for the estuary (and Wales) can be assessed.

On questioning the agencies and organisations with environmental interests in these processes, it was clear to the Group that there are good working relationships between these bodies. NRW, EA, MMO and the D&S IFCA provided clear statements[36] suggesting regular and frequent liaison and sharing of information as well as exchange of views throughout relevant processes, in addition to responses to formal statutory consultations. As an example, extensive discussions were noted with regard to the marine licence applications for sediment disposal between NRW and MMO.[37] Evidence received from the EA[38] highlighted the close working relationship between NRW and EA and a Memorandum of Understanding (MoU) between the two organisations. The specialist nuclear resource provided by EA to NRW was also elaborated upon. Reference was also made to the processes in place to manage and resolve the very rare occurrences where there are differences of opinion between the two bodies. Particular mention was also made of the EA's provision of technical assistance and advice to NRW in relation to sediment disposal at the Cardiff Grounds site and its assistance in dealing with specific concerns from some stakeholders[39].

A further cross-border matter relates to the role and use of the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in informing decisions relating to permitting and licensing for a range of clients including the UK Government, NRW and EDF. The potential removal of the AFD from the permit for HPC and the contradictory views of Cefas and the conservation agencies on both sides of the estuary have already been noted in Chapter 1 and illustrate this concern.

[36] Devon and Severn IFCA Written Response 16/12/20; MMO Written Response

[37] MMO Written Response

[38] EA Verbal Evidence, 21/12/21.

[39] NRW Written Response

2.4 Discussion and concluding comments

The planning landscape for the offshore environment in the Severn Estuary/Bristol Channel has been notoriously complex for decades.[40] However, the introduction of new planning regimes in recent years has complicated the situation still further and is of concern given increasing plan-led regulatory regimes. Required under different legislative and policy contexts, there remain concerns regarding the inter-relationship between some of the plans, particularly where planning boundaries and timescales do not align or facilitate inter-agency and cross-border working.

However, consultation processes and Strategic Environmental Assessments associated with all the plans have ensured some consideration of cross-border matters, including dialogue between agencies and other bodies across the estuary. The Group notes and welcomes Welsh Government's and MMO's intentions for continued scrutiny of the effectiveness of cross-border marine planning arrangements and the possibility of further supplementary guidance on this matter, particularly given the emerging plan-led system for offshore consenting. The facilitation of cross-border planning through the development of a UK-wide marine evidence base, as noted in the Marine Policy Statement (2011)[41], is also to be welcomed. However currently, the separate marine portals for Wales and England do not facilitate this and so there remains reliance on informal arrangements and networks, such as that provided by the Severn Estuary Partnership[42] and the Severn Estuary Ecological Research Forum[43] for information and knowledge sharing.

Whilst there is no single planning framework, the Conservation Regulations for the Marine Site provide an estuary-wide focus from an ecological perspective, ensuring that plans and proposals with the potential to damage the integrity of the site are scrutinised through Habitat Regulations and Appropriate Assessment processes. Even with the Single Scheme of Management through ASERA, there remain concerns about the capacity of the overall planning framework for the estuary to identify and address cumulative impacts. Whilst the Severn Estuary Strategy (2016)[44], which involved broad stakeholder input through its formulation, could be seen to provide a strategic vision for the estuary, this is non-statutory. It is also not detailed enough to inform local decision-making regarding consents, licenses and permits, even though it was developed using the high level marine objectives from the UK Marine Policy Statement.

As Section 2.3 demonstrates, separate and fragmented processes associated with the granting of permissions, consents and licences on either side of the estuary,

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[40] Ballinger, R. and Stojanovic, T., 2010. Policy development and the estuary environment: a Severn Estuary case study. *Marine pollution bulletin*, *61*(1-3), pp.132-145.

[41] HM Government Northern Ireland Executive Scottish Government Welsh Assembly Government (2011), *UK Marine Policy Statement*, 51pp., https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[42] https://severnestuarypartnership.org.uk/

[43] https://www.devonandsevernifca.gov.uk/Latest-News-and-Information-Items/Severn-Estuary-Ecological-Research-Forum-November-2020

[44] Severn Estuary Partnership (2016) *Severn Estuary Strategy, 2017 – 27*, 20pp. https://severnestuarypartnership.org.uk/wp-content/uploads/sites/2/2018/03/2017-2027-Severn-Estuary-Strategy.pdf

undermine coherent cross-border decision-making. Whilst the public bodies involved are actively engaged in dialogue there are few formal mechanisms for joint decision-making. In turn, this may lead to piecemeal decisions regarding applications for individual licenses which may not be in the overall estuary's and Welsh people's interests. There also remain concerns regarding the role and influence of Welsh legislation and policy within UK decision-making processes, particularly with respect to the PINS process.

Advice 1 – *the need for guidance for regulators, planners and plan users including developers to simplify and clarify the planning system for the estuary*

In the light of the complexity of the planning framework approach, there is a need for greater clarity on the roles and interrelationships between the various planning systems, particularly as these influence local decisions relating to key matters such as pollution and development control. The production of a 'road map' to enable understanding of the system, as advocated within the Severn Estuary Strategy[45], may be appropriate here.

Advice 2 – *explore measures for strengthening cross-border planning*

Welsh Government should continue to liaise with the Marine Management Organisation over appropriate measure to strengthen cross-border marine planning in the light of monitoring of plan effectiveness. This will be particularly important as the plan-led system of licensing emerges and matures for the estuary. The possibility of joint supplementary guidance for the estuary should be considered as part of this.

Advice 3 – *use Memoranda of Understanding to secure effective, long-term good working relationships between relevant public bodies on either side of the estuary*

Memoranda of Understanding (MoU) could be developed and updated to secure effective relationships between relevant government bodies and agencies, where these do not already exist. The efficacy of such MoU should be reviewed periodically in the light of evolving cross-border issues and the handling of these.

[45] Severn Estuary Partnership (2016) *Severn Estuary Strategy, 2017 – 27*, 20pp. https://severnestuarypartnership.org.uk/wp-content/uploads/sites/2/2018/03/2017-2027-Severn-Estuary-Strategy.pdf

Table 2.1 Relevant plans and strategies relating to the Severn Estuary/Bristol Channel

Types of plans	*Name of plan / strategy*	*Characteristics*	*Organisations involved (including lead organisation)*	*Geographical*	*Relevance to Hinkley C*
Management Scheme for Marine Site	Severn EMS Management Scheme (2018 - 2023)	Under UK law Regulation 38 of the Conservation of Habitats and Species Regulations 2017 Guides Relevant Authorities (RA) in the exercise of their functions in relation to land or waters within or adjacent to that area or site Includes updated Action Plans for each RA	The Association of Severn Estuary Relevant Authorities (ASERA) Relevant Authorities include most of the conservation agencies, port and harbour authorities (including Bridgwater Port Authority, adjacent to Hinkley) around the EMS	A transboundary Scheme - includes intertidal areas immediately adjacent to Hinkley and around the Severn Estuary Scheme covers the Severn Marine Site: the Severn Ramsar site; the Severn Special Protection Area (SPA); the Severn Special Area of Conservation (SAC)	Relevant Authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on an interest feature of the site. This may include consideration of issues beyond the boundary of the EMS. RA Action Plans provide guide for the need for Habitats Regulation Assessment for activities likely to impact on the site
Marine Plans	Wales National Marine Plan (2020)	Required under the Marine and Coastal Access Act 2009: public authorities have a statutory obligation to make decisions in accordance with these when issues planning consents and marine licences	Welsh Government	Covers Welsh waters from High Water Mark to the middle of the estuary/Channel	Form the context for the issuing of Marine Licences
	South West Marine Plan Consultation Draft (MMO, 2020)		Marine Management Organisation	Covers English waters from High Water Mark to the middle of the estuary/Channel	
Emergency plan for the Bristol Channel (2018)	Bristol Channel Standing Environment Group – Activation Plan	provides operational guidance and a framework to assist the Bristol Channel Standing Environment Group member organisations to	Public Health bodies; Environment Agency and Natural Resources Wales; Natural England;	Transboundary - Covers Inner Bristol Channel and Severn Estuary	Cover chemical incidents (including hazardous and noxious substances) Notes the membership and role of the group and its members

		achieve functionality and operate effectively as a result of a maritime pollution incidents where there is likely to be a threat of sea, land or air pollution.	Fisheries departments of MMO and Welsh Government; Devon and Severn IFCA; local authorities (Monmouthshire & Bristol)		including some details of tasks and procedures
River Basin Management Plans (RBMP)s (2016) Updated plans all due to be published (following consultation) in 2021	Severn RBMP South West RBMP Western Wales RBMP	Under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 River Basin Management Plans are prepared for each River Basin District Plans set out legally binding objectives for each quality element for each of the protected areas and water bodies in the river basin district, including an objective for the water body as a whole.	*Severn RBMP* Responsibility for planning the future of the Severn river basin district is shared between the Environment Agency and Natural Resources Wales Plan approved by the Secretary of State for the Environment, Food and Rural Affairs and Welsh Government *South West RBMP* Environment Agency *Western Wales RBMP* Natural Resources Wales	Severn RBMP – lies to the north of Hinkley South West RBMP lies offshore Hinkley Western Wales RBMP lies offshore (on Welsh side of Channel)	All public bodies must have regard to these objectives when making decisions that could affect the quality of the water environment. Provide the context for the issuing of Water Discharge Activity (WDA) Permits
Shoreline Management Plans	The Severn Estuary Shoreline Management Plan2 (2017)	Aa high level non-statutory policy document designed to assist coastal flood and erosion risk management planning	Severn Estuary Coastal Group (a partnership by local authorities, regulators and other stakeholders) https://severnestuarycoastalgroup.org.uk/	Covers littoral areas from Lavernock Point/Hartland Point upstream to N of Gloucester	Determines the preferred policy options for coastal defence decisions

Table 2.2 Relevant policies in the marine plans for the Severn Estuary/Bristol Channel

Welsh National Marine Plan (2019)	**South West Marine Plan (Consultation Draft) 2019**
Policy GOV_02 Cross border and plan compatibility	SW-CBC-1 Cross-border cooperation
Relevant public authorities, in making their decisions, should have regard to: • any applicable policy in a relevant marine plan … a. Proposals likely to have significant adverse impacts upon an established activity covered by a formal application or authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for the proposal to progress under exceptional circumstances. b. Proposals likely to have significant adverse impacts upon an established activity not subject to a formal authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for proceeding. b. Under SAF 01 a and b, compatibility should be demonstrated through, in order of preference: • Avoiding significant adverse impacts on those activities, and/or	Proposals must consider cross-border impacts throughout the lifetime of the proposed activity. Proposals that impact upon one or more marine plan areas or impact upon terrestrial environments must show evidence of the relevant public authorities (including other countries) being consulted and responses considered.
D&D_01: Dredging and Disposal (supporting)	SW-DD-1
Proposals that maintain navigable channels and long term access to open at-sea disposal sites for appropriate material will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	In areas of authorised dredging activity, including those subject to navigational dredging, proposals for other activities will not be supported unless they are compatible with the dredging activity.
SAF_01: Safeguarding existing activity	SW-DD-2
	Proposals that cause significant adverse impacts on licensed disposal areas should not be supported. Proposals that cannot avoid such impacts must, in order of preference: a) minimise b) mitigate or c) if it is not possible to mitigate the significant adverse impacts, proposals must state the case for proceeding.

• Minimising significant adverse impacts where these cannot be avoided; and/or • Mitigating significant adverse impacts where they cannot be minimised	
SAF_02: Safeguarding strategic resources	SW-DD-3
Proposals which may have significant adverse impacts upon the prospects of any sector covered by this plan to engage in sustainable future strategic resource use (of resources identified by an SRA) must demonstrate how they will address compatibility issues with that potential resource use. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for proceeding. Compatibility should be demonstrated through, in order of preference: • Avoiding significant adverse impacts on this potential strategic resource use, and/or • Minimising significant adverse impacts where these cannot be avoided; and/or • Mitigating significant adverse impacts where they cannot be minimised	Proposals for the disposal of dredged material must demonstrate that they have been assessed against the waste hierarchy. Where there is the need to identify new dredge disposal sites, proposals should be supported which are subject to best practice and guidance.
ENV_02: Marine Protected Areas	
Proposals should demonstrate how they: • avoid adverse impacts on individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; • have regard to the measures to manage MPAs; and • avoid adverse impacts on designated sites that are not part of the MPA network.	

Chapter 3

The radioactive content of Hinkley Point sediments and their assessment for disposal at sea

This chapter will review the evidence and concerns with regard to the radioactive content of the sediments at Hinkley Point that have been and are planned to be disposed at the Cardiff Grounds disposal site. This chapter will examine the processes and methodologies behind the sampling, analysis and dose assessments that have been carried out to determine whether the Hinkley Point sediments can be disposed at sea. The review will be based on the evidence and communications received by the Group from the involved organisations and interest groups as well as any additional and relevant resources. Advice from the Group is given based on the review of the evidence.

3.1 Background

Nuclear power plant operations at Hinkley Point commenced in 1965 with the commissioning of the Magnox Hinkley Point A (2 x 960 MWt) and later in 1976 with the commissioning of the AGR Hinkley Point B (2 x 1494 MWt). Hinkley Point A was decommissioned in 2000. Airborne and liquid discharges have occurred over the lifetime of the operation (HP A and B) and decommissioning (HP A) of the reactors at the Hinkley Point site, with liquid discharges having been released into the Severn Estuary. Other nuclear facilities that have had liquid discharges of radionuclides into the Severn Estuary are the nuclear power plants at Oldbury (from 1967, decommissioned in 2012) and Berkeley (from 1962, decommissioned in 1989) and the Amersham radiochemical production centre in Cardiff (from 1980s). Other sources of man-made radionuclides to the Severn marine environment are global fallout, the Chernobyl accident in 1986 and marine transported discharges from other nuclear facilities along the west coast of the UK, most notably the nuclear reprocessing facility at Sellafield. Liquid discharges from Sellafield have been many orders of magnitude higher than from UK nuclear power plants, and particularly in the 1970s. In addition, all marine sediments contain natural levels of natural occurring radionuclides from the Uranium-238 and Thorium-232 decay chains as well as Potassium-40.

In 2018 and as part of the overall Hinkley Point C project, EDF carried out licensed dredging of sediments off Hinkley Point and disposal of these sediments at Cardiff Grounds. Hinkley Point lies within the Severn Estuary Special Area of Conservation (SAC), and sediment dredged within the SAC should be disposed within SAC in order to maintain sediment balances in this conservation area. Licensing of the dredging and disposal was approved by Natural Resources Wales (NRW) with a final volume of 156,351 m^3 of sediment disposed at Cardiff Grounds. In connection with the 2018 marine licence, sediments had been sampled at Hinkley Point in 2009, 2013 and 2017. An overview of the samples taken during these years is given in Table 3.1. All analysis of these samples as well as dose assessments have been carried out by the Centre for environment, fisheries and aquaculture science (Cefas). In each case and based on the analyses conducted, Cefas reported that doses to individual members of the dredging/disposal crew, the general public, and the collective dose, were within the *de minimis* criteria of 10 micro Sieverts per year (individual doses) and 1 man Sievert per year (collective dose), respectively (Cefas

2013, 2017 and 2019). Cefas stated that '*since the conservative generic radiological assessment procedure indicated that doses received were below recommended limits, a subsequent more detailed case specific assessment was not necessary*'. Cefas concluded that '*from radiological considerations, there is no objection to this material being dredged and dumped*'.

EDF then announced plans to carry out further dredging at Hinkley Point as part of the necessary works to install cooling water intakes in the Bristol Channel, with a further 470,000 m^3 sediment to disposed at Cardiff Grounds. Following concerns expressed in the Senedd/Welsh Parliament, and by other stakeholders regarding the disposal of Hinkley Point sediments at Cardiff Grounds, NRW and EDF agreed a more extensive sampling and analysis programme in 2020 as part of the marine licence application for this work. In addition, NRW requested that EDF submit an environmental impact assessment as part of their marine licence application. The samples collected in 2020 included cores with samples taken at various depths which were then analysed by gamma and alpha spectrometry by Cefas (Cefas 2021a and 2021b). Based on the analysis of the samples collected in 2020, Cefas again reported that doses to individual members of the dredging/disposal crew, the general public, and the collective dose, were within the *de minimis* criteria of 10 micro Sievert per year (individual doses) and 1 man Sievert per year (collective dose), respectively. Cefas concluded that '*from radiological considerations, there is no objection to this material being dredged and disposed of to sea*'. As of February 2021, EDF have now submitted a marine licence application to NRW to carry out the planned 2021 dredging with disposal at Cardiff Grounds. EDF have also applied for a marine licence application to the Marine Management Organisation (MMO) for the same dredging work, but with disposal at Portishead, which also lies with the SAC.

Table 3.1. Summary of sediment sampling carried out at Hinkley Point for radiological analyses

	No. of sampling stations/ Was sub-surface sampling carried out			
	2009	2013	2017	2020
Surface	5	17	12	22*
Sub-surface	Yes	No	No	Yes

* 6 surface grab samples, 22 cores and 6 replicate cores to collect further samples for reassurance purposes.

3.2 Concerns

- Is there sufficient information/transparency concerning the discharge histories of Hinkley Point A and B?
- Have the sampling and analysis strategies to assess the radionuclide content of Hinkley Point sediments been robust?
- Is there evidence of 'hot particles' in sediments off Hinkley Point?
- Are the assumptions/methodologies used to assess any impact from the radionuclide content of Hinkley Point sediments robust?

- From a radiological perspective, can sediments dredged from around Hinkley Point be disposed at sea?
- Has there been any impact on levels of radionuclides around Hinkley Point from construction work at Hinkley Point C?

3.3 Review of evidence

3.3.1 Is there sufficient information/transparency concerning the discharge histories of Hinkley Point A and B?

With regard to the discharge history of Hinkley Point A and B, the Group were provided with a copy of the report NRPB-M173 (by Neil McEvoy MS and Geiger Bay), that had been described as a '*Westminster*' or '*UK Government report*'. This document is a Working Group 1 (WG1) report from the MARINA project that was published by the former National Radiological Protection Board (NRPB) in 1990. The MARINA project was a Commission of European Communities (CEC) project set up in 1985 to assess the impact of radioactivity in Northern European marine waters and involved invited experts from member states. WG1 consisted of members from the Netherlands, Germany, Belgium, the UK, Denmark, Spain and Ireland. The remit of WG1 was to provide information on discharges from civilian nuclear facilities and the report contains discharge data from 72 sites across different European countries that discharge directly or indirectly into Northern European waters. All this information is provided in the abstract and foreword to the report. The report is not available electronically, but it was published in 1990 so this is not entirely unexpected. However, the report is listed in the International Atomic Energy Agency's (IAEA) library database[46] and was cited 6 times in the 1990s by scientific publications[47]. The MARINA project was followed up by the MARINA II project, which included an update to the report from the MARINA WG1 (Gerchikov et al., 2003).

A graph provided by Keith Barnham using data from the MARINA WG1 report also referenced discharge data for Hinkley Point A from the former Ministry for Agriculture, Fisheries and Food (MAFF). This data was published in the MAFF Radioactivity in surface and coastal waters of the British Isles reports (which later became the Radioactivity in Food and the Environment reports (RIFE)) and which are available from the Cefas website[48]. This graph was annotated with the query as to whether '*Westminster stopped plutonium testing after 1984?*', but the MARINA WG1 report only covered the period up to 1984. Discharge data from Hinkley Point A (1972 onwards) and B (1976 onwards) are also reported in the report series Radioactive effluents from Nuclear Power Stations and Nuclear Fuel Reprocessing Plants in the European Community, published by the European Commission. It should be noted that discharge data reported in earlier MAFF and European Commission reports was often stated as total activities discharged, rather than as detailed information for individual radionuclides such as Plutonium-239. As such the MARINA WG1 report is a valuable resource for discharge data from nuclear facilities

[46] https://inis.iaea.org/search/search.aspx?orig_q=RN:22068698

[47] https://scholar.google.com/scholar?cites=14914259701084414 94&as_sdt=2005&sciodt=0,5&hl=en

[48] https://www.cefas.co.uk/

across Northern Europe for this time period. Detailed discharge data for Hinkley Point A and B from 1995 onwards has been reported to OSPAR[49] and is available from the online European Commission Radioactive Discharges Database[50].

All nuclear facilities have airborne and liquid discharges of radioactive substances, which are authorised by national regulations. The relative amounts of individual radioactive substances that are discharged can change and will reflect different operations carried out over the lifetime of the facility. The graph provided by Keith Barnham showed a comparison of normalised discharge data of Plutonium-239 for Hinkley Point A taken from the MARINA WG1 report (NRPB, 1990), with normalised 'gamma' discharge data from MAFF. The graph was further annotated with '*1982, larger plutonium peak but no gamma peak*'. The discharge data used in this graph had been normalised by dividing discharge data for each year by the discharges reported in 1969. Normalising data in this manner can be useful to highlight variations over time in discharges of an individual radionuclide. However, comparing normalised discharges of different radionuclides where there is a significant difference in the magnitude of those discharges may not give the complete picture. Figure 3.1a shows discharge data for Plutonium-239 and Caesium-137 taken from the MARINA WG1 report (NRPB, 1990), normalised in each case to the amount discharged of these respective radionuclides in 1969. Caesium-137 has a half-life of 30 years and is the main man-made gamma emitter reported in Hinkley Point sediments by Cefas. Figure 3.1b shows the actual amount of Plutonium-239 and Caesium-137 discharged from Hinkley Point A. When comparing these figures, although a peak in normalised Plutonium-239 discharges can be seen in 1982, it is clear that the actual amount of Caesium-137 discharged in 1982 was greater (12.4 times) than the amount of Plutonium-239 discharged. It is worth adding that there were discharges of both Plutonium-239 and Caesium-137 (as well as other radionuclides) from Hinkley Point B in 1982, albeit at levels far lower than from Hinkley Point A, as well as discharges from other nuclear facilities on the Severn Estuary.

[49] https://odims.ospar.org/

[50] https://europa.eu/radd/index.dox

Figure 3.1a. Normalised (to 1969 data) discharges of Plutonium-239 and Caesium-137 from Hinkley Point A. Source: NRPB (1990)

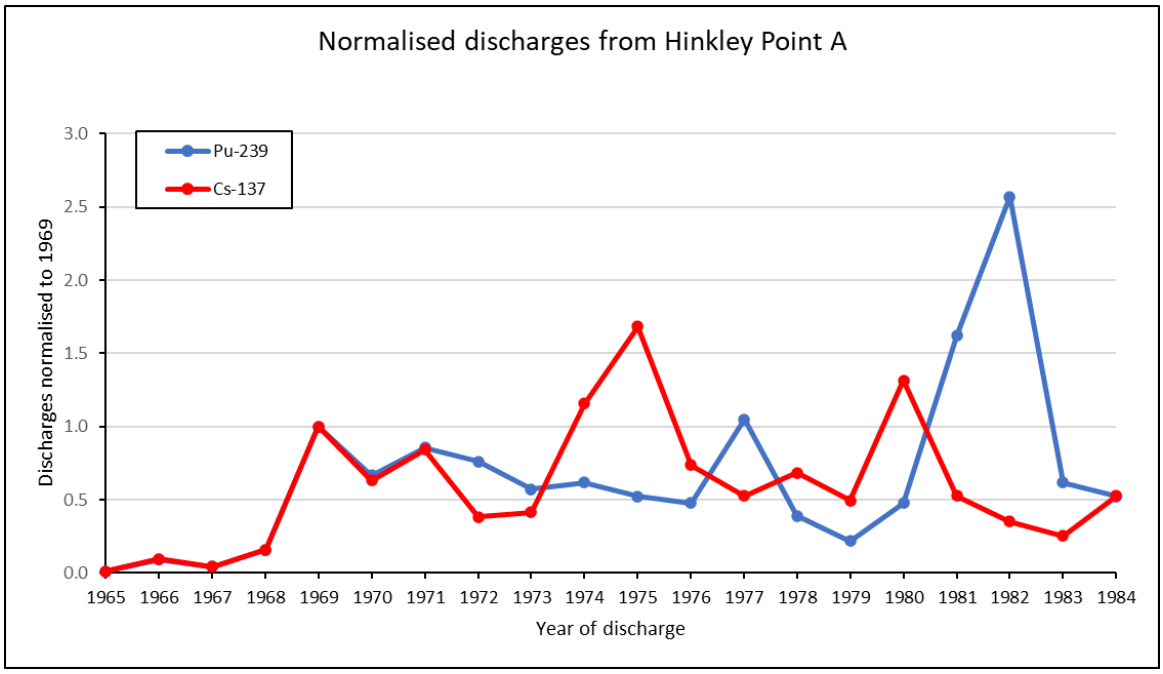
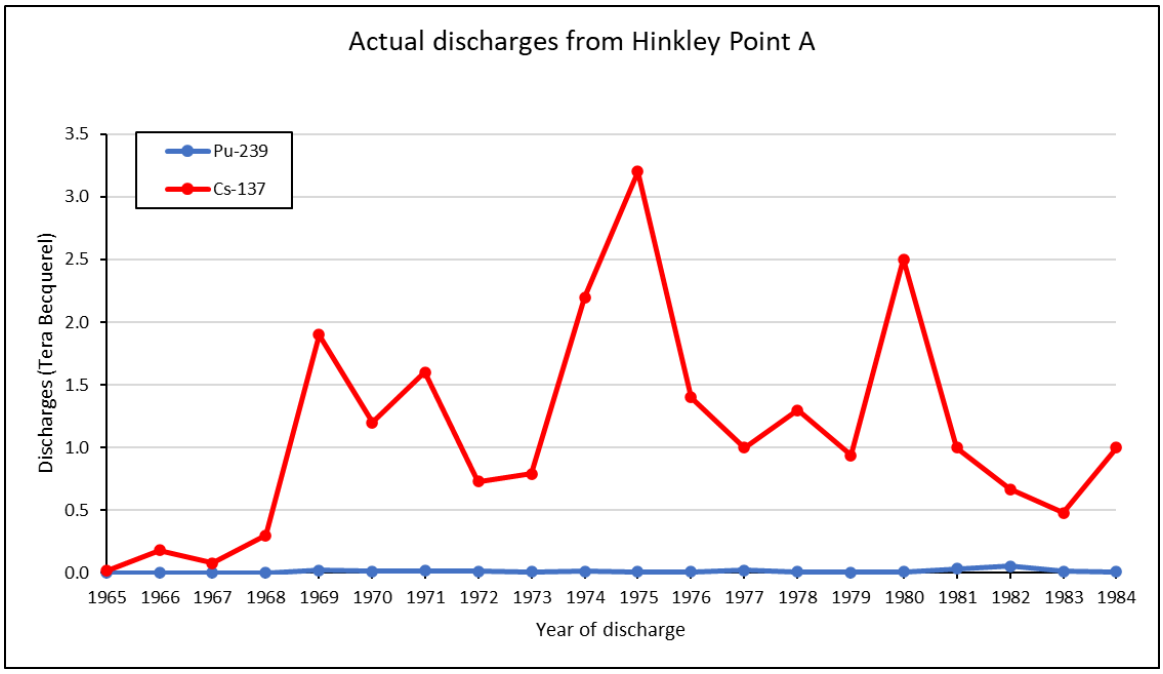


Figure 3.1b. Actual discharges of Plutonium-239 and Caesium-137 from Hinkley Point A. Source: NRPB (1990).



3.3.2 Have the sampling and analysis strategies to assess the radionuclide content of Hinkley Point sediments been robust?

In the case of Cardiff Grounds, the consent to dispose of sediments falls under the jurisdiction of NRW rather than the MMO, but there is no fundamental difference in the marine licence application process. When developing a sampling and analysis strategy to support an application for a marine licence for capital dredging and

disposal, the MMO website[51] recalls that the UK is signed up to the London Convention & Protocol and OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic. Similarly, the NRW website states that material '*must first be analysed for a range of physical and chemical properties, in line with OSPAR guidelines*' before it can deemed suitable for dredging and disposal at sea. The MMO website states that a sediment sampling plan must be agreed with the MMO in consultation with Cefas, which will set out the sample locations as well as the specific biological, chemical and physical analysis required. The NRW website states that the production of an agreed sampling and analysis plan is carried out using external advisors.

OSPAR Agreement (2014-06) states guidelines for the management of dredged material at sea (OSPAR, 2014) and indicates the number of separate sampling stations required to obtain representative results, assuming a reasonably uniform sediment distribution in the area to be dredged: (Table 3.2).

Table 3.2. Indicated number of sampling stations for volumes of sediment to be dredged as per OSPAR Agreement (2014-06) (OSPAR, 2014)

Amount dredged (m^3)	Number of Stations
Up to 25 000	3
25 000 - 100 000	4 to 6
100 000 - 500 000	7 to 15
500 000 - 2 000 000	16 to 30
>2 000 000	extra 10 per million m^3

The OSPAR Agreement (2014-06) further states that

> *'§5.2 A survey of the area to be dredged should be carried out. The distribution and depth of sampling should reflect the size and depth of the area to be dredged, the amount to be dredged and the expected variability in the horizontal and vertical distribution of contaminants. Core samples should be taken where the depth of dredging and expected vertical distribution of contaminants suggest that this is warranted. In other circumstances, grab sampling will usually be sufficient.'*

The MMO includes radiological analysis as one of the types of contaminant analysis that may be required[52], but detailed analytical guidance is only given for other types of contaminants. OSPAR guidelines only list trace metals and organic contaminants as required analytes (OSPAR, 2014), and these are the only types of contaminants

[51] https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

[52] https://www.gov.uk/government/publications/marine-licensing-physical-and-chemical-determinands-for-sediment-sampling/chemical-determinands

that are included on the NRW website[53]. The Group was informed by the MMO that they rarely receive applications for marine licences to dredge and dispose sediment at sea, where the sampling and assessment of radioactive substances are required to be considered.

Cefas stated that '*no radiological assessment (for the purpose of a dredging application) was originally requested or carried out by Cefas'* as part of the analytical contract undertaken in 2009 on behalf of an external client who was working for EDF at Hinkley Point. However, *'in anticipation of a dredging application, Cefas recommended to the customer that both surface and bottom sediment samples be taken to ensure any subsequent radiological assessment was more robust*.'

Cefas stated that

> *'based upon expert knowledge on the sources, environmental concentrations and behaviour of man-made radionuclides in sediment around the UK, gathered from decades of monitoring data, the normal procedure for radiological assessment of dredged sediments is to take surface samples only. The only exception to this is in the vicinity of Sellafield (NE Irish Sea), where sub-surface peaks of artificial radionuclides are known to exist and are potentially radiologically significant. The recommendation to take bottom samples was primarily because naturally occurring radionuclides are known to be the largest contributor to doses (giving significantly higher dose contributions than those from measured/estimated for man-made radionuclides). Secondly, it was also considered prudent to assess the potential effect of the transport of radionuclides from the elevated discharges in the 1970s from Sellafield.'*

The bottom samples collected for radiological analysis in 2009 were taken from depths of between 2 and 5 m below the sediment surface. The results of the radiological analysis (Cefas, 2019) and other contaminant analyses (Cefas, 2011) of these samples and other samples taken at intermediate depths (other contaminants only) would suggest that modern industrial contaminants including man-made radionuclides are only present within the top 1 to 2 m of the sediment in the area sampled. If this is the case, then analysing samples from the bottom of these cores would not have identified any potential effect of the transport of radionuclides from the elevated discharges from Sellafield in the 1970s.

Hinkley Point A and B have discharged a range of radionuclides into the Severn Estuary over their operational and decommissioning lifetimes. The radionuclides discharged have different physical half-lifes and different behaviours when discharged into the marine environment. Discharges of radionuclides with relatively short physical half-lifes would not be expected to contribute significantly to the radiological content of sediments over a period of 50 to 60 years. All radionuclides, both man-made and natural, have distinct chemical behaviours that control their ability to bind to sediments or remain in the water column. The process by which radionuclides bind to sediments is dynamic, meaning that they may be released back into the water column and vice versa at rates specific for an individual radionuclide, its chemical form, sediment type and the environmental conditions (e.g. salinity of overlying water and level of oxygen within the sediment). Strontium-90 has a half-life

[53] https://naturalresources.wales/permits-and-permissions/marine-licensing/sediment-sampling-and-analysis/?lang=en

of 29 years but tends to remain in the water column when discharged to the marine environment. So rather than binding to sediments, discharged Strontium-90 would be transported further afield by ocean currents. Other radionuclides such as Plutonium isotopes, Americium-241 and to a lesser degree Caesium-137 have the ability to bind more readily to sediments, which may allow for a sediment record of historical inputs of these radionuclides, such as discharges from a nuclear facility or fallout from the Chernobyl accident. However, the process of sediment deposition is rarely undisturbed, with biological, physical and chemical processes normally affecting the fate of sediment particles and any radionuclides (or other contaminants) bound to these particles. The Severn Estuary has the highest energy levels of any estuary in the UK, resulting in a continuous vast movement of sediment within the estuary. So, it can be expected that even discharges of those radionuclides that readily bind to sediments would be subject to transport away from the area around Hinkley Point due to the strong tidal currents in the Severn Estuary. The sediments around Hinkley Point will undoubtedly contain man-made radionuclides discharged from nuclear operations at Hinkley Point, but these will not reflect the total discharged activity from the lifetime of Hinkley Point A and B.

The range of activities for the man-made radionuclides Cobolt-60, Caesium-137 and Americium-241 and the naturally occurring radionuclides Radium-226, Thorium-232 and Uranium-238 for sediment sampled off Hinkley Point in 2009, 2013 and 2017 are given in Table 3.3 (Cefas, 2013, 2017, 2019). All values for Cobolt-60 and the majority of values for Americium-241 were below the limits of detection. This does not necessarily imply that these radionuclides are not present in the sediment, but simply that the amount of the radionuclide is below the detection limit for the methodology that has been used. From an examination of the gamma spectral reports for the sediment samples collected in 2017, the only man-made gamma emitting radionuclide that was evident in these samples was Caesium-137. The values and detection limits reported for Cobolt-60, Caesium-137 and Americium-241 in these sediment samples are low as seen in an environmental context. The values reported above detection limits for Caesium-137 and Americum-241 in surface sediment are likely to be mainly due to contemporary discharges from Hinkley Point A and B. Table 3.3 also shows the range of activities for the same man-made radionuclides and naturally occurring radionuclides for sediments sampled off Hinkley Point in 2020 as determined by gamma spectroscopy (Cefas 2021a). The surface sediments collected in 2020 show very similar levels of both man-made and naturally occurring radionuclides as previous surface samples. For sediment cores, maximum levels of Caesium-137 were typically found in the surface samples, with only 12 cores showing sub-surface levels of Caesium-137 above the detection limit. All sub-surface samples showing levels of Caesium-137 above the detection limit were taken from the top 1 to 2 m of the sediment core. There was no evidence of any enhanced sub-surface levels of Cobolt-60 or Americium-241. The Group recognises that these results indicate that the sampling and analysis of surface sediments alone would have provided a conservative estimate of the total radioactive content of the volume of sediment to be dredged.

Table 3.3. Range of activities for man-made and naturally occurring radionuclides in sediments sampled off Hinkley Point (Cefas, 2013, 2017, 2019, 2021a)[1]

		Range of activities in sediment (Becquerel per kg dry weight)					
	Depth	Co-60	Cs-137	Am-241	Ra-226	Th-232	U-238
2009	S	<0.3 - <0.5	1 – 43	<0.4 - <1[a]	16 - 25	22 - 34	31 - 50
	SS	<0.3 - <0.4	<0.3	<0.5 - <1	28 - 74	26 - 41	41 - 7
2013	S	<0.3 - <0.5	7 - 32	0.6 - 3[b]	11 - 25	14 - 34	19 - 46
2017	S	<0.3 - <0.5	13 - 20	<0.6 - <2	20 - 24	27 - 38	42 - 66
2020	S	<0.1 - <0.7	<0.1 - 35	<0.5 - <4[c]	8 - 26	9 - 41	9 - 43
	SS	<0.1 - <0.9	<0.1 - 29	<0.3 - <5[d]	8 - 73	9 - 56	7 - 58

1 - Results as determined by gamma spectroscopy. S - surface sample; SS - Sub-surface sample; a - One value of 0.7 reported above detection limits; b - 3 out of 17 samples with values above detection limits; c - 4 out of 28 samples with values above detection limits; d - 2 out of 137 samples with values above detection limits

Cefas has developed a tiered approach to the radiological assessment of sediments for dredging and disposal (Cefas, 2006), where the initial assessment is based on analysis of sediments by gamma spectroscopy only. As part of this first step, activities of alpha emitting Plutonium isotopes (for use in calculating doses) are estimated from the data for Americium-241 using ratios based on available information. This is a reasonable approach as both Americium-241 and Plutonium isotopes would be expected to behave in similar ways when discharged into the marine environment. In the assessments carried out on Hinkley Point sediments, Cefas have used ratios for Americium-241 to Plutonium isotopes based on Sellafield discharges. According to the tiered approach further steps that would include the analysis of Plutonium isotopes and Americium-241 by alpha spectrometry, would only be warranted if indicated by the initial assessment based on results determined by gamma spectroscopy. The radiological assessment would then be repeated using both gamma and alpha results to determine if the sediment was suitable to be disposed at sea.

As part of the more extensive analysis programme for the samples collected in 2020, 2 grab samples and 3 cores (and some samples from a reserve core) were analysed by alpha spectrometry. Table 3.4 shows the values derived for Americium-241 (average from gamma spectroscopy) and Plutonium-239,240 and Plutonium-238 (estimated from Americium-241 value) that would have been used in any initial assessment compared to the average values for these radionuclides as determined by alpha spectrometry.

Table 3.4 Comparison of values for Americium-241 and Plutonium isotopes that would have been used in initial assessment against average values of these radionuclides as determined by alpha spectrometry

Radionuclide	Average/estimated values that would have been used in initial assessment (Becquerel per kg dry weight)	Average values as determined by alpha spectrometry (Becquerel per kg dry weight)
Americium-241	1.66[a]	0.13[a]
Plutonium-239,240	0.95	0.12[a]
Plutonium-238	0.16	0.017[a]

a - All average values calculated using the full value of detection limit reported.

As can be seen, the average value determined by alpha spectrometry for Americium-241 is more than 10 times lower than the average value determined by gamma spectrometry. Alpha spectrometry is a far more sensitive analytical method, which involves chemistry to concentrate the amount of alpha emitters present in a sample. This can allow for results at levels far lower than possible for gamma spectroscopy. Even though the assumed ratios of Americium-241 to plutonium isotopes are somewhat higher than the real ratios, the actual levels of plutonium isotopes in the sediment are between 8 and 9 times lower than the estimated levels. The Group recognises that the use of data from gamma spectroscopy along with estimated levels of plutonium isotopes for the first step of the Cefas tiered approach (Cefas, 2016) would result in a conservative dose assessment.

3.3.3 Is there evidence for 'hot particles' in sediments off Hinkley Point?

Small high-activity radioactive particles of diameters ranging from around 1 mm down to several micrometres can form and be released into the environment due to accidents and normal operations at nuclear facilities. Such radioactive particles are often referred to as 'hot particles' and their existence has raised concerns when considering the implications and impact of such particles in dose assessments.

According to the IAEA (IAEA, 2011), nuclear fuel particles are rarely detected in discharges during normal operating conditions of nuclear power plants. Nonetheless, particles from failed nuclear fuel elements can be released into the coolant and thus transported to other parts of the power plant. More often, activated metallic particles or corrosion particles can be released to the coolant where they can be transported in and outside the primary circuit. Particles may also be released from spent nuclear fuel assemblies once they have been removed the reactor and stored in storage ponds.

Cefas stated that

> *'the suggestion that large numbers of 'hot particles', containing significant levels of plutonium, would be present in sediments around Hinkley Point is contrary to that observed from environmental measurements over several decades from annual routine monitoring. Unlike at Sellafield, 'hot particles' have not been identified around the Hinkley Point coastline.'*

Cefas further stated that '*gamma spectroscopy is the accepted method for detecting hot particles in the environment (IAEA, 2011)*' and that '*no 'hot particles' have been identified in the Sellafield area that only include pure alpha and beta emitting radionuclides.*' 'Hot particles' from the Sellafield area are classified as either being alpha-rich, beta-rich or Cobalt rich, but all of these contain gamma emitters and usually Caesium-137 which is a beta and gamma emitter. Spent nuclear fuel will contain a number of different plutonium isotopes including Plutonium-238, 239, 240, 241 and 242. Where plutonium is present in any 'hot particle', the radioactive decay of the different plutonium isotopes will give rise to gamma emitting daughter radionuclides (e.g. Americium-241 and Uranium-237) that can be used to indicate the presence of plutonium isotopes. 'Hot particles' containing alpha emitters can be detected by using CR-39 track detectors, but these will be detected by gamma spectroscopy through the additional presence of gamma emitting radionuclides. The analysis that Cefas has carried out as the first step in their tiered approach would have highlighted the presence of any 'hot particles'. None of the sediment samples analysed to date have shown elevated levels of gamma emitting radionuclides that would indicate the presence of activation or plutonium containing 'hot particles'. This is further supported by the alpha spectrometry results from the samples collected in 2020.

3.3.4 Are the assumptions/methodologies used to assess any impact from the radionuclide content of Hinkley Point sediments robust?

Cefas has developed a tiered approach to the radiological assessment of sediments for dredging and disposal (Cefas, 2006) based on guidance and exemption criteria developed by the IAEA. On the basis of any radiological assessment, if the expected effective dose to any member of the public or dredging ships' crew is of the order of 10 micro Sieverts or less in a year and if the expected collective effective dose to the public or dredging ships' crew is not more than 1 man Sievert per year, then the sediment is deemed to contain *de minimis* levels of radioactivity (i.e. it is not considered to be radioactive) and may be disposed at sea if it fulfils all the other criteria. For perspective, the average background dose to the UK population is around 2700 micro Sieverts per year.

For the dose assessment for sediments sampled at Hinkley Point in 2009, 2013 and 2017, Cefas has used the average of the analytical values reported for the man-made and naturally occurring radionuclides. In calculating average values for Cobalt-60 and Americium-241, the Group recognises that Cefas has adopted a conservative approach by using the full detection limit values in those instances where analytical results were reported as being below the detection limit. As stated previously, the initial assessment includes dose contributions from plutonium isotopes, estimated from the gamma results for Americium-241.

The pathways of exposure to members of the dredging ships' crew from man-made and natural radionuclides in the sediment that Cefas have considered are external exposure as well as internal exposure from inadvertent ingestion of sediments and inhalation of resuspended sediments. For the general public, Cefas has considered the ingestion of seafood caught in the vicinity of the disposal site, external exposure to radionuclides deposited on the shore, inadvertent ingestion of beach sediment, inhalation of resuspended beach sediment and inhalation of sea spray. The occupancy time over the course of a single year used by Cefas for the general public on beaches for the dose assessment was 67 days.

The Group recognises that the dose assessment used by Cefas is based on guidance from the IAEA and the International Commission on Radiological Protection (ICRP) which has been developed through international consensus. Differences of opinion on ICRP risk factors have been voiced by the independent European Committee on Radiation Risk (ECRR). For clarification, the ECRR is not a formal scientific advisory body to the European Commission or the European Parliament. It is not within the scope of the Group to comment in detail on these differences of opinion, but it should be noted that the Health Protection Authority (now Public Health England) have previously reviewed the methodology proposed by the ECRR and concluded that it does not have a sound scientific basis (e.g. Mobbs et al., 2011).

3.3.5 From a radiological perspective, can sediments dredged from around Hinkley Point be disposed at sea?

Table 3.5 gives a summary of the dose assessment results based on the analytical results for sediment samples collected off Hinkley Point in 2009, 2013 and 2017. In each case the individual and collective doses derived were below the *de minimis* criteria used by Cefas and developed by the IAEA. In each case, the naturally occurring radionuclides in the sediment gave a higher contribution to the overall dose than detected or estimated levels of man-made radionuclides. The Group recognises that information on the vertical distribution of man-made radionuclides in the sediment off Hinkley Point obtained from the cores sampled in 2020 would indicate that surface sampling alone would give a conservative estimate of the radionuclide content of the total volume of sediment to be dredged. The Group recognises therefore that from a radiological perspective, the sediments that were dredged in 2018 were suitable for disposal at sea according to the London Convention & Protocol. For the sediments sampled in 2020, the individual and collective doses derived from gamma spectrometry data were identical to the doses derived from gamma and alpha spectrometry data. This is because the contribution from alpha emitters to the overall doses is very low. In both cases, the individual and collective doses derived were below the *de minimis* criteria. The Group would expect therefore that from a radiological perspective, the sediments that are planned to be dredged in 2021 would be deemed suitable for disposal at sea according to the London Convention & Protocol.

Table 3.5. Summary of dose assessments based on analytical results for sediment samples collected off Hinkley point (Cefas 2013, 2017, 2019, 2021a, 2021b)

	Individual dose (micro Sievert per year)		Collective dose
	Dredging crew	General Public	(man Sievert per year)
2009	5.6	1.9	0.044
2013	4.8	1.6	0.035
2017	5.8	1.9	0.035
2020 (gamma only)	3.9	1.2	0.038
2020 (gamma and alpha)	3.9	1.2	0.038
De minimis criteria	10	10	1

3.3.6 Has there been any impact on levels of radionuclides around Hinkley Point from construction work at Hinkley Point C?

Geiger Bay and Tim Deere-Jones have both raised concerns of increased levels of (and doses from) man-made radionuclides in the marine environment around Hinkley Point following the construction work on Hinkley Point C. In particular, potential increases in the level of Americium-241 in sediments around Hinkley Point have been highlighted. Tim Deere-Jones submitted the data for levels of Americium-241 in sediments around Hinkley Point as taken from the RIFE reports for 2016 to 2018 (Environmental Agency et al., 2017 to 2019), stating that at the different sampling sites there had been between a 24% and 158% increase in values for 2018 compared to 2016 (Table 3.6). It should be noted that all the reported values are detection limits and all the stated detection limits are low in an environmental context. Using the full value of any of the detection limits in Table 3.6 in the Cefas dose assessment methodology would not result in any dose above the *de minimis* criteria. Stating that values have increased by a certain percentage has little meaning when such values are low in the first place. Furthermore, there are a number of other factors that should always be considered when comparing changes in low environmental levels, particularly when such values are reported as detection limits. As stated previously, data reported as detection limits does not imply that the radionuclide is not present in the sample, but simply that the amount of the radionuclide is below the detection limit for the methodology used. Detection limits for gamma spectroscopy can be influenced not only by the amount of the radionuclide in the sample, but by the amount of sample analysed, how long the sample is analysed as well as the type of detector used. More importantly, there will always be an inherent variation in environmental levels when sampling at the same site over a long time period. Changes in inputs of radionuclides can impact on environmental levels, but environmental factors such as storm events that can result in the movement of large volumes of sediment can also influence the levels of man-made radionuclides in surface sediments over time.

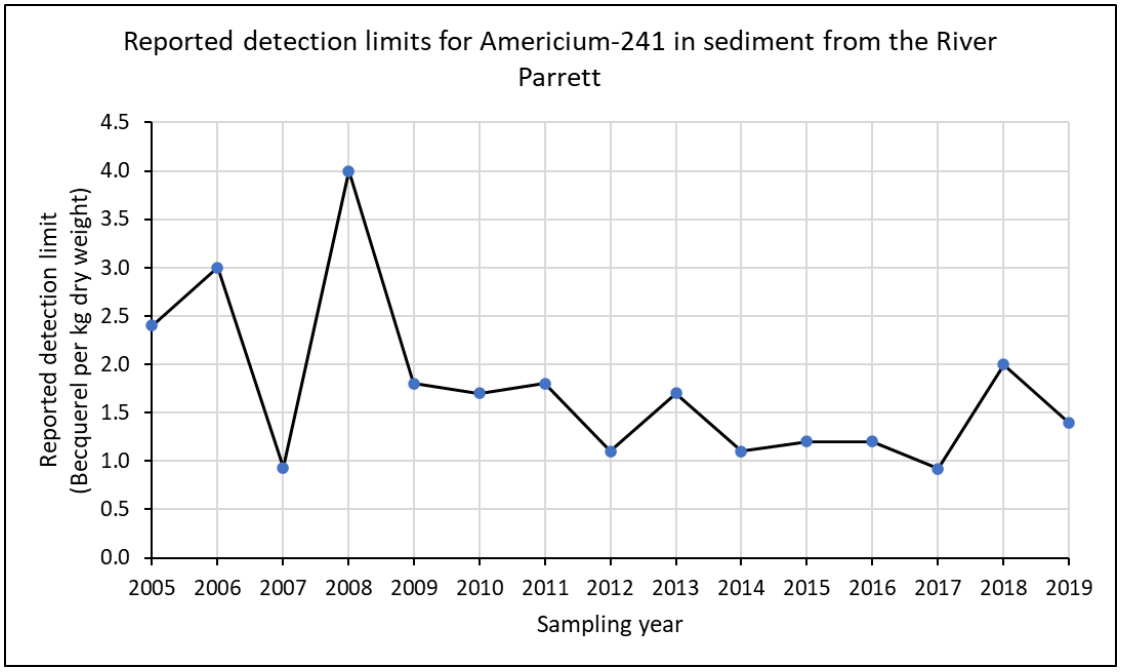
Table 3.6 Americium 241 in sediments (Becquerel per kg dry weight) from sampling sites around Hinkley Point between 2016 and 2018 (Environment Agency et al., 2017 to 2019).

Sampling Site	2016	2017	2018
Pipeline	<0.50	<0.69	<0.78
Stolford	<0.66	<0.79	<1.70
Steart Flats	<0.52	<0.66	<0.88
River Parrett estuary	<1.20	<0.92	<2.00
River Parrett Bridgwater	<0.65	<0.78	<1.60
Weston	<0.38	<0.48	<0.47
Burnham	<0.37	<0.45	<0.54

Looking at the time series of Americium-241 in sediment at the River Parrot sampling station over a longer time period from 2005 to 2019, all values were reported as detection limits as was the case for all other sampling stations in the area around Hinkley Point (Environment Agency et al., 2006 to 2020). Over the entire period from 2005 to 2019, there was far greater variation in the reported detection limit than over the period from 2016 to 2018 (Figure 3.2).

The Group recognises that it is not really possible to conclude anything from the observed variation in these detection limits, other than that all the reported values are low.

Figure 3.2 Reported detection limits for Americium-241 (Becquerel per kg dry weight) in sediment from the River Parrott between 2005 and 2019 (Environmental Agency et al., 2006 to 2020).



3.4 Advice

One of the main reasons for convening the Group originally was over public concerns that sediment from Hinkley Point may pose a radiological health and environmental risk when disposed in Welsh waters. However, the Group was reassured by the analytical results for sediment samples collected off Hinkley Point in 2009, 2013, 2017 and in 2020, when samples were taken from different depths in the sediment to be dredged and when these samples were analysed for both gamma and alpha emitting radionuclides. Based on the samples collected in 2009, 2013 and 2017, the individual and collective doses derived were below the *de minimis* criteria used by Cefas and developed by the International Atomic Energy Agency (IAEA) (i.e. the sediments were not considered to be radioactive). In each case, the naturally occurring radionuclides in the sediment gave a higher contribution to the overall dose than detected or estimated levels of man-made radionuclides. The Group recognises therefore that from a radiological perspective, the sediments that were dredged in 2018 were suitable for disposal at sea according to the London Convention & Protocol. For the sediments sampled in 2020, the individual and collective doses derived from gamma analysis were identical to the doses derived from gamma and alpha analysis. This is because the contribution from alpha emitting radionuclides to the overall doses is very low. In both cases, the individual and collective doses derived were below the *de minimis* criteria. The Group would expect therefore that from a radiological perspective, the sediments that are planned to be dredged in 2021 would be deemed suitable for disposal at sea according to the London Convention & Protocol.

However, it is apparent to the Group that there is a lack of guidance on the MMO and NRW website for situations where radioactive substances need to be addressed in any required sampling and analysis plan to support a marine licence application to dredge and dispose of sediment at sea. Although there is detailed information on the MMO website for the sampling, analysis and assessment of trace metal and organic contaminants, there is no such similar guidance for radioactive substances. Radiological analysis is not even mentioned on the NRW website as one of the types of contaminant analysis that may require consideration. Such guidance should cover the situations where surface sampling for radioactive substances would be sufficient, when sub-surface sampling is required for other contaminants as set out in OSPAR Agreement (2014-06) §5.2.

Advice 1. The Group suggests it would aid prospective marine licence applicants and stakeholders alike if guidance could be included on the Marine Management Organisation and Natural Resources Wales websites as to;

a) when radioactive substances should be considered as part of any sampling and analysis plan

b) what sampling, analysis and assessment might be required for radioactive substances, including the need, or not, to take samples at different depths.

Issues relating to radioactivity in general often cause concern for the general public. The subject can be very emotive and difficult to understand without expert knowledge, particularly with regard to exposures to low levels of radioactivity and the degree of health or environmental risk. Good and clear communication to the general public to improve the understanding of risk perception related to any radiation exposure is as important as it is challenging. In the case of Hinkley Point, the Group recognises that data from cores taken in 2020 supports the expert knowledge and view of Cefas that '*the normal procedure for radiological assessment of dredged sediments is to take surface samples only*'. However, as part of the communication process to stakeholders in situations such as Hinkley Point, consideration should be given to demonstrating that sub-surface distributions of radionuclides are not of concern where such information is not already available.

Advice 2. The Group suggests that when developing a sampling plan for radioactive substances in support of an application for a marine license to dredge and dispose sediment at sea, there can be value in demonstrating that sub-surface distributions of radionuclides are not of concern, if appropriate and where such information is not already available.

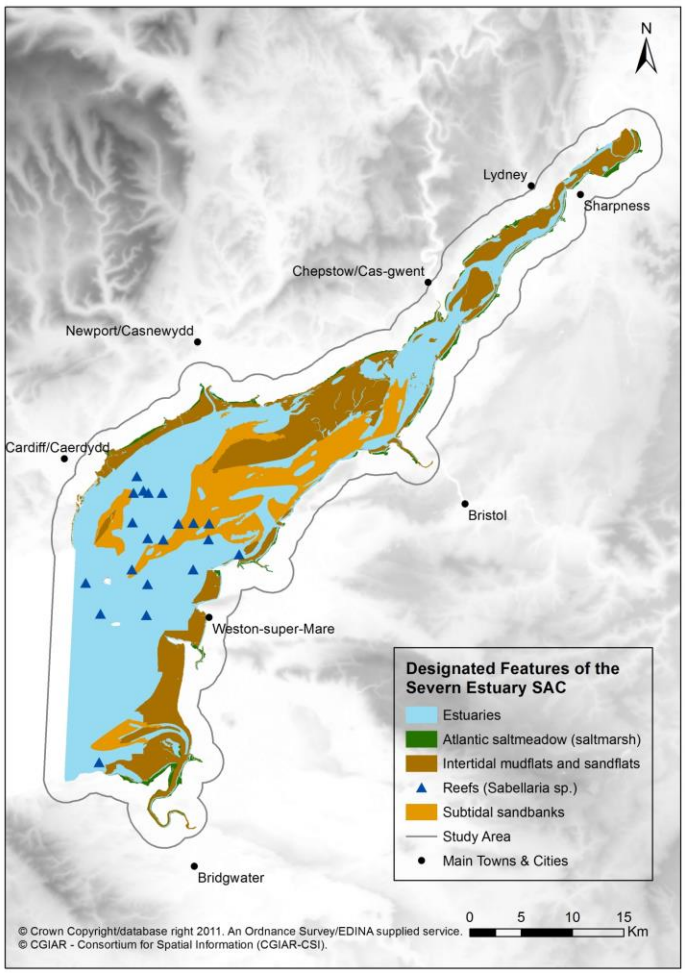
Chapter 4

Modelling Studies and Cardiff Grounds Disposal Site

4.1 Introduction

This chapter will firstly report on the modelling studies undertaken by Cefas to assess the predicted effects of a new nuclear power station, being built at Hinkley Point C, on the water quality characteristics in the Severn Estuary and Bristol Channel. The modelling studies were undertaken by Cefas (commercial arm under the BEEMS programme) and hereinafter referred to as Cefas (commercial), and used for advisory purposes to government agencies by Cefas (advisory). The studies are described in two reports provided to the Hinkley Point C Stakeholder Reference Group (the Group) by Cefas (commercial) including: TR186 2011, and Version 2, Edition 2, TR267 (undated). Secondly, this chapter will review the suitability of the Cardiff Grounds marine disposal site, in terms of accommodating the future quantity of sediments proposed for disposal at this site. Consideration will be given to the likely impact of the sediments remaining in the Severn Estuary, as desirable to meet the requirements of the Severn Estuary Special Area of Conservation (SAC), with its extent being shown in Figure 4a below.

Figure 4a. Boundaries and Designated Features of the Severn Estuary SAC



4.2 Background

In 2010 the UK Government announced eight sites for new nuclear power stations across the UK, with Hinkley Point C (HPC) being one of these sites. In November 2012 a nuclear site licence was granted and in July 2016 the EDF Board approved the project, subsequently approved by the UK Government in September 2016. In the meantime, Cefas (commercial) reported in July 2011 on the details of a modelling study to predict the impact of a proposed cooling water discharge from HPC on the receiving water quality in the Bristol Channel and Severn Estuary, with the impacts being considered for HPC, being operated both as a standalone power station and in combination with Hinkley Point B. The report of this study, Cefas TR186, was provided to the Group, with a higher resolution model study being submitted to EDF in January 2017 and November 2020, and subsequently made available to the Group.

The main concern relating to the hydro-environmental impacts from the HPC power station, affecting the ecology of the Severn Estuary, relate to the typical discharge from the cooling water outfall being 125 m^3/s and with the discharge temperature rise being typically 11.6^{o}C above the intake temperature. This is a relatively large heat flux to be discharged from a power station into an estuary. To put this discharge into perspective, this is approximately six times the mean flow in the River Taff, at Pontypridd, where the mean discharge is 20.9 m^3/s[54].

Another concern relating to the impact of HPC on the Severn Estuary ecosystem relates to plans by EDF to carry out further licensed dredging of sediments off Hinkley Point and dispose of these sediments at either Cardiff Grounds (LU110) or Portishead (LU070) disposal sites for dredged material, as outlined in Chapter 1. In 2018 licensed dredging was approved by Natural Resources Wales (NRW) to dispose of 156,351 m^3 of sediment at Cardiff Grounds. In 2021, and as part of the works to construct the cooling water intakes and outfalls, EDF plan to dispose of up to a further 470,000 m^3 (i.e., close to three times the amount licensed in 2018) at Cardiff Grounds or Portishead sites.

This chapter reviews the evidence made available to the Group and advises on three key potential concerns, including: (i) the original modelling studies undertaken by Cefas (commercial) in 2011, (ii) the subsequent finer resolution General Estuarine Transport Model (GETM) modelling studies, and (iii) the suitability of the Cardiff Grounds disposal site to receive a substantial amount of further dredged sediments and whether this additional sediment load is likely to remain within the Severn Estuary. It is noted that the modelling studies referred to in (i) and (ii) above were undertaken by Cefas (commercial) and then subsequently audited by Cefas (advisory) in advising regulatory authorities on the impact of HPC on the estuarine environment. We comment in Chapter 6 on the desirability of removing the perception of conflict which can surround this arrangement and the lack of an independent audit.

[54] NRFA Station Mean Flow Data for 57005 - Taff at Pontypridd (ceh.ac.uk). Accessed on 15 February 2021.

4.3 Assessment of Original Hydro-environmental Modelling Study, Cefas TR186

The original report provided by EDF and their modelling contractor Cefas (commercial) to the Group, relating to the hydro-environmental and ecological modelling studies undertaken to assess the impacts of the new HPC nuclear power station, is entitled: Predicted Effects of New Nuclear Build on Water Quality at Hinkley Point[55]. This report: "summarises as at July 2011: (a) The understanding of UK legislation that relates to aspects of the water quality that may be influenced by the development and operation of the proposed --- (HPC); (b) The potential areas of uncertainty with respect to compliance with existing or possible future regulation; and (c) An evaluation of the compliance of the proposed HPC cooling water discharge with water quality standards both stand alone and in combination with HPB using results of the Stage 3a modelling."

The main environmental and ecological impact from the outfall of HPC relates to the predicted thermal plume from two outfalls, located approximately 1.8 km offshore from HPC, with cooling water being supplied from four intake tunnels located approximately a further 1.7 km offshore. The typical total discharge through the tunnels would be 125 m^3/s, and with the temperature rise of the discharge from the outfalls being approximately 11.6^oC above the intake temperature. Two numerical model studies were undertaken to assess the hydro-environmental and ecological impact of the thermal discharge on the estuarine receiving waters, including: a Delft3D model study, subcontracted to ABPMer, and a Generalised Estuarine Transport Model (GETM) study undertaken by Cefas (commercial).

In the first instance, in undertaking a major hydro-environmental modelling study to assess the impact of a new build structure on the estuarine ecology and water quality etc. it is increasingly common practice, both in the UK and internationally, for such highly technical computational modelling studies to be reviewed by an independent expert, or group of experts, in the field. This is deemed to be particularly important when the scale of the project and its potential environmental and ecological impacts are of general public concern. The predictive results of such complex computer modelling studies are crucial to the design and operation of large-scale projects and particularly with regard to establishing the impact of the project on the estuarine and/or coastal environment. For example, in the UK it is now common practice for water companies (such as Dŵr Cymru Welsh Water) to have hydro-environmental modelling studies audited by an independent assessor for bathing water compliance studies. Furthermore, in a not dissimilar project to HPC (in terms of being high profile and of general public concern), in the International Tribunal for the Law of the Sea (ITLOS) Malaysia v. Singapore land reclamation dispute[56], in its Order of 8th October 2003, ITLOS prescribed that Malaysia and Singapore cooperate and jointly establish a group of 4 international experts to oversee a major hydro-environmental impact assessment study of Singapore's proposed land reclamation on the Malaysian coast. This major modelling study covered an assessment of the impacts of the reclamation on all aspects of the hydrodynamics, water quality, morphology and ecology on the estuarine and coastal receiving waters. The detailed

[55] Cefas, "Predicted Effects of New Nuclear Build on Water Quality at Hinkley Point", TR186, September 2011, pp. 148.

[56] Hean, C.K., Koh, T. and Yee, L. Malaysia & Singapore the Land Reclamation Case. Strait Times Press Pte Ltd. 2013, pp. 122.

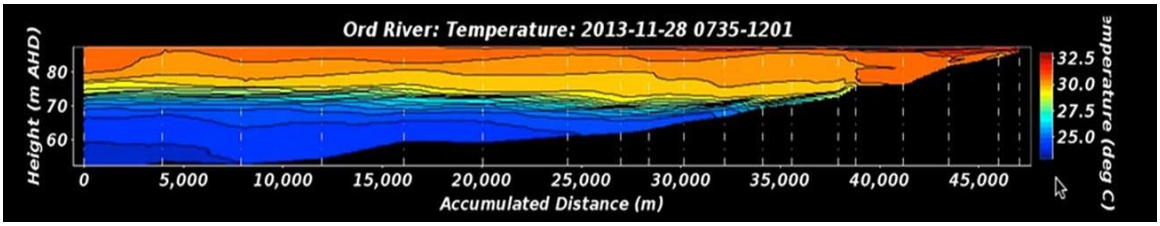
modelling studies lasted just over a year, with many detailed technical reports being made available in the public domain. For such a high profile and major new build nuclear power station, i.e., HPC, it is therefore surprising that the complex modelling studies were not overseen from the onset by either an individual independent expert or, preferably, a small group of experts. It appears from discussions between the Group and EDF and Cefas that in this case the modelling review was undertaken by Cefas (advisory). We believe that this arrangement raises understandable public concern about the degree of independence of the review process.

In reviewing the model studies and outcomes reported in Cefas TR186, a number of key concerns arise and are summarised below (in the order documented in the report):

- In the ITLOS EIA modelling studies outlined above, only 3 internationally recognised commercial models were deemed to be appropriate for such a high-profile project, including: Mike21 and Mike 3 (developed by the Danish Hydraulic Institute - Dhi), Delft2D/3D (developed by Deltares, the Netherlands) and TELEMAC (developed originally by EDF and now HR Wallingford). Likewise, in similar EIA studies in the UK these three models are increasingly deemed to be the most appropriate models to be used for such studies. It is therefore not clear why one of these internationally recognised models was not used from the outset for this high profile EIA modelling study.
- In the studies reported in Cefas TR186 two modelling studies were undertaken, namely Delft3D and GETM. However, it is not clear why two similar modelling studies were undertaken in parallel, rather than focusing resources on using one model and predicting the impacts for a finer grid resolution and for longer simulation times.
- In the report provided to the Group very limited details are provided of the model studies. In particular, no information is given on the grid structure, the location and details of the open boundary conditions (i.e., does the model go to the Continental Shelf and the Severn Estuary tidal limit?) etc.
- Within the model domain details are given in general terms of the grid sizes. This includes, in the GETM model, a ‘100 m x 100 m horizontal resolution and 20 layers in the vertical over the entire Severn Estuary, whereas the Delft3D model has a 50 m x 50 m grid resolution close to the intake and outfall structures, and 8 layers in the vertical’. However, again it is not clear if the horizontal resolution in the GETM model goes all the way up the Severn Estuary to the tidal limit. Also, the resolution in the region of the outfall is relatively coarse for such a high-profile project. Likewise, for the Delft3D model it is not clear where the 50 m grid resolution starts, relative to the outfall and intake, and how information was transferred from the coarse to the fine grid domain, assuming it was a structured vis-à-vis unstructured grid. For example, no information is provided as to how various fluxes were transferred and conserved normally, and particularly tangentially, from the coarse to fine grid domains.
- No details are provided as to the treatment of the outfall itself. This is key to the model predictions as it is important to predict the thermal plume characteristics as accurately as possible, particularly when discharging such a high flow and temperature increase into a relatively large grid size (even at 50 m x 50 m). It is also not clear as to why, in the GETM model, the assumption was made in

representing the outfall plume, which was assumed to discharge evenly at all depths under the assumption that the water column would be fully mixed'. This assumption is questionable, as comparable studies reported in the literature for somewhat similar studies show significant stratification for thermal plumes, with such plumes only mixing slowly through the vertical water column when plume dynamics is included[57] – see the example below from Imberger for the River Ord, discharging seawards through Lake Argyle, in Western Australia, and compare this typical sharp thermal front with the predicted excess temperatures, for a much larger temperature gradient, shown in the Cefas report (Figure 17) and where there is limited evidence of stratification.

Figure 4b Plot of a thermal plume from the river Ord, with a flow of 125 m^3/s



- No details are provided in the report of the crucial bed roughness values included in the model or comparisons to check the level of accuracy in the related predictions of the tidal currents. Such calibration and validation simulations (conventionally for spring and neap tides respectively) need to be reported for sites located in the region of interest, near the outfall, as well as across the domain, i.e., from the seaward to landward boundaries. Furthermore, the bed roughness representation affects the vertical eddy viscosity distribution and governs the vertical diffusivity of heat and thereby the characteristics of the thermal plume. In contrast to the pronounced stratification shown in Figure 4a, obtained for a similar discharge, but a much smaller temperature difference, the widely publicised CAEDYM model shows a much more extensive and preserved thermal plume than that shown in Figures 17, 20 and 21 of the Cefas TR186 report. These results raise concerns about the model set-up (particularly at the outfall site) and its accuracy in predicting the corresponding extent of the thermal plume in the receiving estuarine waters.
- No details are given in the report of the surface heat exchange coefficient used in the models. It is important that an independent reviewer can assess the dependence of this parameter on various local conditions, and the sensitivity of the plume characteristics to the assumed coefficient. In particular, the size of the plume predicted in Figures 20 and 21 appears to be rather small, bearing in mind the relatively large heat flux from the outfall and, whilst it is unlikely that this plume would have a significant impact in terms of raising the estuarine water temperatures along the Welsh coast, the area along the south and east coast of the Bristol Channel and Severn Estuary is understood to be a breeding ground for various fish species, and hence it is desirable to ensure that the thermal plume is predicted accurately, as this could have an impact on fish migration pathways and thereby the ecological status and sustainability of the Severn Estuary.

[57] Luketina, D.A. and Imberger, J. 1987, Characteristics of a surface buoyant jet. *Journal of Geophysical Research.* 92(5), 5435-5447.

- No detailed information is provided in the report as to how decay rates for total residual oxidant (TRO) and other water quality indicators were obtained, other than in general terms. For example, the value for the half-life of TRO is cited as 784 s (or 13 min) on page 57 of the report, but this seems to be relatively short compared to several comparable studies reported in the literature, such as Richardson et al[58], with such a short half-life potentially unduly reducing local concentrations. Again, sensitivity comparisons would have been more reassuring.
- No details are given in the report on several key kinetic and heat flux processes represented in the modelling studies. For example: (i) the heat flux at the free surface will be highly dependent on the local ambient air temperature and which will be diurnal and vary with irradiation etc.; (ii) the diffusion and dispersion of the buoyant plumes in the transport equation will be dependent on the plume dynamics and the spatially varying eddy diffusivity and dispersion within each layer; (iii) the decay rates for various water quality indicators are likely to change markedly with salinity, turbidity and irradiance (leading to significant differences between night and day-light conditions); etc. For these examples it is again not clear as to how these complex processes were represented in the model studies and all, or many, of which could cumulatively affect the predicted thermal plume characteristics.

4.4 Assessment of the Subsequent Hydro-environmental Modelling Study Cefas TR267

Following concerns expressed by the Group about the modelling studies reported in TR186, at a meeting with EDF and the Cefas (commercial) team that had carried out the modelling studies on 16th November 2020, Cefas subsequently provided details of additional modelling studies, reported in an undated report, numbered TR267, first drafted in 2013 and submitted to EDF in 2017[59]. This report presents “the setup and validation of a 25 m resolution General Estuarine Transport Model (GETM) model of Hinkley Point”. This edition of the report “presents the results of annual model runs for HPB and HPC, together with additional validation results from the annual model runs”.

In the Executive Summary of the report, Cefas advise that “a detailed evaluation of the GETM model performance --- concluded that the GETM model was fit for purpose for modelling the Hinkley Point C thermal plume but indicated that the thermal predictions for the GETM model overestimated the far field thermal impacts at the seabed”. These findings are consistent with the concerns expressed about the previous model report and the assumption that the thermal plume is well-mixed at the outfall site. To overcome these over predictions of thermal impacts, Cefas decided to run the model at a finer grid resolution ‘due to insufficient model resolution, leading to incorrect estimates of the initial plume mixing’. ‘In particular, it was noted that the 100 m model resolution was considered insufficient to accurately model the HPB plume – in the vicinity of the HPB discharge culvert and that --- it did

[58] Richardson, L.B., Burton, D.T., Helz, G.R. and Rhoderick, J.C. 1981. Residual oxidant decay and bromate formation in chlorinated and ozonated sea-water. *Water Research.* Vol.15, 1067-1074.

[59] Cefas, “Hinkley Point: GETM Plume Model 25m model setup, validation and results of annual model runs for HPB and HPC”, TR267, Undated, pp. 69.

not produce the expected amount of plume stratification close to the outfall'. This finding is not surprising compared to the predictions of Imberger (Figure 4a); an independent expert review of the modelling from the onset could have raised concerns about the representation of the outfall in the original model at an earlier stage.

As stated in the report 'the validation study shows that the 25 m GETM model represents a significant improvement over the previous model, producing equivalent hydrodynamics (as expected), but with a much more realistic stratification of the discharge plume'. The method of representing the discharge of the plume at the outfall site by assuming 'that the vertical column over the cell over which the outfall is located is well mixed' remains a simplified representation of a very complex buoyant plume trajectory. Comparable studies of thermal plumes generally use more sophisticated and accurate representations of plume dynamics through the use of plume models, such as the CORMIX model, now provided by the US Environmental Protection Agency (USEPA)[60].

In reviewing the model setup of the 25 m model of Bridgwater Bay reported in Cefas TR267, further key concerns arise and are summarised below (in the order documented in the report):

- The fine grid 25 m model, presumed to be a structured grid, only covers a relatively small plan-surface area of the Bristol Channel and Severn Estuary, with no details being provided as to how key fluxes are conserved, particularly tangential to the boundary, between the coarse and fine grid domains. Full momentum conservation across linked models can commonly be challenging in structured grid models, with unstructured grid models generally being conservative and enabling a higher grid resolution at sites of interest, such as an outfall. Furthermore, for the model shown in Figure 4, page 9, the graphs suggest that the landward boundary is in the highly tidal region of the Severn Estuary and close to the Second Severn Crossing. If correct, it is not clear why this model boundary was not taken to the tidal limit, near Gloucester, thereby being driven by the river flow and ensuring a more precise boundary condition and particularly in an estuary where tidal resonance is pronounced.
- In general, and as expected, the predictions obtained from the finer grid model, particularly with regard to the thermal plume characteristics, give better results than those reported using the previous grid resolutions, i.e., Cefas TR186. Nevertheless, and as for the earlier model, several key points relating to missing information to assess the details of the processes included in the model remain.
- A comment is provided in the report on page 10 about the bottom roughness, where the value used was '0.005 m'. This value equates to a Nikuradse sand grain roughness of 5 mm, which is unduly small for an estuary with such a complex bathymetry. Comparable estuarine studies in the literature suggest that a more realistic bottom roughness value would be typically about 0.2 m, representing the more dominant form drag roughness associated with ripples and dunes, rock outliers, gravel etc. on the estuary bed. Accurate predictions of the hydrodynamics in a long estuary (such as the Bristol Channel and Severn Estuary) are generally highly dependent on the bed friction coefficient. Engineers

[60] www.cormix.info. USEPA. Accessed on 15 February 2021.

frequently work with a Manning roughness coefficient for bed friction. In an estuary region with a typical depth of 10 m and a mean current of 1 m/s (values typical of the region around the outfall site), a roughness value of 0.005 m would equate to a Manning roughness coefficient of 0.014, which would represent the bed friction for uniform flow 'in smooth straight canals lined with concrete', as given in Chow[61] - regarded as a classic text in this field. In contrast the 'normal' Manning coefficient for a canal described as: 'clean, straight, full stage, no rifts or deep pools' and with 'more stones and weeds' is quoted as being greater than 0.03. This is consistent with minimum values measured in the Conwy Estuary[62] and more recently in south San Francisco Bay[63]. For the same flow conditions as before, this would give a bottom roughness value of 0.24 m, or 240 mm. Such a difference in the bottom friction would be expected to have a noticeable impact on the hydrodynamic predictions, the turbulence characteristics and mixing, and the predicted plume and water quality characteristics in the region.

- Another comment reported on page 10 is that 'the critical and minimum depth allowed in the drying and flooding schemes were 0.5 and 0.2 m, respectively'. These are rather limiting values, particularly for drying, and presumably mean that a grid cell is removed from the domain when the grid cell depth is less than 0.5 m. In comparison with flooding and drying algorithms included in the models developed at Cardiff University, the minimum depth requirements, both for flooding and drying, are typically twice the bed roughness height[64], i.e., 0.01 m for the roughness height of 0.005 m used in the GETM model. The Severn Estuary basin experiences extensive flooding and drying, due to the high tidal ranges, and particularly along the inter-tidal mudflats in the Severn Estuary SAC. If drying cells are removed too early, or flooded too late, in the tidal cycle, then the true plan-surface area is reduced and the tidal currents and mass fluxes in the region are also reduced, thereby potentially giving different predictions of the local tidal currents, tidal excursion, and sediment and concentration levels.
- Whilst the fine grid model does not appear to raise concerns about the thermal plume from HPC affecting the surface water temperatures along the Welsh coast, any impacts on fish migration up the Severn Estuary may be of concern regarding ecological sustainability of the estuary SAC in the future.

4.5 Suitability of Cardiff Grounds for Disposal of Dredged Sediments

As stated in Chapter 3, in 2018 EDF carried out licensed dredging of sediments off Hinkley Point and disposed of these sediments at Cardiff Grounds (disposal site LU110). NRW approved the final disposal of 156,351 m^3 of sediment at Cardiff Grounds in 2018. EDF has since applied to NRW to carry out further dredging and

[61] Chow, V.T. Open Channel Hydraulics. McGraw-Hill Book Co. Inc. 1960. pp.680.

[62] Knight, D.W. 1981. Some field measurements concerned with the behaviour of resistance coefficients in a tidal channel. *Estuarine, Coastal and Shelf Science,* 12(3), 303-322.

[63] Egan, G. et al. 2019. Observations of near-bed shear stress in a shallow wave- and current-driven flow. *Journal of Geophysical Research: Oceans*, 124, 6323-6344.

[64] Falconer, R.A. and Chen, Y.P. 1991. An improved representation of flooding and drying and wind stress effects in a 2-D tidal numerical model. *Proceedings of the Institution of Civil Engineers, Part 2, Research and Theory.* 91(4), 659-678.

disposal in 2021 with up to an additional 470,000 m^3 of sediment being discharged either at Cardiff Grounds and/or Portishead. As also stated in Chapter 3, Hinkley Point lies just within the SAC, illustrated in Figure 4a, and sediment dredged within the SAC should be disposed of within the Severn Estuary SAC, as stated in The Hinkley Point C Development Consent Order 2013 (DCO): "PW23 Dredged material arising from the authorised project shall not be disposed of except within the Severn Estuary Special Area of Conservation"[65]. Cardiff Grounds and Portishead both lie within the Severn Estuary SAC shown in Figure 4a.

To put this quantity of sediment proposed for disposal at Cardiff Grounds in 2021 by EDF into perspective, this volume would equate to 33 rugby pitches (each of area 7,000 m^2) placed side by side and covered with sediment to a depth of 2 m (i.e., the height of a tall adult). Although this seems a relatively large volume of sediment, this volume is approximately only 50% of the typical volume licensed annually by NRW for disposal by other organisations at this site. The public concern about the level of contamination of the dredged sediments from Hinkley Point has been dealt with in the previous chapter. In this section consideration will focus on the suitability of Cardiff Grounds to be used as a dispersive disposal site in the longer term, particularly in the context of complying with the DCO and the requirement to dispose of dredged material within the Severn Estuary SAC. In an accompanying note to the Active Marine Licences relevant to LU110, and provided by NRW to the Group, NRW advise that: "based on the current evidence made available to NRW, the LU110 (Cardiff Grounds) disposal site is behaving in a dispersive nature and operating as a sustainable disposal site, as the Severn Estuary is naturally highly dynamic".

In a paper prepared by Group members for the fourth (October) meeting of the Group, it was reported that 'to maintain the health of an aquatic ecosystem, it is important to retain sediment within the same hydrodynamic system', as required in the DCO, i.e., any sediments dredged within the Severn Estuary SAC should remain within the Severn Estuary. In 2020 Cefas (advisory) completed a review of Welsh disposal sites and reported on modelling studies of sediment plume trajectories from Cardiff Grounds[66]. The paper also reports that the NRW pre-application advice states that: "whilst it is impossible to guarantee no single particle from LU110 (Cardiff Grounds) will ever reach the Penarth/Barry coastline, material disposed will join the naturally highly dynamic region off Cardiff and move in a general North East direction towards the long-term sinks of the Newport Deeps and River marches". The report also goes on to state: "In addition, the WNMP (Welsh National Marine Plan) notes that whilst there is a requirement to ensure adequate provision for port access and disposal sites, beneficial use of dredged material is to be encouraged. Beneficial use in this case may include, but is not limited to, retaining sediment within the natural sediment system to support sediment-based habitats, shorelines and infrastructure (known as Sustainable Deposit), as well as habitat restoration, beach nourishment, and shoreline stabilisation/protection".

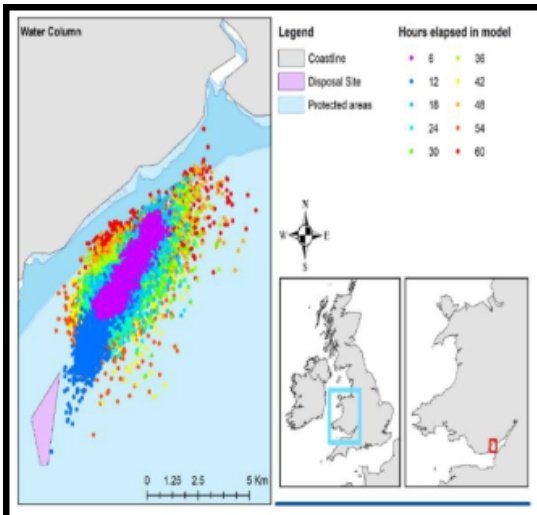
The modelling results from previous studies and the summary for Cardiff Grounds disposal site, within the Severn Estuary, are summarised in Table 4a below. These modelling results are, in key respects, at variance with several different hydrodynamic model studies undertaken for the Bristol Channel and Severn Estuary,

[65] https://www.legislation.gov.uk/uksi/2013/648/contents/made, Accessed on 3 March 2021.

[66] Cefas, "Welsh Disposal Site Review", C6268U, March 2021, pp. 70.

using Cardiff University's 2-D and 3-D models, as well as using (or overseeing) widely used commercial models, including TELEMAC and Delft 3D (operated in 2D mode).

Table 4a. Modelling results and summary for Cardiff Ground disposal site



LU110 - Cardiff Grounds

- 650,000 tonnes per annum (average) with a maximum of 1,022,874 tonnes in 2011.
- Within Severn Estuary SAC.
- Material remains largely within the water column and is retained within 10km of the site.
- Dispersive site.
- Plume spreads northeast, overlapping with boundaries of Severn Estuary SPA, SSSI and Ramsar site.
- Proximity to coastline may mean site is further influenced by other factors such as wave dynamics.
- Recommendation by review: further investigation into the sensitivities of the protected area features may be beneficial.

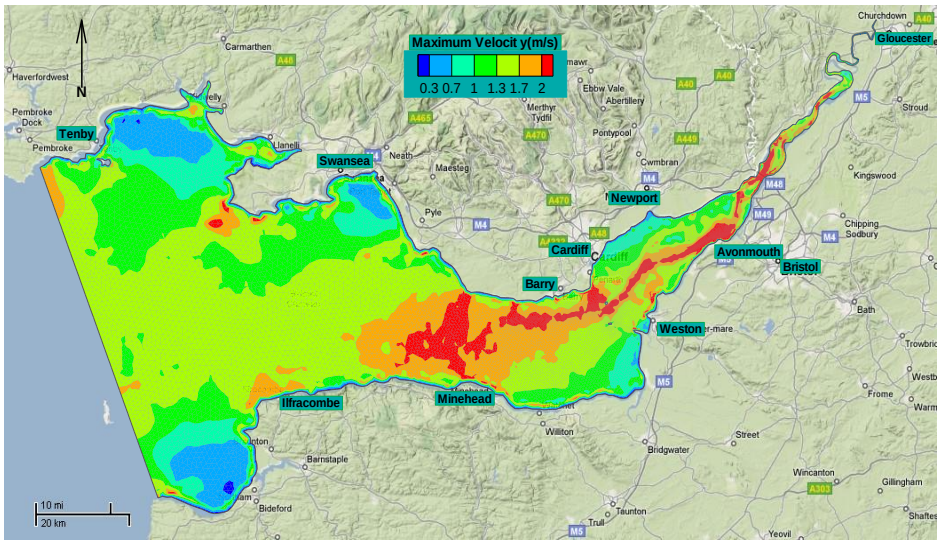
In the Cefas (advisory) report there is limited information about the details of the hydrodynamic model, in that no information is provided with regard to a number of key parameters for predicting the trajectory of this sedimentary plume, including: (i) grid resolution within the Severn Estuary, and particularly in the region of Cardiff Grounds, (ii) extent of the boundary up the Severn Estuary and whether the model went up to the tidal limit of the Severn, i.e., to Gloucester weir, (iii) were discharges included in the model for the key rivers, particularly the Severn, (iv) what bottom roughness values were assumed to represent bed friction and turbulence generation, (v) what degree of model calibration and validation was undertaken in the Severn Estuary, and particularly in the region around Cardiff Grounds, etc. In particular, the model simulations in Table 4a show that 'material remains largely within the water column and is retained within 10 km of the site' and the plume is shown to propagate in a North Easterly direction, i.e., upstream, and further into the Severn Estuary. This predicted plume trajectory after 60 hr is a little surprising, in that the tidal current structure off Penarth Pier and Cardiff tidal sites (both close to Cardiff Grounds) indicate that the current is slightly stronger on the ebb vis-à-vis flood tide, based on tidal times for the ebb and flood tide durations respectively, and as partly explained by the estuarine dynamics and the flows from the main rivers upstream, including the Severn, Wye, Avon and Usk.

The Cardiff University 2D unstructured grid DIVAST model was originally refined to investigate the hydrodynamics in the Bristol Channel and Severn Estuary and to assess the hydro-environmental impact of a Severn Barrage, from Cardiff to Weston[67], across the Severn Estuary. A finite volume boundary fitting model was

[67] Xia, J., Falconer, R.A. and Lin, B. 2010. Impact of different tidal renewable energy projects on the hydrodynamic processes in the Severn Estuary, UK. *Ocean Modelling.* 32(1-2), 86-104.

used, which initially had boundaries located at the mouth of the Bristol Channel, from Stackpole Head (Wales) to Hartland Point (England) and with the upstream boundary extending to the tidal limit at Gloucester. An early illustration of the tidal currents is given in Figure 4c, where the maximum tidal currents in the region of Cardiff Grounds are predicted to be approximately 1.3 to 1.7 m/s. In several subsequent studies over the past decade this model has been further refined to include extending the seaward boundary to the Continental Shelf, as well as refining a range of hydrodynamic and water quality parameters. More recently, parallel model development work has also been undertaken using the TELEMAC model (originally developed by EDF), which is based on an unstructured finite element grid. Details of this model are given in Guo et al[68].

Figure 4c. Model predicted peak tidal currents in the Bristol Channel and Severn Estuary



In assessing the hydrodynamic features in the Severn Estuary, particularly around Cardiff Grounds, Dr Athanasios Angeloudis, at the University of Edinburgh[69], and Dr Reza Ahmadian, in the Hydro-environmental Research Centre at Cardiff University, were invited to provide predictions to the Group of the current structure in the vicinity of Cardiff Grounds. In both cases the peak currents in the region of Cardiff Grounds exceeded 1 m/s, as shown in Figure 4c. Dr Ahmadian and his Research Associate Dr Man Lam[70] then produced two animations of tracked particles released from the Cardiff Grounds at high tide (ebb flow) and low tide (flood tide) respectively, with tidal phases being relative to the tidal times at the seaward boundary. The simulations of the particle trajectories were both run for 10 tides, with the resulting particle locations shown after 5 tidal cycles for high (Figure 4d (i)) and low (Figure 4d (ii)) tide initial

[68] Guo, B., Ahmadian, R., Evans, P. and Falconer, R.A. 2020. Studying the wake of an island in a macro-tidal estuary. *Water.* 12(5), 1225, 1-18. Open Access.

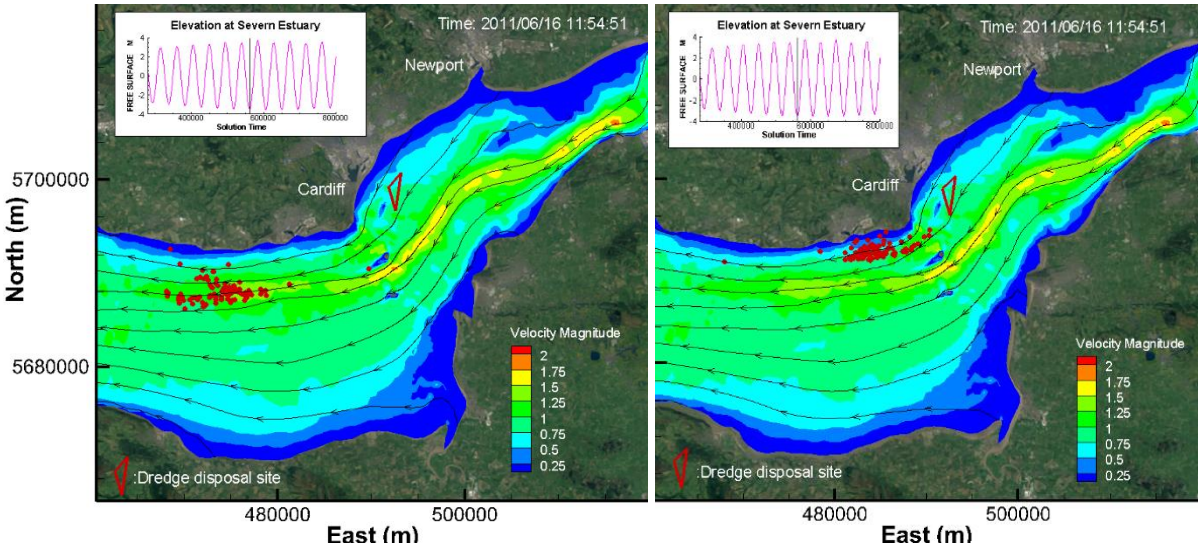
[69] Angeloudis, A. Private Communication on hydrodynamic modelling in the region of Cardiff Grounds. University of Edinburgh, 2020.

[70] Ahmadian, R. and Lam, M. Private Communication on modelling plume trajectory from Cardiff Grounds. Cardiff University, 2021.

releases. Five tidal cycles correspond to 62.1 hr, which is just slightly longer than the trajectory given in Table 4a, of 60 hr in the Cefas C6268U report plume trajectory.

The resulting model predicted trajectories shown in Figure 4d illustrate that for both ebb and flood neap tide releases the plume particle trajectories (illustrated with red dots) are both in the South Westerly direction, and that at the end of 5 tides the bulk of the particles are seen to have left the Severn Estuary SAC, as shown in Figure 4a. These results differ significantly from the plume trajectories reported in the Cefas C6268U report and bring into question the more general point as to the appropriateness of Cardiff Grounds as a site for dredged sediment disposal. These results suggest that ideally a more comprehensive modelling study should be undertaken in the near future to study the case for Cardiff Grounds being used as a suitable disposal site for dredged sediments and particularly in terms of sustaining the unique ecological characteristics of the Severn Estuary SAC.

Figure 4d Predicted location of particles (red dots) released from Cardiff Grounds after 5 tides at (i) high and (ii) low tide, relative to seaward boundary



(i) High (ebb) tide release (ii) Low (flood) tide release

In any modelling studies undertaken in the future, to focus on establishing the plume trajectory from Cardiff Grounds, it would also seem prudent to include predicting sediment plume trajectories from Portishead disposal site. Such a comprehensive modelling study should include the key hydro-morphological processes associated with sediment transport, including erosion and deposition, and for cohesive and non-cohesive sediments. Such a study would enable key stakeholders to establish the impact of the disposal of marine sediments at either, or both, the Cardiff Grounds and Portishead sites on the ecological status and sustainability of the Severn Estuary SAC.

4.6 Concluding Remarks

This chapter reports on the evidence provided to the Group, relating to the computational modelling studies undertaken by Cefas (commercial), to assess the likely impact of a new nuclear power station at Hinkley Point C. These hydro-environmental and ecological modelling studies are important in terms of assessing the tidal current structure in the Bristol Channel and Severn Estuary and then establishing the impacts of the thermal discharge from the outfalls on the water quality and ecology, particularly in the Severn Estuary SAC and along the Welsh coast.

A review of the modelling evidence provided to the Group has led to 3 key concerns and advice from the Group. These concerns and advice are summarised below:

- Limited information is provided in the reports made available to the Group to comment on the quality of the modelling studies undertaken to assess the hydro-environmental and ecological impacts of HPC on the Severn Estuary SAC. Whilst the predicted thermal plume is unlikely to have any significant impact on the water temperatures along the Welsh coastline, the thermal plume could have an impact on local fish breeding grounds in the vicinity of Hinkley Point and the subsequent migratory pathways of fish in the Severn Estuary. The limited information provided on the modelling studies has made it difficult to assess with confidence the predicted thermal plume trajectories.
- For such a major nuclear power station project, sited in a SAC and within a highly dynamic and unique estuary, the only assessment of the modelling studies undertaken by Cefas (commercial) appear to have been undertaken by experts working in Cefas (advisory). This is highly unusual, in that such modelling studies are increasingly independently audited by an expert, or group of experts, with such auditing being routinely undertaken in the UK and internationally. In this case it is difficult to see how the public can have confidence in the model predictions when the modelling has been done by Cefas (commercial) operating under contract to EDF and that advice on the modelling is provided to the UK and Welsh Government agencies by Cefas (advisory) operating in its more public facing role.

Advice 1. Concerns are expressed by the Group on the original modelling undertaken by Cefas (commercial) and the lack of an independent audit of these studies, particularly for such a high-profile project of understandable public concern. Questions remain unanswered about the efficacy of the commercial arm of Cefas undertaking the modelling and colleagues elsewhere in the organisation providing advice to government agencies based on the predictions from the modelling studies. This engagement of Cefas as the modeller and Cefas as an independent advisory body to government agencies, is not an arrangement which is likely to inspire public confidence when associated with such a high-profile infrastructure project.

- Following the request by the Group for details of the modelling studies and a review of the Cefas report TR186, the Group expressed a number of concerns to EDF and Cefas about a lack of information in the report on the model details etc. Following the meeting Cefas provided a more recent report (TR267) to the Group on further hydro-environmental modelling studies, using only the GETM model. Whilst this subsequent study involved modelling part of the estuary (in

the vicinity of the HPC outfalls and intakes) with a finer resolution mesh, several concerns remain. For example: (i) the bottom roughness value used is appreciably lower than that normally used for such an estuarine model study, (ii) there are no details in the report as to how the heat flux was represented in the model, (iii) how the heat flux varied with the ambient air temperature, etc. It is therefore difficult to ensure a high level of confidence in the modelling of the thermal plume, based on the evidence provided to the Group. Whilst the thermal plume is unlikely to have an impact directly on the ecology of the estuarine waters along the Welsh coast, it could affect the fish breeding grounds close to Hinkley Point and the fish migratory pathways upstream in the Severn Estuary SAC.

Advice 2. A number of key concerns remain about the accuracy and transparency of the modelling of the hydrodynamic and water quality processes and, in particular, on the characteristics of the thermal plume. This is particularly relevant for such a high profile project with a significant cooling water outfall discharge and temperature rise. Questions remain about the accuracy and transparency of the the impact of the high thermal heat flux on the ecological sustainability of the Severn Estuary SAC and fish migratory pathways.

- Based on extensive model simulations of the Bristol Channel and Severn Estuary, undertaken over the past 15 years at Cardiff University, for a range of hydro-environmental impact assessment studies (particularly for barrages and lagoons), tidal current model predictions have been provided by the universities of Edinburgh and Cardiff on the hydrodynamics and (for the latter) neutrally buoyant sediment trajectories in the vicinity of Cardiff Grounds. These preliminary results do not consider sediment erosion and deposition but assume the sediments to remain in suspension. Nevertheless, the results contradict earlier, and recent, model studies included in the Cefas C6268U report submitted to NRW. The Cardiff University results, consistent with some anecdotal evidence, predict that a sediment plume from Cardiff Grounds dispersive site will transport the sediments to the South West of the Severn Estuary, and out of the SAC, rather than North East and further up the estuary, as predicted in earlier model studies and reported by Cefas. These findings bring into question the suitability of Cardiff Grounds as an appropriate site for discharging sediments in the future, bearing in mind that the site is within the Severn Estuary SAC and public concern about sustaining the unique and high-quality ecological status of the Severn Estuary.
- It is noted that EDF are also considering applying to discharge a relatively large quantity of dredged sediments at the disposal site at Portishead. Any significant quantity of sediments disposed of at this site may also have an impact on the hydro-ecological characteristics of the Severn Estuary SAC and it would therefore also seem prudent to model the hydro-morphological characteristics of the Portishead disposal site.

Advice 3. In view of the uncertainty in the model predictions of the sediment trajectory plume from Cardiff Grounds dispersal site, questions are raised about the efficacy of this site in terms of sustainably supporting the unique ecological characteristics of the Severn Estuary SAC, and the Hinkley Point C Development Consent Order (2013). In the recent Cefas C6268U report to NRW the analysis of

model predictions showed that the sediment plume from Cardiff Grounds would travel North East, and up the Severn Estuary. In contrast, model predictions undertaken by Cardiff University indicate that the plume will travel South West and out of the Severn Estuary SAC. Such a difference is significant, and it is advised that either the Welsh Government or NRW consider undertaking more comprehensive modelling studies in the future to assess the hydro-morphological processes in the locality of Cardiff Grounds. It would also seem prudent to investigate the hydro-morphological characteristics of the Portishead disposal site as part of the same study, as this site could also affect the ecological sustainability of the Severn Estuary SAC.

Chapter 5

Emergency planning for nuclear operations at Hinkley Point

This chapter will review the development, coordination and implementation of off-site emergency plans for nuclear operations at Hinkley Point with regard to UK regulations and the implications for Wales. The review will be based on the evidence and communications received by the Group from the involved organisations as well as any additional and relevant resources. Advice from the Group is given based on the review of the evidence.

5.1 Background

Emergency planning for nuclear emergencies should ensure that arrangements are in place to effectively respond to any emergency on the site where the emergency situation occurs as well as off-site where members of the public might be affected. In the UK, the Radiation Emergency Preparedness and Public Information Regulations (REPPIR) sets out the framework for preparedness measures to ensure that arrangements are in place to effectively respond to any emergency. These regulations were revised in 2019 (REPPIR19) replacing the previous regulations (REPPIR01). REPPIR19 and REPPIR01 Both REPPIR01 and REPPIR19 require that a defined Detailed Emergency Planning Zone (DEPZ) to be designated in the area around a nuclear facility. The DEPZ is a defined zone around a site where it is proportionate to pre-define protective actions which would be implemented without delay (e.g. within a few hours) to mitigate the most likely consequences of a radiation emergency. The local population within a DEPZ will be contacted if there is an incident on site that might result in a release and informed as to what action to take (e.g. evacuation and to where).The guidance in REPPIR draws upon recommendations published by the International Atomic Energy Agency (IAEA), but uses different terminology (IAEA, 2013). The IAEA recommends Precautionary Action Zones (PAZ), that are equivalent to the UK DEPZ, related to the total thermal rating (MW(th)) of all reactors on a site and the estimated doses as a result of severe accidents. For sites with reactors producing more than 1000 MW(th), the IAEA recommendation for the PAZ is between 3 and 5 km in radius.

Under REPPIR19 (ONR, 2019), operators of nuclear facilities must present a technical assessment for the required DEPZ to the responsible local authority in advance of any significant radioactive material being brought on site (i.e. nuclear fuel). The assessment by the operator should include modelling of any potential release and associated exposure doses. The local authority should then review the assessment of the operator and make recommendations to enlarge the DEPZ to take into account any situations that are not already covered by the DEPZ (e.g. to make evacuation orders easier to carry out). The Office for Nuclear Regulation (ONR) can provide further recommendations as required to the operator or the local authority. In the case of Hinkley Point, the responsible local authority is Somerset County Council (SCC).

The current DEPZ for the Hinkley site is 3.5 km (Somerset CC, 2012). All operators of nuclear installations and all local authorities which have active off-site emergency plans for nuclear installations in the UK, must now produce revised plans under REPPIR19. EDF presented its revised consequences report for Hinkley Point B in September 2019, with a recommended minimum DEPZ of 1 km. SCC are in the

process of developing their off-site emergency plan for Hinkley Point B which will include any changes to the currently defined DEPZ.

Outline planning zones (OPZ) operate at distances beyond the DEPZ. The presence of an OPZ should assist local authorities in planning for extremely unlikely but more severe events. The IAEA states that urgent protective action planning zones (UPZ), that are equivalent to the UK's OPZ, should be between 5 and 30 km for sites with reactors producing more than 1000 MW(th). Under REPPIR01 there was a requirement to consider extending planning zones under a severe release scenario but not an OPZ as now defined under REPPIR19. Under the new REPPIR19 regulations, the predetermined OPZ in the UK for civilian nuclear power plants is 30 km (whether in operation or undergoing decommissioning but where irradiated fuels are still present), where the OPZ extends from a clearly indicated centre point.

Under the off-site emergency plan for Hinkley Point that was developed under REPPIR01 and published by SCC in 2012 (SCC, 2012), an extended release scenario zone was defined with a radius of 15 km from the perimeter of the DEPZ (3.5 km), giving a total radius of 18.5 km. The 2012 off-site emergency plan also stated a further zone of 15 to 40 km for Food/Water Restrictions and notes that local authority interest in this zone includes:

- Vale of Glamorgan
- Cardiff
- Newport
- Caerphilly
- Rhondda Cynon Taf

The Welsh Government and the aforementioned Welsh local authorities were also included in the Off-Site Nuclear Emergency Alert & Notification Chain by SCC.

EDF's revised consequences report for Hinkley Point B (EDF, 2019) now includes an OPZ of 30 km that includes parts of South Wales (Figures 5.1a and 5.1b). The consequences report further states that

> *'It is recommended that advice be issued within 24 hours to restrict consumption of leafy green vegetables, milk and water from open sources/rain water in all sectors of the Detailed Emergency Planning Zone and downwind of the site to a distance of 43km'.*

The prevailing wind direction for the Hinkley area and the area of South Wales within 43 km of Hinkley Point B are shown in Figures 5.2 and 5.3.

A revised REPPIR19 off-site emergency plan for the Hinkley Point site is currently under development by SCC. A further revised consequences report and off-site emergency plan for the Hinkley site will be required before nuclear fuel is installed at Hinkley Point C, but the OPZ will remain the same (i.e. 30 km), as predetermined by REPPIR19.

Figure 5.1a. 30 km OPZ around Hinkley Point B

Figure 5.1b. Region of Wales within the 30 km OPZ around Hinkley Point B

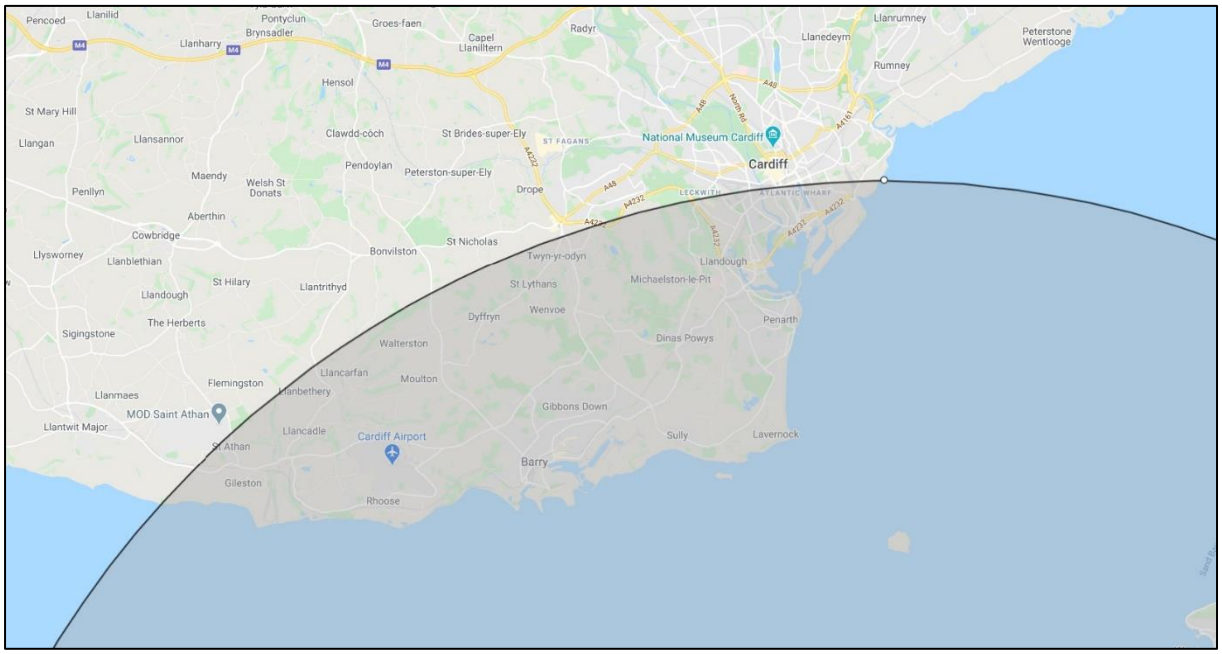
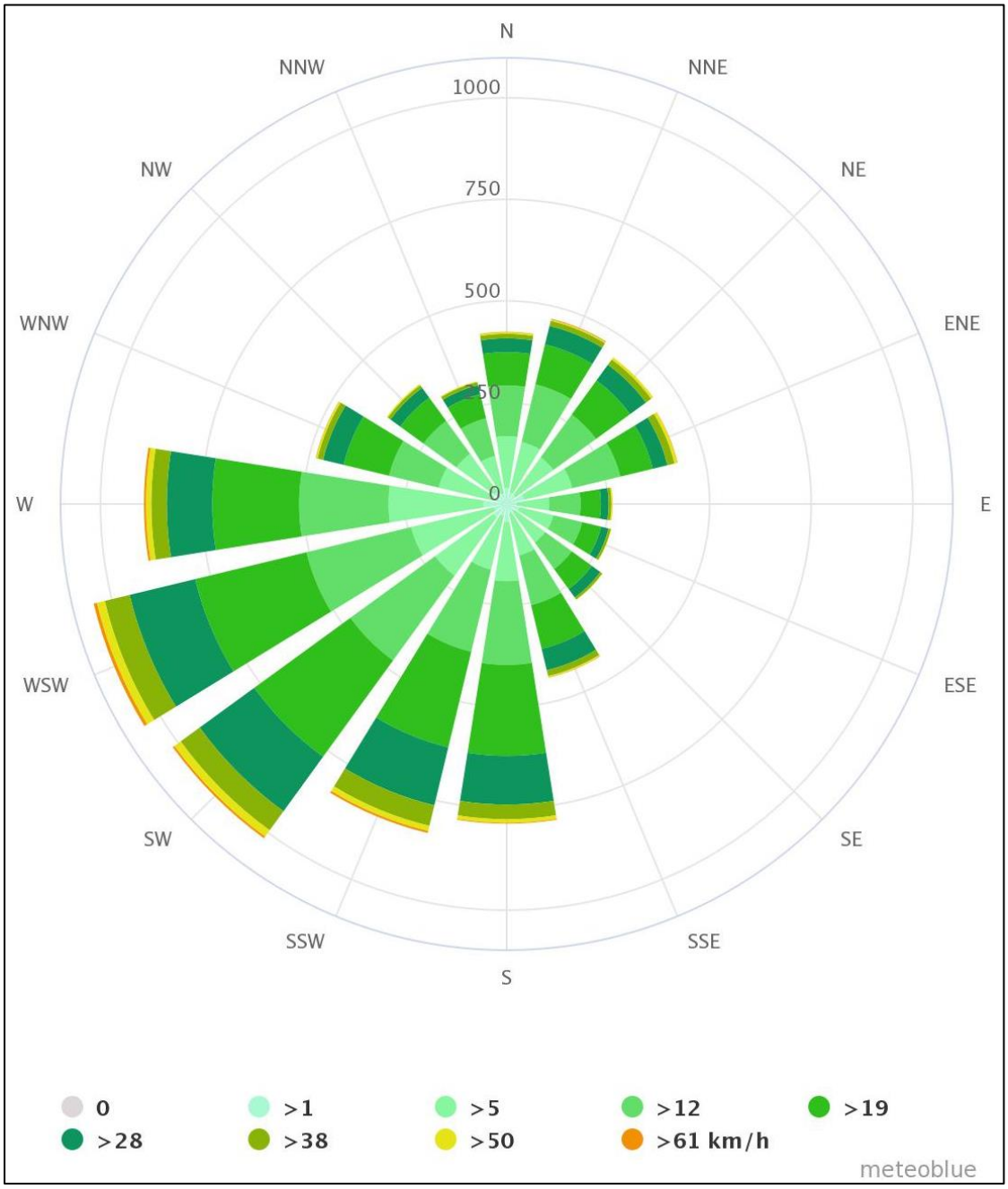
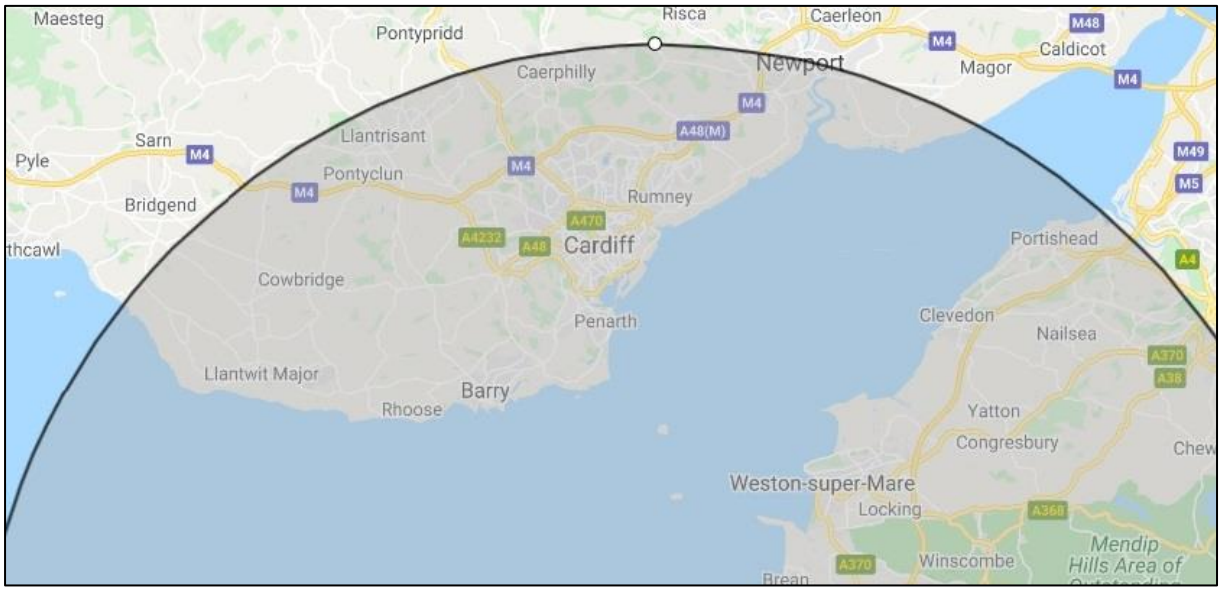


Figure 5.2. Wind rose for Weston-Super-Mare based on 30 years of hourly weather model simulations, showing the number of hours per year the wind blows from the indicated directions[71].



[71] https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/weston-super-mare_united-kingdom_2634308

Figure 5.3. Region of Wales within a 43 km zone around Hinkley Point B



5.2 Concerns

- Has the Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services been involved in the development of any off-site emergency plans for nuclear operations at Hinkley Point?
- What requirements are placed on such Welsh authorities/organisations in relation to preparing and maintaining plans or procedures relating to potential nuclear emergencies at Hinkley Point?
- Are such Welsh authorities/organisations aware of these requirements and what has been done to meet these requirements?

5.3 Review of evidence

5.3.1 Has the Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services been involved in the development of any off-site emergency plans for nuclear operations at Hinkley Point?

Concerning what requirements are in place to ensure that the Welsh Government, relevant local authorities, local resilience fora and emergency services are informed of, and consulted on, off-site emergency plans for Hinkley Point, ONR stated that

> *'REPPIR19 places a duty on the lead local authority, in this case, Somerset County Council, in preparing or reviewing an off-site emergency plan, to consult a range of organisations including such other persons, bodies or authorities as the local authority considers appropriate. [reg 11(5)]. The guidance (ONR, 2019) further specifies that the local authority must ensure that all individuals or organisations identified in regulation 11(5) and anyone else with a role in delivering the off-site emergency plan are made aware of the proposals and its contents.'*

Furthermore, ONR stated that

> *'Although REPPIR19 does not explicitly state that neighbouring authorities that have jurisdiction within the outline planning zone should be consulted, in this case, it would be reasonable to expect Somerset County Council to consult any other authority should there be the possibility that those authorities may be required to undertake any actions in an emergency, or should there be a possibility that their population is affected, even if the likelihood of the event was extremely low'.*

ONR added that

> *'The local authority is also required to make available the extent of the OPZ to the public, for example by publishing a map showing the boundary of the zone on their website. However, as the planning for the OPZ is at the strategic level, it is not appropriate to pre-identify any specific protective actions for members of the public within the OPZ. This advice would be provided in the unlikely event of an emergency with consequences that extend to the OPZ. However, under the banner of strategic planning, we may expect a lead local authority to be in contact other local authorities or organisations, for example those with jurisdiction in the DEPZ or OPZ, that could be required to carry out any actions in an emergency, such as passing on information to their population. The extent of the interaction may simply inform them of any potential arrangements (even high-level plans) that they may need to put in place.'*

With regard to contact between the ONR and Somerset County Council, ONR stated that

> *'Our representatives have had a number of bilateral teleconferences with the emergency planning representatives to seek assurance of the development and publication of the revised Hinkley off-site emergency plan and public information, in accordance with the revised requirements for REPPIR19.'*

Concerning oversight of off-site emergency plans, ONR stated that

> *'In January 2020, ONR wrote to all the lead local authorities with nuclear sites in their jurisdiction clarifying various roles and responsibilities under REPPIR19. The letter stated that although ONR no longer had a statutory role in the determination process for detailed emergency planning zones, we remained committed to assisting local authorities in navigating the revised processes required by the regulation during the implementation period. The letter went on to describe how we would sample some of the assessments to provide us with an overview of how operators and local authorities are following the new processes and fulfilling their new statutory responsibilities. The letter also made it clear that ONR is not required to, and would not be performing a formal assessment of, or approving the individual DEPZs. Similarly, under either the previous or the 2019 regulations, ONR is not required to review or approve off-site emergency plans.'*

ONR added that

> *'REPPIR does not place any duty on ONR to review or approve emergency plans, however we intend to review all the off-site emergency plans including the HPB off-site emergency plan in the coming months to ascertain the level of compliance. Furthermore, if we do identify any shortfalls in the plans, these will*

be relayed to the relevant local authority and a way to rectify the issue or issues will be agreed.'

When asked for a view on the effectiveness of the scrutiny process for off-site emergency plans, ONR stated that

'We would expect the production and approval of the document to be subject to Quality Assurance arrangements, which we would expect to be in accordance with the Council's or the Local Resilience Forum's usual governance arrangements. Where there is a significant change to the plan, off-site plans should undergo a consultation period where those who need to comment are afforded the opportunity. REPPIR19 Regulation 11(5) lists the organisations that would need to be consulted on production or revision of the off-site plan'

ONR added that

'ONR has no part in the approval process but we are provided with a copy of published plans for our own information and regulatory oversight. During an inspection of the local authorities' arrangements, we would often look to check that there is appropriate consultation and collaboration.'

ONR had planned an inspection of SCC's emergency arrangements under REPPIR in March 2020 but this was postponed due to Covid-19. This inspection is now planned for 2021.

On the question of whether SCC had consulted risk management authorities in Wales during the development of off-site emergency plans for the Hinkley site in the past, SCC stated that '*there has been only limited dialogue in recent years*' between SCC Civil Contingencies Unit and the relevant risk management authorities in Wales, but SCC saw '*value in increased contact between the risk management teams on either side of the Bristol Channel going forward*' in regard to plans to start decommissioning Hinkley Point B in 2022 and the subsequent completion of Hinkley Point C.

Furthermore, SCC stated that

'Cardiff Council, Vale of Glamorgan Council, Rhondda Cynon Taf County Borough Council, Newport City Council have been referenced in the off-site planning documents since the introduction of REPPIR 01 and are sent copies of the multi-agency off-site plan following plan updates. Somerset County Council is required to update the off-site plan on a three-year schedule.'

Concerning the recent update to the off-site emergency plan for Hinkley Point B under REPPIR19, SCC stated that

'The most recent off-site plan update went live in August 2020 following the introduction of REPPIR 19 and the redetermination of the detailed emergency planning zone. Copies of the most recent plan have been sent to the authorities listed above with reference to the outline planning sections.'

In an initial reply via the Welsh Local Government Association, Cardiff Council, Rhondda Cynon Taf County Borough Council and Monmouthshire County Council have replied that they are not aware of any contact from SCC concerning Hinkley Point, at least with the departments within these local authorities that have replied so far.

Newport City Council confirmed that they had recently received a copy of SCC's revised off-site emergency plan for Hinkley Point B (August 2020 version), although there was no reference to the City Council in the plan. Newport City Council noted that the plan stated that in the event of an off-site nuclear incident at Hinkley Point B, environmental monitoring would be coordinated by Public Health England, and undertaken by the Environmental Agency, the Food Standards Agency and Water Companies with support from EDF. These activities would be undertaken beyond the outer boundary of the OPZ out to 43 km from the site, which includes Newport City Council.

Concerning the information that must be made available to the public regarding off-site nuclear emergencies, SCC stated that

> *'The Civil Contingencies Unit is finalising an update to the public information relating to off-site nuclear emergencies. In the near future, this information will be shared with all organisations mentioned in the off-site plan including those in the outline planning areas including the authorities listed above. Organisations will be asked to include the public facing information on their websites.'*

In the event of any off-site nuclear emergency SCC stated that

> *'the call-out and alerting arrangements for an off-site nuclear emergency at Hinkley Point B would include the Welsh authorities. As set out in the off-site plan, notification would be via the Ministry of Housing, Communities & Local Government (MHCLG) to the Welsh Government for onward transmission to relevant local authorities and public bodies.'*

On the issue of timing for production of off-site emergency plans, with a view to the potential timeline for such work for Hinkley Point C, the ONR stated that

> *'The lead local authority must produce an off-site emergency plan within eight months of being sent a Consequences Report and the operator cannot start working with ionising radiation before the off-site emergency plan is put into effect.'*

On the same issue, SCC stated that

> *'We would look to ONR to give a notification and direction to Somerset County Council when the C Site is required to come within the scope of the off-site planning arrangements under REPPIR 19. Somerset County Council will then carry out an update of the off-site plan to incorporate the C Site and will engage with organisations involved with the off-site plan. Our current planning assumption is that this will take place within the next 5 years.'*

5.3.2 What requirements are placed on relevant Welsh authorities and organisations in relation to preparing and maintaining plans or procedures relating to potential nuclear emergencies at Hinkley Point?

On the issue of what requirements are placed on relevant Welsh authorities and organisations in relation to preparing and maintaining plans or procedures relating to potential nuclear emergencies at Hinkley Point, the ONR stated that '*it is for Somerset County Council to prepare and maintain the off-site emergency plan and to identify and consult relevant organisations on its content.*'. ONR recalled that the guidance under the REPPIR approved code of practice §334 proposes that the lead local authority should ensure

'that the plan can be put into effect without delay when required by ensuring that prior information has been supplied in accordance with regulation 21 and by seeking confirmation, so far as reasonably practicable, from responding organisations that: (i) the necessary information, instruction and training has been provided and the necessary equipment for restricting exposure has been made available, in accordance with regulation 11(6); and (ii) any other underpinning capabilities required to implement the plan are in place and readily available.'

In asking for insight into their experience in managing the off-site emergency plan for Hinkley Point A and B, SCC stated that

'REPPIR 01 and REPPIR 19 set out expectations for training, exercising and preparedness regarding the off-site arrangements. Somerset County Council is required, with EDF to deliver a test of the off-site plan on a three-year cycle. The exercise scope and objectives are agreed in advance with ONR. ONR provide assessors to observe the tests and sign off the post -exercise reports and recommendations. The most recent test of the off-site plan was Exercise Nighthawk held in June 2018. Because the focus of the exercise was the immediate area surrounding the site and not the wider outline planning area, we did not extend an invitation to the Devon or Welsh authorities on that occasion.'

With regards to future exercises, SCC stated that

'Representatives of risk management organisations in Wales would be very welcome to attend future Level 2 (off-site plan) exercises as observers. The next Level 2 exercise for Hinkley Point B will be Exercise Dorado. This will be a modular exercise to be held as workshops across two dates in July and September 2021.'

SCC added that they are '*required to ensure that information is available to partner organisations that would have a role in the activation of the off-site plan.*', which would be delivered via circulation of the off-site plan, delivery of exercises to test the plan and delivery of briefing and awareness events prior to exercises. The exact participants in any exercise would vary with the scope of the exercise planned. SCC stated that '*The briefing event webinar for Exercise Dorado is scheduled for 9th June 2021 and representatives of the risk management organisations in Wales would be welcome to attend*'.

5.3.3 Are such authorities/organisations aware of these expectations and what has been done to meet these expectations?

When asked whether the ONR has a view on whether relevant authorities and services dedicate appropriate time and resources into training for nuclear emergencies and into raising awareness of potential emergencies with local populations, to ensure plans and procedures can be implemented effectively as necessary, the ONR stated that

'We have previously scrutinised the training arrangements for off-site nuclear emergencies as well as the provision information to members of the public within Detailed Emergency Planning zones; these are both requirements under REPPIR (both under 2001 and 2019 legislation). Of those local authorities inspected, some areas for improvement were identified in some aspects of the training and these were reported back to the local authorities. Lead (nuclear) local authorities and relevant emergency responders regularly engage at the

national level to share good practice and raise issues, specifically at the Local Authorities Nuclear Working Group (LANWG), the Blue Lights Working Group (BLWG) and the Lessons Learned Working Group (LLWG). We attend these groups to provide feedback and to gain oversight of the common issues.'

ONR added that

'To date, we have not identified any significant shortfalls in compliance with the regulations in the areas identified in your question, although we have been made aware of pressures on local authority and emergency responder resource in some areas made worst by Brexit planning and the Covid-19 response. As a result, we have offered assistance and guidance to assist local authorities continue to achieve compliance under the existing pressures.'

Monmouthshire County Council stated they were heavily involved with the off-site arrangements for Oldbury nuclear power station and also worked with partners in developing the Gwent Local Resilience Forum (GLRF) Extendibility Arrangements Plan in relation to Oldbury (GLRF 2011). The Extendibility Arrangements Plan was designed to dovetail with the Oldbury off-site emergency plan produced by South Gloucestershire County Council. The plan covered cross border command and control structures and reinforced existing arrangements to ensure response agencies in the Gwent LRF could deal with an off-site nuclear incident at Oldbury. The Plan addressed countermeasures that could be implemented and set out arrangements for warning and informing the public. Both the Oldbury off-site emergency plan and the GLRF Extendibility Arrangements Plan were formally withdrawn at the end of 2017, due to the progress of decommissioning work at Oldbury nuclear power station.

Monmouthshire County Council stated that they would be interested in gaining a greater understanding of the footprint and reference scenarios for potential off-site nuclear incidents at Hinkley Point and that they would have the basis of a template and issues that would require consideration from their previous work with Oldbury.

Newport City Council stated that as they are not within the DEPZ, no formal Hinkley Point B emergency plans have been developed. However, the City Council has existing procedures to ensure that any notification of a radiation release are managed, particularly with regards notification to Environmental Health. Newport City Council stated that they will review these procedures in light of the update from SCC.

5.4 Advice

Advice 1. On the basis of the information received from the Office for Nuclear Regulation and Somerset County Council, the Group suggests that the Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services should review plans or procedures relating to potential nuclear emergencies at Hinkley Point in light of any information received from Somerset County Council to date and in particular with regard to the REPPIR19 updated off-site emergency plan that Somerset County Council has sent to the stated Welsh local authorities. Such a review should examine whether sufficient resources are available to respond as required in the event of an off-site nuclear emergency at Hinkley Point. Similar reviews may be required in relation to any other nuclear site and associated off-site emergency plan that may have implications for Wales.

Advice 2. The Group sees the benefit in establishing greater cross-border cooperation with regard to nuclear emergency preparedness in the case of Hinkley Point and the future operations at Hinkley Point C and any other cross-border situation involving a nuclear site in England or Wales. As part of this process, the Group would encourage the Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services to participate, as appropriate, in Somerset County Council's next Level 2 exercise for Hinkley Point B in 2021.

Chapter 6

The use of powers by the Welsh Government and its agencies in the context of the Hinkley Point C sediment disposal at Cardiff Grounds

6.1 Background

This chapter will first, based on the Group's examination of the evidence that it has collated in considering issues arising from the past and potential disposal of radioactive sediments from the Hinkley Point C site at the Cardiff Grounds disposal site, draw out observations on the use of powers by Welsh government its agencies. It will deal with matters arising in this regard from the substantive areas of inquiry undertaken by the Group into the ecosystem resilience of the Severn Estuary; cross border systems and processes; sediment disposal; modelling and the Cardiff Grounds and the Portishead marine disposal areas; and emergency planning. These considerations will be set against the legal background of multi-dimensional complexity regarding regulatory provision for nuclear sites, encapsulating environmental and human impacts, which the Group views as being amplified in a cross-border context, where multiple administrations and their agencies and differing legal provision come into play.

The complexities that we encountered appeared and reappeared and will continue to manifest in various forms and constellations throughout the regulatory timeline for Hinkley Point C as a large complex infrastructure project, reflecting environmental, institutional, political, and societal contexts that both situate the process as a whole and contribute in diverse ways to its constituent parts. While interactions between the many actors in the multiple decision-making processes are framed by law and policy, they are fleshed out in practical terms by a range of less formal but significant documents that have been agreed between them, such as Memorandums of Understanding (MOU). The Group observes that these vary considerably in currency, approach, and detail.

The Group observed that many of the elements that we encountered are common to developments at this scale/of particular sensitivity that involving complex, interlocking regulatory concerns. In addition, the Group observed that the cross border context and devolution, as it matures, with distinctive approaches to environmental matters becoming increasingly evident and embedded in different parts of the UK, raise particular concerns which require proactive treatment to deliver sustainable decisions for the environment and people of Wales. The Group notes that in Wales, the relevant legal framing for the activities of the Welsh Government and its regulatory agencies in this area and for Welsh local government, provided by the Well-being of Future Generations Act (WFG Act) in principle provides the basis for a much more joined up approach to regulation in temporal, spatial and functional terms. In this context the WFG Act's five ways of working (namely: long term; prevention; integration; collaboration; and involvement) have a great deal to offer – but in cross-border contexts, the space to deliver on this agenda is constrained by decisions taken elsewhere, under very different legal provision.

The diagram below identifies core areas of complexity and connection in the timeline of approving and operating a nationally significant infrastructure project with cross-

border impacts. It employs a temporal approach to core elements of the applicable regulatory process (tracking through the stages: 'before' - land use planning; 'during' - subsequent regulatory approvals; and 'after' – monitoring, enforcement, and potential challenges) that apply, framed by the environmental setting, and impacts upon it and contextual recurring considerations relating to the various applicable law and policy settings.

Figure 6.1 **Key elements of planning and regulatory decisions with cross-border impacts**

Key:

Red	Before
Blue	During
Yellow	After
Green	Contextual/Recurrent

6.2 Review of evidence

6.2.1 Ecosystem Resilience Severn Estuary Environment

The Group noted in its treatment of ecosystem resilience in Chapter 1 that the Severn Estuary is subject to dense, multiple, intersecting and often overlapping, regulatory regimes with regard to pollution control and ecosystem integrity. It also noted that, despite this coverage, the ecological status of the features of interest in designated areas is largely unfavourable and that the Severn Estuary ecosystem is

therefore in need of support. These observations raise serious concerns as to the efficacy of existing protective regimes, both in regard to a precious and unique environment and to securing the stake of future generations in Wales in it, that require a long term and sustainable approach toward its regulation. The Group also notes that post-Brexit issues in regard to environmental justice provision may be relevant to ongoing decision-making around Hinkley Point C.

6.2.2 Cross Border Systems and Processes

While the Group note in Chapter 2 that the ASERA management scheme[72] provides for cross cross-border management of the Severn Estuary ecosystem, coordinating on matters of detail continues to raise challenges. The fact that the Severn Estuary falls under two discrete marine planning areas and two distinct sets of institutional arrangements also raises significant issues – the fact that systematic, publicly available cross-border concordats was envisaged in s44 of the Marine and Coastal Access Act 2009 was noted, as was the informal cross border cooperation process that represents current practice. The Group took the view that the evident good relationships across many aspects of regulating the estuary are commendable, but would benefit from a stronger institutional underpinning. The Group notes that, in the absence of overarching structural coverage the Welsh National Marine Plan[73] and the consultation draft of the South West Marine Plan[74] do allude to the need to further develop cross border arrangements.

This stakeholder review has highlighted the challenges that exist in relation to the current planning process, both in terms of the Hinkley Point C development and many other developments of varying scale.

There is a clear need to integrate the planning system more effectively on all levels from local to national and across border. This is also needed in the pre-planning, as well as planning stages, and with the permitting process more closely aligned with the planning process.

Only by integrating the planning process in terms of supporting contributions from all of the appropriate agencies involved, whether directly, or indirectly as "neighbouring", downstream or upstream, can the environmental, ecological and health impacts of such developments be considered. Without this, planning decisions by the appropriate planning authority, cannot be fully informed.

The importance of doing this in the current climate is the pressures on the existing planning authorities. Even before the COVID-19 pandemic, planning authorities had been suffering challenges including decreasing resources and capacity to set and

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[72] Association of Severn Estuary Relevant Authorities (ASERA) (2018) Severn Estuary European Marine Site Management Scheme 2018 – 2023, 63pp. Online at https://asera.org.uk/wp-content/uploads/sites/3/2018/05/Severn-Estuary-EMS-Management-Scheme-2018-2023-May-2018-2.pdf (accessed 05/03/21).

[73] Welsh Government (2020) *Wales National Marine Plan*. Online at

https://gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan-document_0.pdf (accessed 05/03/21).

[74] Marine Management Organisation (2020) *South West Inshore and South West Offshore Marine Plan*. *Draft for consultation* January 2020. online at https://www.gov.uk/government/publications/draft-south-west-marine-plan-documents. (accessed 05/03/21).

enforce planning conditions. It has been suggested that these issues will only increase during pandemic recovery.

In addition, integration of the system is needed to ensure that relevant legislation is considered for those who will be affected by a development. In Wales, the Wellbeing of Future Generations Act specifically emphasises the importance of these broader considerations, while Planning Policy Wales 11 has embraced the principles of WFG Act to set the direction of planning for Wales for the future.

Finally, many developments, whether of local or national interests, such as HNC, have the potential to cause concern among members of the public who perceive that they will be affected by such a development. Integration is key to ensuring that the process is more transparent and that people are able to have their concerns heard and accounted for.

This is not an issue that is specific to Hinkley Point C, nor solely to England or Wales. Moving to a more integrated, transparent, and robust planning system that is fully cognisant of the responsibilities placed on it by WFG Act, can appropriate protections for our future generations be ensured.

With regard to the Hinkley Point C Development Consent Order (DCO) (2013), the Group noted that, while Welsh agencies were able to input into this decision-making process and were agreeable to the outcome, the current challenge to its terms raises concerns and observe that the decision to be taken in this regard should not weaken protections offered to the environment. The Group notes further ongoing concerns from the parallel EDF applications to dump sediment in Welsh and English governed parts of the estuary and take the view that this serves to underline the imperative need to ensure detailed cooperation in decision-making to ensure that a consistent approach is applied and that the developer's ultimate decision as to which site it will use is appropriately framed to guarantee the highest level of protection for the estuary ecosystem regardless. A fundamental issue that emerged from the Group's investigation is that decisions taken across borders can have significant implications for Welsh institutions in pursuing their obligations under Welsh law in areas concerning sustainability and the environment, where there are now significant distinctions in the applicable law between Wales and England. In the case of Hinkley Point C, while there was sustained informal cross-border discussion, the more general issue of the links between planning permission and the regulation of polluting activities is very much to the fore. This raises important cross-border issues, as planning permission granted in England not only has significant environmental ramifications for Wales but also on the ability of Welsh agencies to fulfil their statutory responsibilities under regulatory law and the WFG Act, as the range of options open for consideration are effectively curtailed by decisions taken in elsewhere. The general position is that planning decisions and pollution control decisions are 'separate but complementary'[75] and this has been confirmed in case

[75] *Currently expressed (this restates the previous approach* from Office of the Deputy Prime Minister, Planning Policy Statement 23: Planning and Pollution Control, para 10, (2004)) in Ministry of Housing, Communities and Local Government: National Planning Policy Framework (2019) (England) at para 183: '*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the*

law (see *Gateshead MBC v Secretary of State of the Environment* [1995] Env L. R. 37). However, as a steady stream of reported case law demonstrates, this approach has not served to fully address potentially problematic confusion as to demarcation of decision-making responsibilities across agencies. This picture of how supposedly interlocking regulatory responsibilities interact in practice becomes more complex still in the context of cross border impacts and increasing distinctiveness in law and policy coverage of planning and environmental regulation between England and Wales.

6.2.3 Sediments

The Group noted in its treatment of sediments issues in Chapter 3, that issues involving nuclear activities raise high levels of public anxiety and require very careful communication to contextualise and clarify the issues and allay concerns. The Group observed that providing explicit guidance on the need to address radioactivity in applications to the MMO in sampling and monitoring plans is essential to fostering a robust regulatory process and public confidence therein.

6.2.4 Modelling and the Cardiff Grounds and the Portishead Marine Disposal Areas

Chapter 4 raises substantive concerns around Hydro-environmental Modelling Study TR186, which in the Group's view were not adequately addressed by Hydro-environmental Modelling Study TR267 and which go to their quality and fitness for purpose in permitting processes. The Group advises that, on the basis of the evidence that it has seen, modelling regarding the impact of Hinkley Point C's thermal plume and future sediment dumping activities on the Severn Estuary SAC, fish breeding grounds and on migratory fish pathways, is not sufficiently robust to fully inform decision-making. It was also noted that the dual role of Cefas as a government advisory body and simultaneously as a commercial provider of modelling to EDF raises systemic concerns. Despite assurances given, the combination of roles undertaken by Cefas, in which Cefas (advisory) appears to have reviewed the work of Cefas (commercial), goes to the credibility of the regulatory process by raising issues as to the appearance of bias and conflict of interest.

6.2.5 Emergency Planning

The report of the International Atomic Energy Agency's (IAEA) Integrated Regulatory Review Service (IRRS) mission to the UK in 2019 revealed the considerable complexity of nuclear regulation generally,[76] with regulatory endeavour fragmented across numerous UK and Devolved Government Departments and agencies. The IRRS pointed to preparation for engaging with the process as having 're-energised' cooperation among the relevant regulatory bodies and encouraged continued cooperation at this level (p9). The IRRS report is peppered with references to Memorandums of Understanding (MOU) documents, indicating that they play a

planning issues should not be revisited through the permitting regimes operated by pollution control authorities.'

[76] Report of the Integrated Regulatory Review Service (IRRS) Mission to the United Kingdom of Great Britain and Northern Ireland, Rev. 1 (April 2020) online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/899129/irrs-report-2020-to-uk.pdf (accessed 24/02/21).

significant role in tackling fragmentation in nuclear regulation. The Group observes that local government involvement in emergency planning, not least in light of changes to relevant provisions in the 2019 Radiation Emergency Preparedness and Public Information Regulations (REPPIR19), not only adds further density to the arrangements in place for emergency planning in this area but also raises issues of capacity, resource, and communication for local authorities in this regard, which are amplified in a cross border context.

6.3 Advice

The picture that has emerged from the Group's inquiry into the sediment dumping issues associated with sediments from Hinkley Point C has proved revealing across a number of key themes namely: fit and/or fracture between regulatory and real world issues in cross-border contexts; regulatory complexity across issues, regulators, and borders; regulatory transparency; and delegation. Each of these themes raises concerns that go to the efficacy of current arrangements to allow the Welsh Government and its institutions to deliver regulation of Wales' part of the Severn Estuary in line with their obligations in Welsh law.

Regulatory fit/fracture

At base, the Hinkley Point C sediments issue raises issues of fit/fracture between regulation and real world environments as the Severn Estuary falls under both Welsh and English law and policy regimes. The Severn Estuary is a complex ecosystem, whose health requires a multi-dimensional and integrated approach to human interactions with it. Geographic and topical fragmentation of regulatory responsibility for the estuary poses challenges which (while inevitable to some degree given the range of environmental and wider sustainability concerns that require coverage and in consequence of governance arrangements that cross a border, invoking increasingly divergent legal settings) require concerted efforts in coordination to deliver the best decisions for the environment and all stakeholders.

Advice 1. The Group advises that clarity around regulatory roles and responsibilities and consideration of the ways they interact can contribute substantially to better regulation in these complex conditions which will continue to be relevant to effective governance of the Severn Estuary.

Regulatory complexity across issues

Regulatory complexity features as a consistently significant issue in the context of disposal of the Hinkley sediments. Of its many dimensions, taking environmental considerations first, Welsh law treats these issues as interlinked and would warrant adopting expansive understanding and engagement with the environmental impacts of any permitted activity, going beyond licensing to consider ecosystem vitality, as required by the Environment (Wales) Act 2016. The societal impacts of regulating large scale complex operations, such as those around Hinkley Point C, with implications across sectors and borders and central and local government, extends to the need to tailor the operation of broader decision-making structures to the particular situation in hand. The need to clarify and make readily visible the arrangements in place to facilitate multi-level, cross-agency and cross-border cooperation is clear. These are significant not only in respect of the efficacy of governance arrangements, but also in regard to fostering public confidence in the

ability of regulators to work together and in revealing the forms that their interactions will take.

Memorandums of Understanding (MOU) and other documents aimed at collaborative working already play an important but under-interrogated role in a number of contexts that are relevant to Hinkley Point C, not least inter-agency issues, e.g., between EA and NRW; and between the Health and Safety Executive (HSE), the ONR, the EA, NRW and the Scottish Environment Protection Agency (SEPA) on the Implementation of the Major Accidents (COMAH) Regulations 2015. In contexts involving complex cross-agency, cross-border, and multi-level governance issue, negotiating and adopting an overriding concordat may offer a potentially useful framing for coordinating activities in the longer term, see for example, the 2019 Coastal Concordat for England.[77]

Advice 2. It is advised that, given the importance of MOUs and other documents covering collaborative working arrangements in shaping cross-sector and cross border regulatory interactions that their role, currency, content and transparency be reviewed. They no longer function as merely technical documents to facilitate regulatory activity, having a dual purpose that also speaks to facilitating regulation in complex conditions in the public interest. It would therefore be prudent to make them more visible and subject to specific report/scrutiny by the Senedd.

- It is advised that in recognition of the fact that MOUs and other documents covering collaborative working play an important role in shaping regulatory interactions, their role should be clear and clearly communicated on signatories' websites to better inform stakeholders, including the general public, about them and their role.
- It is advised that, in addition to MOUs and other documents covering collaborative working containing a commitment to review and update, that good document hygiene should be practiced by signatories in their treatment on websites, subjecting the material to regular editing, foregrounding current iterations, ensuring direct links to coverage of substantive areas and to other relevant agencies, and archiving material that is no longer current.
- It is advised that MOUs and other documents covering collaborative working, as documents adopted in the public interest, employ clear and simple language.
- Given their variability in form, it is advisable that the precise nature and status of each MOU and documents performing similar functions should be explicitly delineated.

Advice 3. The Group advises considering, as a matter of urgency, developing a comprehensive and publicly available coastal concordat for Wales that reflects not only regulatory rationalisation (the prime driver of the English Coastal Concordat) but encapsulates the principled, distinctly Welsh approach to sustainability in the WFG Act and the Environment (Wales) Act.

[77] A coastal concordat for England (revised: December 2019) Updated 30 October 2020. Online at https://www.gov.uk/government/publications/a-coastal-concordat-for-england/a-coastal-concordat-for-england-revised-december-2019 (01/03/2021).

Regulatory complexity across borders

Cross agency working already creates considerable complexity in this area and, as devolution prompts increasingly distinctive coverage in substantive law, this constitutes an additional significant factor in the treatment of cross-border regulatory issues involving Wales.

Advice 4. The Group advises that, where there will be cross-border impacts, integration is needed to that concerns relating to the application of contextually significant Welsh law and policy, notably the Well-being of Future Generations Act and Planning Policy Wales (Edition 11)[78], are addressed at an early stage.

Advice 5. Given the inclusion of 'involvement' as one of the five ways of working in the Well-being of Future Generations Act, which at base requires the provision of good, clear, information to all stakeholders in public decision-making processes, the Welsh Government and its agencies would be advised to promote, as good practice, the inclusion of more explicit information on sampling and monitoring of radioactive substances in interactions with the Marine Management Organisation.

Advice 6. The Group notes that changes to zoning in the Radiation Emergency Preparedness and Public Information Regulations (REPPIR19) mean that there might be resource and capacity implications for Welsh local authorities arising from the Hinkley Point C development and advise the Welsh Government that supporting them as a group, through the appointment of a designated specialist officer, would greatly facilitate efficacious and coordinated engagement with emergency planning plans and processes.

Transparency

Public confidence and trust in regulatory decision-making is predicated on delivering transparency and traceability across and within decision-making processes in order to justify confidence that core administrative law requirements on, for example, lawfulness, reasonableness, and probity have been met. A further fundamental dimension of transparency lies in the ability to challenge flawed decisions. The Group notes that delay in the Environment Bill becoming law and in instituting the Office of Environmental Protection (OEP) for England is not fully addressed by the provision of the Interim Environmental Governance Secretariat (IEGS) within Defra. The latter body has limited capacity and any substantial complaints that pass its preliminary filtering activities will have to await the creation of the OEP for determination.[79]

It also appears to be the case that, pending the creation of Wales' promised independent commission for the environment[80] (WICE), the Interim Environmental

[78] Welsh Government: Planning Policy Wales (Edition 11) February 2021. Online at https://gov.wales/planning-policy-wales (accessed 08/03/21)

[79] Letter from the Secretary of State for the Environment to the Chairs of the Environment Food and Rural Affairs and the Environmental Audit Committee. Online at https://committees.parliament.uk/publications/3556/documents/34372/default/ (accessed 23/02/21)

[80] Letter from the Minister for Environment, Energy and Rural Affairs to the Chair of the Environmental Governance Stakeholder Task Group online at https://gov.wales/sites/default/files/publications/2020-11/letter-by-minister-for-environment-energy-and-rural-lesley-griffiths.pdf (accessed 23/02/21).

Protection Assessor for Wales is in an analogous position. This would amount to an effective deferral of justice should complaints need to be made in the interim, which raise questions of compliance with article 9 of the Aarhus Convention on prompt access to justice. Furthermore, it is not clear how cross border environmental justice issues, such as those that arise in the Severn Estuary, will be dealt with in the interim period and beyond, though it is noted that the already evident asymmetry in status between the (departmental) IEGS the (independent) WICE has the potential to create additional tensions, not least in terms of public expectations of environmental justice.

Advice 7. The Group advises the Welsh Government that the duration of interim arrangements be as brief as possible in order to avoid potential non-compliance with the Aarhus Convention.

Advice 8. The Group advises the Welsh Government that the relationship between the independent commission for the environment and the Office of Environmental Protection, and how they will interact on issues of cross-border concern, requires urgent attention.

While it is recognised that specialist state bodies such as Cefas, an agency of DEFRA, often host public advisory and commercial activities within their organisational structure, the Group observed that it is imperative that it is always readily apparent that these functions operate at arm's length from one another and which limb of the organisation has been involved in a particular activity. In the context of Hinkley Point C, the delineation between Cefas's public role in advising regulators and its commercial activity in undertaking consultancy for EDF was muddled and inadequate, creating confusion and raising questions as to transparency and generating adverse perceptions regarding independence.

Advice 9. It would be highly advisable that Cefas (advisory) not be used by NRW to review the work of Cefas (commercial) in regulatory processes, due to the impression of bias that this creates, noting that actual bias is not required to damage the credibility of a decision-making process, nor to raise the prospect of judicial review. In short, review processes must not only be independent, but be seen to be independent. Furthermore, as decision-makers Natural Resources Wales would be advised to require applicants to state clearly throughout any application for a permit which limb of Cefas they have engaged with.

Advice 10. For Welsh decision-makers it would be advisable to act on the view that, at a minimum, transparency requires that the following core information be readily ascertainable and clearly indicated in all relevant documentation: who is responsible for making the decision; why they are responsible for doing so; their competence to do so; and how they have reached a decision on the substance of the matter; and how the decision has given effect to the requirements of all relevant statutory framings, including the cross-cutting Well-being of Future Generations Act.

Delegation

While the Group recognises that delegation of decision-making powers is often necessary with regard to technical issues, delegation is not always concerned with such matters. The Group observes that, insofar as obligations under the WFG Act are concerned, particular considerations arise: the fact the NRW is a public body as

defined in s6(1)(e) of the WFG Act and is thus subject to legal obligations in this regard does not displace the responsibilities of the Welsh Ministers under s6(1)(a) and each in their respective roles is required in *'carrying out sustainable development*' to s3(1)(b) take '*… all reasonable steps (in exercising its functions) to meet … [defined well-being] objectives'*. Thus, where cross cutting and complex regulatory issues arise that have implications for Wales and the Welsh people, and where the efficacy of the arrangements that are in currently in place raise significant questions, the Welsh Government has a responsibility to ensure the effective pursuit of the five ways of working.

Advice 11. For the purposes of transparency and in respect of its role referred to above, it would be advisable for Welsh Government to ensure documentation and processes promote quality control in addressing whether and how all of the relevant statutory and policy framings, including the Well-being of Future Generations Act, have been considered by its agencies in their decision-making roles.

The Group observes that valuable lessons can be drawn on the use of powers by the Welsh Government and its agencies, not only to inform future engagement with the Hinkley Point C project itself, but that are also of potentially broader significance. The Group came to the view that our examination of the issues points to the advisability of developing proactive, coherent, structured, and transparent treatment of issues with cross-border impacts, linking decision-making on planning, the regulation of pollution and ecosystem concerns in the cause of sustainability. Coverage for infrastructure projects that are significant in size/sensitivity and environmental impacts would be most fit for purpose if it encapsulated conscious linkage of administrative and real-world systems: before (at planning and inter-agency cooperation stages); during (in decision-making); and after (regarding monitoring, enforcement, and potential challenges in PINS, the OEP/WICE and the Courts) decisions are made.

Chapter 7

Advice

The Group came to the view from our examination of the issues, that there are a number of problems with established processes for major infrastructure developments which could have unintended negative consequences, if not addressed, within the cross-border context. The Group welcomes the opportunity to review the current arrangements and regulatory systems around Hinkley C in order to improve environmental and transparency outcomes. This points to the advisability of developing proactive, coherent, structured, and transparent treatment of issues with cross-border impacts, linking decision-making on planning and the regulation of pollution and ecosystem concerns to ensure that the Welsh requirements of the Well-being of Future Generations (Wales) Act and the Environment (Wales) Act are taken fully into consideration.

What is contained here is our primary advice to the First Minister, based on the discussion of issues in Chapters 1-5. It should be read alongside Chapter 6, and the detailed evidence in each chapter will provide a fuller understanding.

1. General good governance (for public confidence)

Decision making

- Decision-making roles and responsibilities to be made more clear to the Welsh public, particularly whether and how all of the relevant statutory and policy framings, including the Well-being of Future Generations (Wales) Act have been considered by agencies in their decision-making roles.
- Governments should require applicants and decision-makers of major infrastructure projects to ensure adequate separation of duties and independence throughout planning stages.

Modelling and independent review

- Modelling must be of the highest level of accuracy and transparency for major infrastructure projects and should be independently reviewed with adequate separation of duties and independence throughout the planning stages.

Specific organisation advice:

- Natural Resources Wales and the Welsh Government should not engage the commercial and advisory arms of Cefas on the same project until clarity is achieved on roles and responsibilities.

2. Cross-border issues (governance)

Cross border project planning

- Any future cross-border infrastructure projects need to consider Welsh legislation and policy from a project concept stage on a project which has a direct, or substantial indirect, influence on the people or environment of

Wales. An urgent review of cross border governance issues is proposed to consider:

- Welsh legislation from the outset of a project's development
- the integrity of Severn Estuary planning across the Welsh/English border
- strengthening cross border planning including for specific agencies e.g., Office of Environmental Protection, the Planning Inspectorate and Natural Resources Wales.
- whether regulatory harmony is best delivered by Memoranda of Understanding and how such arrangements should be delivered.

3. Cross border issues (environment)

Designated sites

- Active management of all designated sites in the Severn Estuary Special Areas of Conservation should be resourced to restore and enhance the resilience of the ecosystem.

Coastal Concordat and Cross border marine planning

- Development of a comprehensive and publicly available coastal concordat that reflects England's focus on regulatory rationalisation and encapsulates the distinctly Welsh approach to sustainability in the Well-being of Future Generations (Wales) Act 2015 and the Environment (Wales) Act (2016).

Specific organisation advice:

- Welsh Government should work with the Marine Management Organisation to introduce appropriate measures to strengthen cross-border marine planning to improve when monitoring of plan effectiveness.

4. Implications of Hinkley Point C development

Impact on Severn ecosystem

The original requirements of the Hinkley Development Consent Order permissions must be upheld to avoid any significant adverse short-term or long-term effect upon the features of the Severn Estuary. In particular, there should be no weakening of the Development Consent Order requirements for an Acoustic Fish Deterrent. As outlined in Chapter 1, with predicted fish loss of 37 tonnes or 182 million fish per annum, the environmental risk is too great.

Compensatory measures

If no suitable mitigation is available, the development can then only be approved provided three tests are met:

- There are no feasible alternative solutions to the plan which are less damaging.
- There are "imperative reasons of overriding public interest" for the plan to proceed.

- Mitigation and compensatory measures are secured to ensure that the overall coherence of the network of European sites is maintained i.e., to replenish the estuary with a commensurate number and range of fish stocks.

Water abstraction best practice

- Alternative water abstraction systems should be considered to the current proposals. Closed water cooling systems, such as those using cooling pools, are now considered best practice elsewhere and considerably reduce the pressure on marine ecosystems.

Cardiff Grounds Marine Disposal Site

- In light of contradictory modelling evidence, the Welsh Government and/or Natural Resources Wales should undertake independent model studies to review the suitability of Cardiff Grounds as a marine disposal site before any further licences are granted.

Radioactivity issues

- While the Group found no evidence of increased risk to the public or the environment, stakeholders should recognise public concern regarding radioactivity and provide appropriate assurances.

Specific organisational advice:

- The Marine Management Organisation website and the Natural Resources Wales website should provide enhanced guidance for marine licencing involving radioactive substances, and
- The Welsh Government and its agencies are advised to promote more explicit information on sampling and analysis of radioactive substances in interactions with the Marine Management Organisation.

5. Emergency Planning

Emergency Planning

- The Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services should review plans or procedures relating to potential nuclear emergencies at Hinkley Point or any other nuclear site that may have implications for Wales

Specialist support

- The Group notes there may be resource and capacity implications for Welsh local authorities arising from the Hinkley Point C development. The Welsh Government should support local authorities through the appointment of a designated specialist support on emergency planning.

Active engagement

- The Group encourages the Welsh Government, relevant Welsh local authorities, local resilience fora and emergency services to participate, as

appropriate, in Somerset County Council’s next Level 2 exercise for Hinkley Point B in 2021

List of received and reviewed evidence, documents and communications

In addition to the sources of information cited throughout the report, the Group received and reviewed further evidence, documents and communications. These are listed here.

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