Environmental Permitting (England and Wales) Regulations 2010

Application by NNB Generation Company Limited (NNB GenCo) to carry on a water discharge activity at Hinkley Point C Power Station

EPR/HP3228XT/A001

Decision document

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Executive summary

1 NNB Generation Company Limited (NNB GenCo) has applied for an environmental permit to carry on a water discharge activity, under the Environmental Permitting (England and Wales) Regulations 2010. The proposed new power station is known as Hinkley Point C Power Station.

2 Hinkley Point C (HPC) will be located immediately due west of the existing Hinkley Point A and B power stations on the Somerset coast, and approximately 12km north-west of the town of Bridgwater. HPC would consist of two UK EPR™ (UK EPR) reactor units, each capable of producing 1630MW_E of electricity for export to the national grid.

3 We have already assessed the UK EPR reactor in our Generic Design Assessment (GDA) process and issued an interim Statement of Design Acceptability (SoDA) in December 2011. We are now satisfied that EDF and AREVA have fully resolved our two GDA Issues, and we issued a full SoDA in December 2012.

4 The water discharge activity relates to the discharge of non-radioactive liquid effluent, which can be attributed to the following sources:

- returned abstracted cooling water
- process effluent from the various plant systems
- treated sewage effluent from staff welfare facilities

5 Hinkley Point C would require a continuous supply of water for cooling. The power station would use a direct cooling system to abstract seawater from the Bristol Channel to serve the steam turbine condensers and various auxiliary systems. After being used within the power station, the seawater would then be discharged at a higher temperature to the Bristol Channel via a 1.8km long outfall tunnel.

6 Returned abstracted cooling water is the main emission (or waste stream) associated with this permit application. It represents approximately 99.9%by volume of the total overall daily discharge of non-radioactive effluent. The maximum daily discharge volume of cooling water would be approximately 11.6 million cubic metres. During standard operation, cooling water would be returned to the Bristol Channel at a maximum temperature of 12.5°C above the ambient seawater temperature, having passed through the steam turbine condensers.

7 Several much smaller waste streams would be combined with the returned abstracted cooling water before being discharged to the Bristol Channel. Process effluent would be produced mainly as a result of removing waste from the plant systems, to maintain the best operating conditions and maximise efficiency.

8 Our assessment considered the discharge of effluent during certain commissioning activities (known as 'hot functional testing') and the subsequent operational phase of Hinkley Point C. The operational phase includes planned maintenance and refuelling periods as well as routine day-to-day operations.

9 We have advertised the application and consulted on it. We assessed the application, considered the responses received and made a draft decision to grant the permit subject to the conditions in the draft permit.

10 In our draft decision document for the water discharge activity we set out our preliminary conclusions on NNB GenCo's application and considered:

- proposed emissions to surface water and their potential impact on water quality
- proposed emissions to surface waters and their potential impact on the nationally and internationally important designated habitats and species of the Severn Estuary
- our GDA conclusions, to make sure that NNB GenCo has dealt with any issues as part of the permitting process that were not covered by GDA
- whether the proposed strategy and discharge of total residual oxidant (TRO) are acceptable for controlling biological fouling of the cooling water system
- the matters raised during the consultation

11 We also considered the impact on marine life of abstracting cooling water, as during this process certain marine life will unavoidably be drawn into the cooling water intakes.

12 We assessed the impact of the water discharge activity in relation to a wide range of legislation, including the Habitats Directive[1] and the Water Framework Directive.[2]

13 In considering the Habitats Directive, we carried out an assessment of potential impacts on the Severn Estuary SAC, SPA and Ramsar designated European conservation sites. The main areas of concern that we focused on were (i) thermal impacts due to the discharge of cooling water at a higher than ambient temperature (ii) toxic contamination due to process chemicals, including the use of biocide to control biofouling, and (iii) the entrainment and impingement of fish and planktonic organisms within the cooling water system.

14 We concluded that we were satisfied that there would be no adverse impact on the integrity of the designated sites as long as certain mitigation and monitoring measures were put in place. These requirements were included within our draft permit unless they were outside our remit, in which case we strongly advised the relevant Competent Authorities to include the requirements within their respective permissions.

15 In considering the Water Framework Directive (WFD), we carried out an assessment of the potential impacts on the WFD waterbodies that could be affected, namely Bridgwater Bay and the Parrett Estuary. Our assessment of the potential impact of the proposed discharge addressed both physico-chemical parameters, as well as the ecological elements that form the basis of the ecological classification of these waterbodies.

[1] The Conservation of Habitats and Species Regulations 2010

[2] Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

16 We concluded that the proposed water discharge activity would not cause the current status of the WFD waterbodies to deteriorate, nor prevent them from achieving their objectives.

17 Our assessment of the impact of proposed discharges indicated that apart from temperature and TRO, the levels of all other permitted substances contained within the waste streams do not exceed the relevant environmental quality standard or target before being discharged to the Bristol Channel. Our draft permit required NNB GenCo to operate the power station in a way that ensures the maximum loading of substances in the discharge does not exceed those levels stated in its application. We included limits for temperature and TRO in our draft permit that would make sure that the environment was protected.

18 At this stage we concluded that there was no reason why we should not grant a permit. We considered that the limits and conditions in the draft permit were suitable to protect people and the environment.

19 We then carried out a consultation on our draft decision and draft permit. The consultation aimed to seek views to help us reach a final decision; in particular whether there were any errors, omissions or new relevant information that had not been considered.

20 We publicised our draft decision and draft permit. We held seven public surgeries and six meetings with local councillors in Somerset and South Wales. These meetings were to help the public understand both our role and how we had made our draft decisions. We received responses from partner organisations and other interested groups. We have made all the responses available on public registers.

21 We assessed all the issues raised by consultees. We consider that nothing has been raised that requires us to change our draft decision. We have decided to grant NNB GenCo an environmental permit to allow it to discharge non-radioactive liquid effluent from the new nuclear power station it proposes to build at Hinkley Point.

22 The permit we are granting only has one minor change compared to the draft permit we consulted on. At the request of NNB GenCo we removed the term ‘(fuel loading)’ from the final bullet point of pre-operational measure PO8 contained in Schedule 1, Table S1.4, as detailed in section 5.1 of this decision document.

1. Introduction

1.1 About this decision document

23 The purpose of this decision document is to set out our considerations and decisions on the application.

24 This document explains:

- the role of the Environment Agency;
- our assessment of the application; and
- our consideration of the responses received to our consultations.

25 This document includes a:

- description of how we process and determine applications (Section 2);
- summary of the application and our consultation on it (Section 3);
- description of our assessment (Section 4);
- statement of our decision (Section 5);
- summary of responses from those we consulted and how we have covered the issues raised (Annexe 2 and Annexe 4);

26 In this document we have:

- identified by name, organisations we have 'working together' agreements with; and
- not identified by name, members of the public who responded.

1.2 The Environment Agency

27 Our corporate strategy **Creating a better place 2010-2015**[3] sets out our aims and describes the role we play in being part of the solution to the environmental challenges society faces.

28 Our strategy aims to create a better place by securing positive outcomes for people and wildlife, in five key areas. We will:

a) act to reduce climate change and its consequences;

b) protect and improve water, land and air;

c) work with people and communities to create better places;

d) work with businesses and other organisations to use resources wisely;

e) be the best we can.

[3] http://publications.environment-agency.gov.uk/PDF/GEHO1109BQXE-E-E.pdf

1.3 Our role in environmental regulation

29 We regulate the environmental impacts of nuclear sites, such as nuclear power stations, nuclear fuel production plants and plants for reprocessing spent nuclear fuel, through a number of environmental permits. These permits may be needed during the site preparation, construction, operation and decommissioning phases of the plant's lifecycle.

30 The permits we issue include conditions and limits. In setting these, we take into account all relevant national and international standards and legal requirements to make sure that people and the environment will be properly protected. These standards and requirements are described in the following Government and Environment Agency guidance:

Defra Environmental Permitting Guidance
http://www.defra.gov.uk/environment/policy/permits/index.htm

DECC Environmental Permitting
http://www.decc.gov.uk/en/content/cms/meeting_energy/nuclear/radioactivity/decc/legislation/epr2010/epr2010.aspx

Environment Agency Environmental Permitting Guidance
http://www.environment-agency.gov.uk/business/topics/permitting/32320.aspx

31 We inspect sites to check that operators are complying with the conditions and limits, and that they have arrangements in place to help ensure compliance. We may take enforcement action (for example, issuing an enforcement notice or taking a prosecution) if they are not compliant.

32 We regularly review permits, and vary them if necessary, to make sure that the conditions and limits are still effective and appropriate. Where significant changes are required, we may consult on these changes.

33 We work closely with the Office for Nuclear Regulation (ONR), which regulates the safety, security and nuclear material safeguards and transport aspects of nuclear sites.

1.4 Our regulatory role in the development of new nuclear power stations

34 As with existing nuclear sites, any new nuclear power station will require environmental permits from us to cover specific aspects of site preparation, construction, operation and eventually decommissioning. In the light of Government and industry expectation that plants of almost the same design might be built on a number of sites and potentially be run by different operating companies, we have split our process for assessing and permitting the operational stage of new nuclear power stations into two phases.

35 In the first phase, Generic Design Assessment (GDA), we carry out detailed assessments of candidate designs put forward by reactor designers. We assessed the design of the UK EPR pressurised water reactor submitted by EDF and AREVA. In December 2011, we

published our decision document and issued an Interim Statement of Design Acceptability (interim iSoDA)[4].

36 During our assessment of the design we identified GDA Issues and assessment findings. A GDA Issue is a matter that the reactor designer must resolve before we would issue a full SoDA. An assessment finding is a matter that any future operator has to address during either the detailed design, commissioning or early operation of the reactor.

37 Our GDA decision for the UK EPR was subject to two GDA Issues, both joint with ONR. EDF and AREVA proposed resolution plans to address both GDA Issues. With ONR, we reviewed these plans and consider them credible.

38 We summarised the two GDA Issues in our decision document as:

a) *Provide a consolidated final GDA submission, including agreed design change for the UK EPR. The Issue reflects that EDF and AREVA will need to continue to control changes to the GDA submission documents, resulting from the management of possible changes to the design until the issue of the final SoDA. Design changes are also possible in resolving the GDA Issues identified by ONR.*

b) *Consider and action plans to address the lessons learned from the Fukushima event.*

39 We are now satisfied that EDF and AREVA have fully resolved our two GDA Issues, and we issued a full SoDA in December 2012.

40 Our detailed assessment of the UK EPR included consideration of other (non-radiological) environmental matters where we have a regulatory role, for example, the abstraction and discharge of cooling water and the discharge of liquid effluents to surface water. In considering non-radiological matters, we identified a number of issues that were outside the scope of GDA and which applicants would need to address during site-specific permitting (phase 2). These site-specific issues are discussed in Section 4.

41 We have now completed the second phase for Hinkley Point C, and completed our determination of an application for a water discharge activity (WDA) environmental permit from NNB GenCo for its proposed Hinkley Point C Power Station.

1.5 NNB GenCo's applications for operational environmental permits

42 NNB GenCo has applied for three environmental permits for the power station when it is operational. These are for the disposal of radioactive waste, the operation of the standby diesel generators and the discharge of trade effluent (cooling water and process effluent) and treated sewage effluent.

43 This decision document records our consideration of the application for the discharge of trade effluent and treated sewage effluent. We have produced separate decision documents for the other two applications.

4 http://www.environment-agency.gov.uk/homeandleisure/135648.aspx

44 NNB GenCo has not started to build the proposed power station at Hinkley Point C. NNB GenCo applied for permission in the form of a Development Consent Order from the Infrastructure Planning Commission (IPC). Consideration of the project has now passed to the National Infrastructure Directorate (NID) of the Planning Inspectorate who will make a recommendation to the Secretary of State for a decision.

45 The Overarching National Policy Statement for Energy EN1 *says "The planning and pollution control systems are separate but complementary" and that "..the IPC should work on the assumption that the relevant pollution control regime and other environmental regulatory regimes, ……...will be properly applied and enforced by the relevant regulator",* also that *"the IPC should be satisfied, before consenting any potentially polluting developments, that the relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework……"*

46 EN1 also states that *"Wherever possible, applicants are encouraged to submit applications for Environmental Permits and other necessary consents at the same time as applying to the IPC for development consent."*

47 NNB GenCo applied for the permits and we considered the applications at this early stage of the development so that we were able to provide an update on the progress of our decision making to the NID at the appropriate time.

48 We consider that there are significant benefits in early regulation of site-specific design and the development of the operator's organisational capabilities.

49 In any case, we consider that issuing a permit early allows us to specify pre-operational conditions and requirements for further information in the permit, so that environmental matters are considered before the detailed design is finalised. We are also able to influence the commissioning programme to make sure that environmental matters are fully addressed.

50 We built on our assessment of the UK EPR in GDA that we have previously consulted on. We will assess changes to the reactor design for Hinkley Point C if NNB GenCo proposes to significantly modify the GDA assessed UK EPR design.

2. How we process and determine applications

51 The Environment Agency is responsible under the Environmental Permitting (England and Wales) Regulations 2010 (EPR 10), for regulating certain activities on nuclear sites in England and Wales. This decision document details our assessment of an application for a water discharge activity, namely:

- the discharge of trade effluent (comprising of cooling water and process effluent) and treated sewage effluent to the Bristol Channel during commissioning and operation of Hinkley Point C power station.

52 We regulate these sites to protect members of the public from harm from the discharge or release of pollutants to water, and to protect the wider environment. We regulate within a framework of extensive government policy, strategy and guidance. This framework is summarised in the Environmental Permitting Core Guidance[5]. This guidance sets out the government's position on how environmental permitting should be applied and implemented, and how both the Environment Agency and operators should interpret particular terms in England and Wales. In summary, the aim of environmental permitting is to:

- protect the environment so that statutory and government policy environmental targets and outcomes are achieved;
- carry out permitting and compliance with permits and certain environmental targets in a clear and open way that minimises the administrative burden on both the regulator and the operators;
- encourage regulators to promote best practice in the operation of facilities;
- continue to fully implement European legislation.

[5] http://www.defra.gov.uk/publications/files/pb13897-ep-core-guidance-130220.pdf

53 Operators can apply to the Environment Agency for a new permit or a variation to an existing permit at any time. The process we follow in assessing applications is outlined in Table 1 below.

Table 1 Overview of the process for determining applications

Phase		Comment
1	Pre-application	We encourage applicants to discuss applications with us before submitting them.
2	Receive application and consult on the application	NNB GenCo makes an application, providing the information as set out in the application form and supporting guidance. We advertise and consult on all applications for new permits. We may also advertise and consult on some variations, depending on the nature of the proposals and the likely degree of public interest.
3	Assess application and make a draft decision	We carefully assess the application and any responses received from the consultation and come to a draft decision on whether to grant the application and, if so, the appropriate permit conditions.
4	Consultation on draft decision	We may choose to consult further on our draft decision and draft permit, depending on the nature of the proposals and the likely degree of public interest. We do this using a consultation document that sets out our draft decision.
5	Review, approval and issue of decision	Where we consult on our draft decision, we carefully consider all relevant information we have received during the consultation. We make a decision whether to issue a new permit and, if so, what its conditions should be. We publish a document that provides the reasons for our decision.

54 We advertised and consulted on the application in accordance with our public participation statement and associated 'working together' arrangements: see our "Working together: your role in our environmental permitting"[6]. In view of the nature of the application and the degree of public interest, we decided to carry out further consultation on our draft decision and draft permit. We did not make any final decision about this application until we had considered the responses to our public consultations.

[6] http://www.environment-agency.gov.uk/static/documents/Business/Working_together_PPS_v2.0.pdf

We made our decision taking into account all relevant legal, policy and regulatory matters, and consultation responses about the application. Table 2 sets out the main issues we need to consider when making decisions on the application and refers to relevant reference documents and guidance.

Table 2 : Key areas of assessment	
Area of assessment	**Documentation**
Management and operator competence	How to comply with your environmental permit RGN 1 Understanding the meaning of operator RGN 5 Operator Competence
Technical	How to comply with your environmental permit for water discharge and groundwater activity permits (EPR 7.01)
Other statutory requirements	RGN 2 Understanding the meaning of regulated facility RGN 4 Setting standards for environmental protection RGN 6 Determinations involving sites of high public interest

55 In Section 4 of this document we explain how we reached our decision against these and any other relevant considerations. We take into account any consultation responses we receive before making a final decision. We will place the permit and our decision document on the public register.

56 While we will normally determine an application, the Secretary of State can require any application to be sent to him for determination (regulation 62 of the EPR 10). As noted in the core guidance, this would be an exceptional step and likely to be taken only if the application involves issues of more than local importance – for example, if the application:

- is of substantial regional or national significance;
- is of substantial regional or national controversy;
- may involve issues of national security or of foreign governments.

57 The core guidance also says that any decision on the need for determination by the Secretary of State would be made solely on those grounds, with no consideration of the substantive merits of the application itself.

58 The Secretary of State has not “called in” this application.

3. The application and our consultations

59 NNB Generation Company Limited (NNB GenCo) applied for an environmental permit to carry on a water discharge activity at a proposed new nuclear power station at Hinkley Point in Somerset. The proposed new power station is known as Hinkley Point C Power Station.

60 NNB GenCo (Company number 06937084) was incorporated in 2009. It is a wholly owned subsidiary of NNB Holding Company Limited, which, in turn, is owned by EDF Energy Holdings Limited (80% share) and GB Gas Holdings Limited (20% share). Centrica (GB Gas Holdings) announced in February 2013 its decision not to participate in UK nuclear new build. NNB GenCo is known locally, and for some of the planning applications, as 'EDF Energy.'

61 NNB GenCo's application consisted of the relevant environmental permit application forms and a submission of information to provide the required detailed technical information.

62 NNB GenCo is a new organisation and construction of the proposed Hinkley Point C has not commenced. There are a number of areas where the organisation or the detailed design of the facilities will need to be developed. NNB GenCo proposed a forward action plan to deal with these matters within their application.

3.1 Location of the site

63 Hinkley Point is located on the Somerset coast approximately 12km north-west of Bridgwater.

64 The water discharge activity relates to the discharge of trade effluent (comprising of cooling water and process effluent) and treated sewage effluent. The discharges will arise during (a) the hot functional testing phase of plant commissioning, and (b) the subsequent operation of the power station.

65 The water discharge activity is limited in scope to the discharge of non-radioactive cooling water, process effluent and treated sewage effluent. Radioactive substance activities are subject to a separate environmental permit application, reference EPR/ZP3690SY/A001. Furthermore, it does not consider the discharge of uncontaminated surface water run-off from the site during the operational phase.

66 There are a number of international and national environmental designated sites close to Hinkley Point. These are:

- Severn Estuary Special Protection Area (SPA);
- Severn Estuary Special Area of Conservation (SAC);
- Severn Estuary Ramsar site;
- Exmoor and Quantock Oakwoods SAC;
- Bridgwater Bay Site of Special Scientific Interest (SSSI);

- Severn Estuary SSSI;
- Blue Anchor to Lilstock Coast SSSI
- Bridgwater Bay National Nature Reserve.

67 The nearest Area of Outstanding Natural Beauty (AONB) is Exmoor.

3.2 Description of the proposed facility

68 The operation of the power station would require a continuous supply of cooling water. The UK EPR uses a direct cooling system that abstracts seawater from the Bristol Channel to serve the steam turbine condensers and various auxiliary systems. After being used within the power station, the seawater would then be discharged at a higher temperature to the Bristol Channel. Returned cooling water represents the main emission (or waste stream) associated with this permit application.

69 Several much smaller waste streams are combined with the returned cooling water before being discharged to the Bristol Channel. These are produced mainly as a result of removing waste from the plant systems, to maintain the best operating conditions and maximise efficiency. Generally, this includes demineralised water contaminated with conditioning chemicals, corrosion products and dissolved salts. There will also be discharges of effluent from the demineralisation plant, used to produce demineralised feedwater; from the site oily water treatment system; and from the on-site sewage treatment plant.

70 We consider abstracting cooling water is closely linked to the water discharge activity because it is part of the same overall process stream that continuously draws in and discharges cooling water. Therefore, as well as assessing the discharges above, we have also considered the impact of abstracting cooling water on marine life, some of which will unavoidably be drawn into the cooling water intakes.

71 The natural environment of the Severn Estuary is highly significant and important both nationally and internationally. It is, therefore, subject to a number of statutory conservation designations to make sure species and habitats in this area are appropriately managed and protected. These include the Severn Estuary Special Area of Conservation (SAC), Special Protection Area (SPA), and Ramsar. The potential impact of the water discharge activity on these designated sites is a key part of our assessment.

72 We received the permit application from NNB GenCo on 23 September 2011. After initially checking the application, we considered that it was ‘duly made’, in the correct form and containing enough information for us to begin our determination.

3.3 Further information requested from the applicant

73 If when we consider an application, we need further information, we can serve a notice on the applicant in accordance with Schedule 5 of the EPR 10. We refer to these notices as Schedule 5 notices.

74 As we considered NNB GenCo's application, we found that we needed further information, and we served two Schedule 5 notices. We made our notices and the responses available on our Hinkley Point webpage[7] and at local public registers. NNB GenCo supplied the information we requested and published it, together with the application, on EDF Energy's Hinkley Point webpage[8].

75 We describe our assessment in Section 4.

3.4 Consultation on the application

76 We advertised and consulted on the application from 1 November to 15 December 2011 in accordance with our Public Participation Statement [9] and Working Together Arrangements [10]. We made the responses available at the public registers, and at Environment Agency and local authority offices listed in Annex 1, except where the person making the response asked us not to do so.

77 We received responses from our consultation on the application from organisations we have 'working together' agreements with, other organisations and members of the public. These responses and how we have addressed them are contained within Annex 2.

78 We had some responses that supported the development, some that were opposed in principle to new nuclear development, and some that raised specific issues about the application.

79 Some of the responses were outside our remit and we have passed these onto the relevant bodies, for example safety related issues to ONR and general opposition to government policy to the Department of Energy and Climate Change (DECC).

3.5 Consultation on the draft decision and draft permit

80 We advertised and consulted on the draft decision document and draft permit from 13 August to 9 November 2012 in accordance with our Public Participation Statement [11] and Working Together Arrangements [12].

81 We published the draft decision document and draft permit on our website and made them available as listed in Annex 3.

82 In accordance with our communications plan, we placed advertisements, distributed posters, issued media releases and wrote to about 1000 individuals and organisations inviting them to take part in the consultation. We held full day public surgeries in Bridgwater, Burnham, Cannington, Otterhampton, Stogursey, Watchet and Barry. We held meetings

[7] http://www.environment-agency.gov.uk/homeandleisure/127159.aspx
[8] http://hinkleypoint.edfenergyconsultation.info/public-documents/environmental-permit-applications/
[9] http://www.environment-agency.gov.uk/static/documents/Business/Working_together_PPS_v2.0.pdf
[10] http://www.environment-agency.gov.uk/business/topics/permitting/36420.aspx
[11] http://www.environment-agency.gov.uk/static/documents/Business/Working_together_PPS_v2.0.pdf
[12] http://www.environment-agency.gov.uk/business/topics/permitting/36420.aspx

with local councillors in Bridgwater, Williton and Winsford in Somerset and Barry, Cardiff and Newport in South Wales.

83 We received responses from partner organisations, other interested groups and members of the public. These responses and how we have addressed them are contained within Annex 4.

84 We made the responses available at the public registers, at Environment Agency and local authority offices listed in Annex 3, except where the person making the response asked us not to do so.

3.6 Other applications

85 NNB GenCo applied for two other environmental permits for the power station when it is operational. These are for the operation of the standby diesel generators (application reference EPR/ZP3238FH/A001) and for the disposal of radioactive waste (application reference EPR/ZP3690SY/A001). We took a coordinated approach to the consultations on all three draft decision documents for the operational permits.

4. Our assessment

4.1 Introduction

86 This section sets out our decision following our assessment of the application and consideration of the responses to the consultations on the application. There are a number of matters we needed to consider before deciding whether to grant a permit and, if so, subject to what conditions.

87 In reaching our decision, we have taken into account the relevant legislation, government policy and guidance, our own guidance and the responses to the consultations on the application. Table 2 in Section 2 summarises the main documents that describe these requirements.

88 There are also a number of issues that are outside our area of responsibility and which we have not considered in reaching our decision. We have set out these issues at the end of this section.

4.2 Overview

89 This application for an environmental permit relates to the discharge of trade effluent (cooling water and process effluent) and treated sewage effluent to surface water from the commissioning and operational phases of a new nuclear power station at Hinkley Point C (HPC). The legal framework that supports our assessment of the application for this water discharge activity is explained in Section 4.3.

90 HPC is located immediately due west of the existing Hinkley Point A power station nuclear licensed site (NLS) boundary, on the Somerset coast. The centre of the HPC development site is located at Ordnance Survey National Grid Reference (NGR) co-ordinates ST 20300 45800. HPC would consist of two UK EPR reactor units, each capable of producing a thermal output of 4500MW_{TH} and a net electrical output of 1630MW_E for export to the National Grid.

91 The operation of HPC would require a continuous supply of water to serve the steam turbine condensers, removing waste heat from the system. The proposed direct cooling system would abstract seawater from the Bristol Channel via two intake tunnels, one for each reactor. These would extend approximately 3.4km and 3.5km respectively from the foreshore high water mark, at a depth of approximately 20m below the seabed. At their seaward extent, the two intake tunnels would be around 480m apart. There would be two intake heads on each tunnel, located about 200m apart, and sitting just above the sea bed. After being used within the plant, the seawater would then be discharged at a higher temperature to the Bristol Channel via a single outfall tunnel, 1.8km long. Figure 1 below shows where the above infrastructure would be located. It also shows the dedicated discharge tunnel associated with the fish recovery and return (FRR) system, as discussed later in this section.

92 When operating normally, the UK EPR reactor needs a maximum of around 67 m^3/s (5.8 million m^3/d) of cooling water. This would result in a maximum cooling water discharge from HPC of 134 m^3/s (or 11.6 million m^3/d). Returned abstracted cooling water would account for approximately 99.9 per cent of the overall discharge, with the remainder made up of process effluent from various supporting systems, and treated sewage effluent from staff welfare facilities.

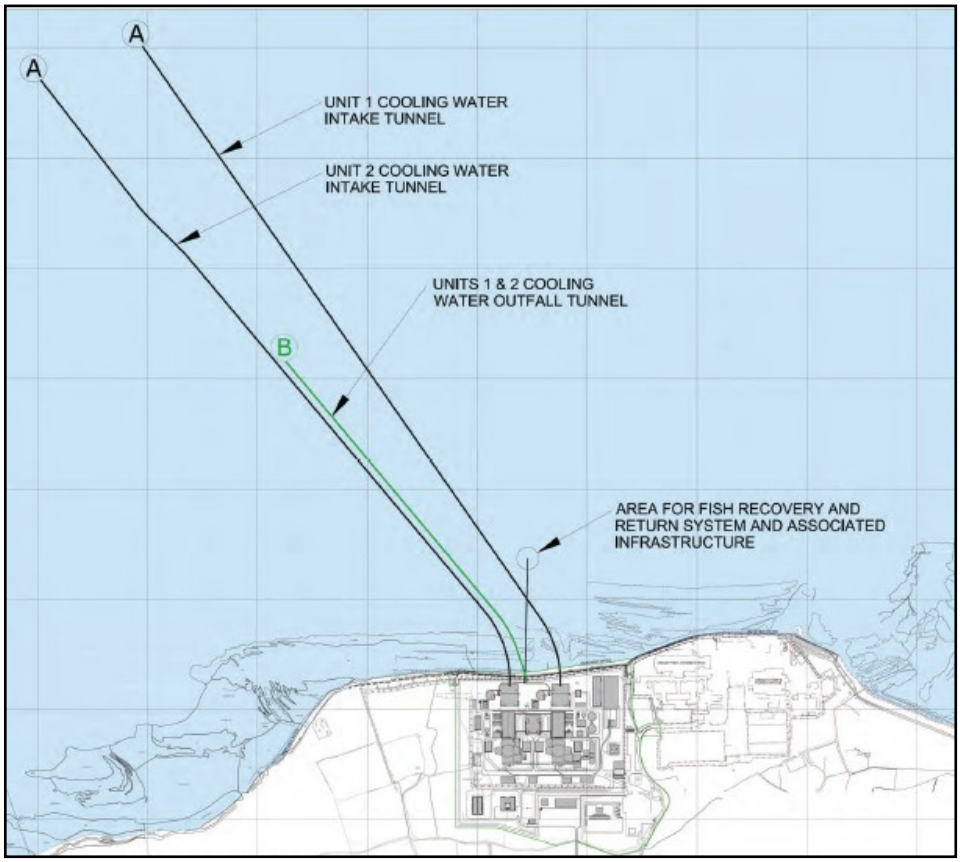

Figure 1. Cooling water system infrastructure showing inlets (A) and discharge outfall (B) (source: NNB GenCo)

4.3 Legal framework

93 NNB GenCo has applied for an environmental permit under the Environmental Permitting (England and Wales) Regulations 2010, to carry on a water discharge activity at Hinkley Point C power station. The following definitions from EPR 10 set out the legal context for the application and our determination of it.

94 Water discharge activity is defined under Schedule 21, Regulation (3)(1)(a) as:

> *"the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any (i) poisonous, noxious or polluting matter, (ii) waste matter, or (iii) trade effluent or sewage effluent."*

95 The requirement for an environmental permit is set out in Part 2, Chapter 1, Regulation 12 (1) (b):

> *"A person must not, except under and to the extent authorised by an environmental permit, cause or knowingly permit a water discharge activity or groundwater activity."*

96 with Part 2, Chapter 2, Regulation 13 (1) (a) stating that:

> *"On the application of an operator, the regulator may grant the operator a permit (an "environmental permit") authorising the operation of a regulated facility."*

97 Regulated facility is a collective term used to describe all the different kinds of operations that require a permit under EPR 10. A water discharge activity is a particular kind of regulated facility as defined under Part 1, Regulation 8 (1) (f):

> *"In these Regulations, "regulated facility" means……... (f) a water discharge activity……"*

98 The regulated facility includes all the equipment essential to carry on that activity and the site (of the regulated facility) is the footprint of that equipment, including the discharge pipe and outlet. The site includes control equipment, control rooms and utility areas serving them. In many cases, as with this permit application, the discharge to surface water will be made outside the boundary of the development site.

99 We have considered several storage areas to be included as part of the regulated facility. These areas are used for storing substances used across the site, but mainly in processes or systems associated with the water discharge activity. This includes the following areas, as referenced on NNB GenCo's site plan submitted with the application, and marked on our permit - (a) hydrazine and ammonia storage, (b) chemical products storage, and (c) oil and grease storage.

100 NNB GenCo has proposed a range of best practice measures to minimise the risk of pollution from accidents and/or spillages. In terms of our permit, the storage areas above,

as part of the regulated facility, are subject to the following standard condition in our permit, to prevent pollution of the water environment:

- *All liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container.*

4.4 The site

101 NNB GenCo has provided satisfactory plans that show the extent of the site of the regulated facility, including discharge points. Schedule 7 of the permit shows the extent of the regulated facility, and the operator is required to carry out the permitted activities within that site boundary. For the purposes of EPR 10, the regulated facility will lie both within and outside the HPC nuclear licensed site, as the outfall tunnel will extend some 1.8km out into the Bristol Channel.

102 While we consider the site plans are satisfactory to determine the application, we acknowledge that due to the early submission of the application, detailed design work is still ongoing. The application contains enough information to identify the buildings, treatment facilities, storage facilities and the outlet point(s) associated with the water discharge activity, but not all of the interconnecting pipework.

103 NNB GenCo has stated that this detail is not yet available, but has made a commitment in its permit application to provide this information when the final design is completed. Given the lengthy time frames involved with the design and construction process, we consider this to be acceptable. We have included a pre-operational measure in our permit, stating that this information must be submitted to us for approval before any discharges can begin.

104 The discharge will be made to the Bristol Channel via two diffuser heads on the cooling water outfall tunnel. NNB GenCo has provided National Grid References (NGR's) for each outlet, at ST 19176 47521 and ST 19128 47578 respectively. It has also stated that these NGR's include a 50m limit of deviation to allow for any tunnel drilling contingencies. We have included a pre-operational measure in our permit that states that confirmation of the final NGR's must be submitted to us before any discharges can begin.

4.5 The UK EPR

105 The UK EPR is a pressurised water reactor (PWR) based around a primary circuit, a secondary circuit and a tertiary (or cooling) circuit. The primary circuit and nuclear steam supply system, which is part of the secondary circuit, are located within the reinforced concrete containment (or reactor) building, located on the area known as the 'nuclear island.' The turbine hall, located on the area sometimes referred to as the 'conventional island' houses the turbo generator sets for producing electricity. There are also numerous support buildings and infrastructure associated with the operation of the UK EPR. In the

context of this application, that includes things such as the cooling water forebays and pumphouses, the outfall ponds, the demineralisation plant and the sewage treatment plant. Figure 2 below shows the basic operation of the UK EPR.

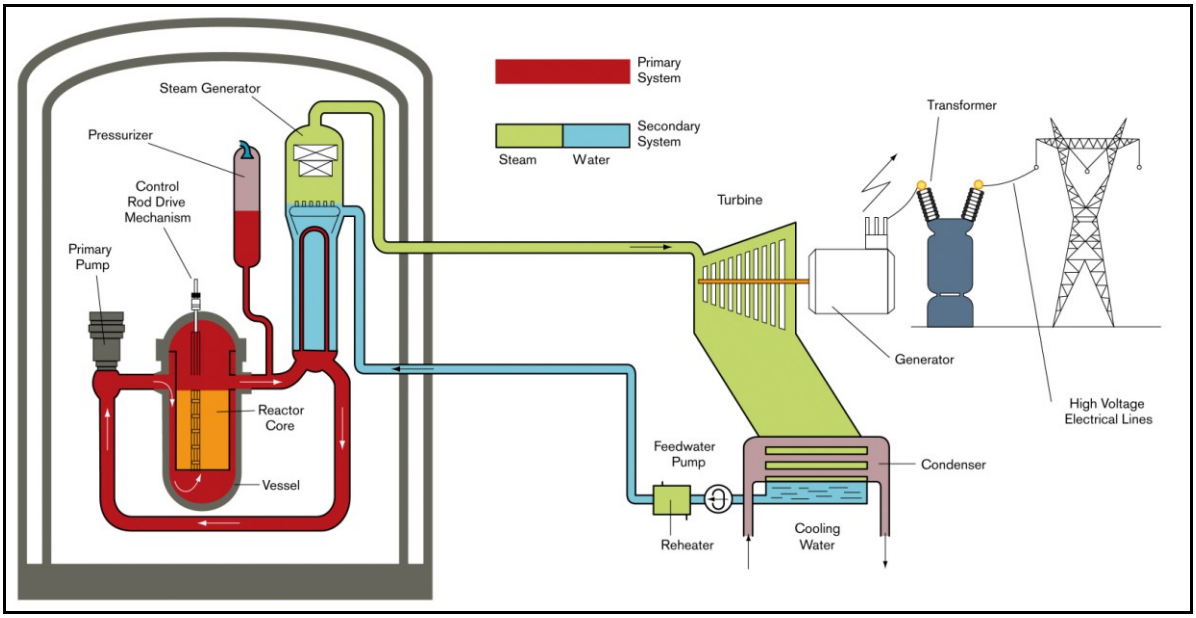

Figure 2. Conceptual diagram of the proposed HPC power station (source: NNB GenCo)

4.5.1 The primary circuit

106 The primary circuit is a closed, water-filled pressurised system consisting of the reactor (a steel vessel containing the fuel within the reactor core) and up to four coolant loops, with each having its own steam generator and coolant (primary) pump, and a pressuriser. The heat produced by the fission reaction inside the reactor is extracted by pressurised water (primary coolant), which circulates around the primary circuit. The heated water passes to the steam generators where the heat is transferred to the secondary circuit.

4.5.2 The secondary circuit

107 The secondary circuit is a closed, independent system that supplies steam to the turbo generator within the turbine hall. The heated steam produced by the evaporation of water (secondary coolant) in the steam generators drives the turbine, which spins a generator to produce electricity. After passing through the turbine, the steam is then condensed by the water circulating in the tertiary circuit. The condensate is returned to the steam generators, and the cycle continues.

4.5.3 The tertiary (or cooling) circuit

108 Cooling water is required to remove “waste heat” from the power station. The tertiary circuit is independent of the primary and secondary circuits. Its purpose is to condense the steam

of the secondary circuit, dissipating waste heat to the environment in the process. The majority of the abstracted cooling water is pumped through the main cooling water system to the condensers, with the balance used primarily within the auxiliary cooling circuits necessary for operating the reactors safely. Each UK EPR unit is served by two main cooling water pumps (CRF pumps), and a number of smaller pumps serving these auxiliary systems.

4.6 Commissioning

109 Commissioning of the UK EPR reactor is proposed to take place in two stages, namely (i) cold flush testing (CFT) and (ii) hot functional testing (HFT). The commissioning process for each unit would last for about 24 months. Both CFT and HFT processes will produce liquid effluents.

4.6.1 Cold flush testing

110 Cold flush testing, which mainly involves cleansing and flushing the various plant systems with demineralised water to remove surface deposits and residual debris from installation, is outside the scope of this permit application. NNB GenCo's intention is for CFT effluent to be discharged to the Bristol Channel via the foreshore outfall serving the HPC construction site. The discharges resulting from CFT will be subject to a separate, later water discharge activity permit application.

4.6.2 Hot functional testing

111 Hot functional testing begins following completion of CFT and when all the required systems are available. It takes place before fuelling the reactor and only once the cooling water infrastructure is in place and operational. The objective of HFT is to test the reactor and associated systems under pressure, temperature, flow and chemical conditioning as close to normal operating conditions as practicable without putting nuclear fuel at risk. The effluent produced during HFT would be diluted within the cooling water system before being discharged via the outfall tunnel to the Bristol Channel.

112 NNB GenCo has stated that due to the current stage of the project and the long lead time until commissioning takes place, detailed information on the nature of the discharges during HFT is limited, but that HFT can be considered as running the systems under normal operating conditions. It states that there are no plans to dose the primary circuit with anything other than the same chemicals used during normal operations. The discharge would, therefore, be similar and subject to the same permit limits as those that would apply during normal operation.

113 We have not, therefore, been able to specifically assess discharges from the HFT process. What this means in practice is that the same permit limits we have proposed for various contaminants during normal operations will also apply to discharges arising during HFT. NNB GenCo is aware of this requirement.

114 NNB GenCo has made a commitment in its permit application to submit a detailed commissioning discharges management plan before any commissioning activities begin. Given the lengthy time frames involved with the construction process, we consider this to be acceptable. From a regulatory viewpoint, the commissioning discharges management plan is an important requirement and, as such, is reinforced through a pre-operational measure attached to the permit.

4.7 Operation

115 NNB GenCo has outlined several scenarios that describe the operation of HPC. An appreciation of the configuration of the plant during these scenarios, which are described below, is important in understanding how we have approached the determination of the application. A theoretical scenario (maintenance test RF2) has also been described, which although it should not occur in practice, has been proposed by NNB GenCo in order to define the limits of its impact assessment.

4.7.1 Standard operation

116 This refers to the situation when both units are operating normally at their full capacity, that is 100 per cent load, with all four CRF pumps operational. The reactors may be subject to power changes within this scenario from time to time in line with operational requirements, but the default is for operation at full capacity.

4.7.2 Outage

117 This refers to the situation when a unit is shut down for planned routine maintenance and/or refuelling. Typically, maintenance would be to a CRF pump or to an element of the filter train. During an outage neither CRF pump on the shut down unit is operational. The smaller pumps continue to feed cooling water to the auxiliary systems. The other reactor unit would continue to operate as per standard operation. An outage would be expected to take place every 18-22 months and typically last for about two weeks.

4.7.3 Maintenance test (RF3)

118 This refers to the situation when both reactor units are operational, one on 100 per cent load with two CRF pumps running, and the other unit on 90 per cent load with only a single CRF pump in operation. The plant could be operated under this configuration as a result of both planned and unplanned situations. The remaining CRF pump would be subject to maintenance during this period.

119 Normally, pump maintenance of this type would be planned to coincide with an outage as described above. However, NNB GenCo reports that it is not unknown for unexpected failures to occur while the unit is operating at full power, for example, pump or drumscreen failure. If this unplanned situation were to occur, the load on the unit would be reduced to a maximum of around 90 per cent rated thermal power (RTP) to compensate for the loss, and would remain in this configuration until the fault is rectified, which would be expected to take no longer than one month.

120 NNB GenCo has stated that even when routine pump maintenance is scheduled to coincide with an outage, it may be necessary to operate the plant in the RF3 configuration for up to a month. This is because the time to complete the required maintenance work is going to take longer than the critical tasks normally associated with an outage, for example, refuelling of the UK EPR unit. In this planned situation, the CRF pump would either be taken off line before the outage proper begins or it could remain off line after the critical outage tasks have been completed and the UK EPR unit has been brought back up to power.

4.7.4 Maintenance test (RF2)

121 This refers to a theoretical situation where both UK EPR units are operating at 100 per cent load, with only a single CRF pump serving each unit, that is with only 50 per cent cooling water capacity. NNB GenCo states that if this situation occurred in practice, this would likely result in the plant being shutdown. It says that having more than one CRF pump out of operation at any one time would not be considered to be part of normal operations. However, because this situation represents a useful worst case in terms of cooling water flow, it has used it within its assessment to characterise short- term (24hr) discharges.

4.8 Key issues of the decision

4.8.1 Emissions to surface waters (water quality assessment)

122 While the permit relates to the whole water discharge activity, the main focus of our assessment relates to the quality of the effluent and the proper operation of the equipment provided. The key issue for us, therefore, was to carefully consider the emissions to surface waters, particularly the discharge of (a) heat, in the thermal plume (b) biocide, and (c) dangerous and hazardous substances used in the various process streams.

4.8.2 Habitats Regulations Assessment

123 The natural environment of the Severn Estuary is highly significant and important both nationally and internationally. It is, therefore, subject to a number of statutory conservation designations to make sure the species and habitats present are appropriately managed and protected.

124 We are required under Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (“Habitats Regulations”) to carry out an ‘appropriate assessment’ for any permissions we grant that could potentially have a significant impact on the designated conservation sites.

125 The purpose of this assessment is to establish whether we can conclude that our permissions, on their own or together with other relevant permissions, plans or projects will not adversely affect the integrity of the sites in question.

126 We have carried out an appropriate assessment (Habitats Regulations Assessment (HRA)), which covers all relevant Environment Agency permissions. A summary of our appropriate assessment for the water discharge activity is discussed in Section 4.13.2.

4.8.3 Generic Design Assessment

127 Generic Design Assessment (GDA) is a joint programme between the Environment Agency and the Office for Nuclear Regulation (ONR), which is part of the Health and Safety Executive. Under GDA, we assess generic design matters for new nuclear reactor designs to determine whether they are suitable for future authorisation, subject to various site-specific licensing and permitting regimes. ONR is responsible for assessing the nuclear safety and security aspects of the new reactor designs, while we consider the environmental aspects.

128 As mentioned in Section 1, we carried out a detailed assessment of the UK EPR, which included consideration of the abstraction and discharge of cooling water and liquid effluent to surface water. In considering non-radiological discharges to surface water, our main objective based on the generic information submitted, was to decide “in principle” whether we would be able to grant a water discharge activity permit for the UK EPR at the subsequent, site-specific permitting phase.

129 From our assessment of the UK EPR, we concluded that we should be able to permit the discharge of non-radiological substances to surface water. However, we recognised that this would depend on our consideration of various site-specific issues, and knowing that any application for a water discharge activity permit would need to include an environmental impact assessment based on detailed dispersion modelling of the receiving waters.

130 It was particularly important to our assessment to identify matters that were outside the scope of GDA which applicants would need to address during site-specific permitting. We consider that all of the site-specific issues arising from our GDA assessment, which are relevant to the water discharge activity, as listed in Table 3 below, have been satisfactorily addressed via NNB GenCo's permit application and our determination of that application.

Site-specific issue from GDA	How addressed by NNB GenCo
1. The impact of the thermal plume (heat) on the receiving environment.	Detailed assessment using three-dimensional hydrodynamic modelling of excess temperature from the thermal plume in Bridgwater Bay.
2. The impact of biocide residues on the receiving environment.	Detailed assessment using three-dimensional hydrodynamic modelling of total residual oxidant (TRO) in Bridgwater Bay.
3. The consideration of the ecological impacts of the discharge(s), including assessment under the Habitats Directive, where applicable.	Comprehensive Habitats Regulations Assessment with respect to the designated European conservation sites of the Severn Estuary, that is SAC/SPA/Ramsar; and consideration of impacts on relevant non-European sites, for example, SSSIs.
4. The impact assessment of those substances and metals currently without an environmental quality standard (EQS), in particular circuit conditioning chemicals.	H1 screening assessment carried out in accordance with Environment Agency guidance. Detailed assessment using hydrodynamic modelling of hydrazine discharges in Bridgwater Bay.

Site-specific issue from GDA	How addressed by NNB GenCo
5. The full consideration of trace metal contained within bulk raw materials.	H1 screening assessment carried out for cadmium and mercury, which are present as trace elements in the raw materials used in certain treatment processes.
6. The discharge arrangements for non-radioactive effluent streams.	Description of discharge arrangements and provision of site plan sufficient to determine the application. Some elements are still to be confirmed on completion of final design, and are subject to a pre-operational measure in our permit.
7. The design of the on-site sewage system.	Sufficient information on the discharge of treated sewage has been provided, including expected emissions data and effluent quality standard. Final design will be confirmed in accordance with a pre-operational measure in our permit.
8. The exact nature of the effluent monitoring system.	Provision of an in-depth description of the procedures and techniques that could be used for monitoring the various waste streams. Confirmation of final details will be subject to a pre-operational measure in our permit, as will confirmation of the exact locations of the monitoring points on each waste stream, following completion of detailed design.

Table 3. Site-specific water discharge activity issues from GDA

131 In our permit we felt it necessary to include a pre-operational measure with respect to issue numbers 6 and 7, and two pre-operational measures with respect to issue number 8. They relate to issues of detail and not principle that NNB GenCo cannot reasonably deal with until further detailed design work has been completed. These issues will be fully addressed following satisfactory completion of the pre-operational conditions.

132 NNB GenCo has highlighted areas within its permit application where the information presented is different from that it submitted under GDA. The most obvious difference is the fact that the GDA submission was based on a single UK EPR, while at HPC there would be two reactors units. The other key differences relate to:

- the production of demineralised water. The permit application states that at HPC the demineralised water required to feed the primary and secondary circuits would be produced from the treatment of mains water in a demineralisation plant. The GDA submission was based on a combination of demineralisation and desalination technology. Desalination is not proposed for HPC.
- chlorination of cooling water. Within the GDA submission, it was proposed that in order to control biological fouling (biofouling), the cooling water would be dosed to 0.5mg/l of active chlorine once every 30 minutes. The permit application states that this would not be needed because operational experience at Hinkley Point B power station (HPB) in particular suggests that biofouling levels are likely to be relatively low. NNB GenCo has proposed an alternative risk-based dosing strategy.

4.8.4 Cooling water abstraction

133 We have decided that an abstraction licence for direct cooling is not required for HPC, as we consider that the abstraction is from the open sea. An abstraction licence would normally only be required if the location or method of abstraction leads to the water being abstracted from an inland water.

134 Regardless of this licensing decision, we consider the cooling water abstraction to be closely linked to the water discharge activity because it is part of the same overall process stream that continually draws in and discharges cooling water. We decided that it was appropriate to assess the potential impacts arising from the abstraction via our HRA for the water discharge activity. The focus for this assessment was to determine whether the proposed cooling technology represented best available techniques (BAT) for minimising impacts on marine life.

135 Abstracting seawater for direct cooling will mean that organisms present in the water will generally be drawn into the water intakes, unless they are able to detect and actively respond to any behavioural cues placed near the intakes, for example strobe lights or acoustic deterrents, and thereby avoid the intakes. These organisms can range from planktonic bacteria and algae to macro-invertebrates and fish. Once within the cooling water intake, the nature of their passage through the cooling water system depends on their size and the design of the system itself. Organisms will either be (a) impinged on the cooling water drum screens used to prevent debris entering the cooling water heat exchangers, or (b) entrained in the flow of cooling water through the screens, via the pumps, heat exchangers and other components of the cooling water circuit and back to the receiving water.

136 We have considered within our assessment the potential for the higher temperature of the cooling water downstream of the condensers to impart a thermal shock to entrained organisms as they pass through the system. Following discharge from the outfall tunnel, the temperature of the cooling water decreases as it mixes with the surrounding seawater, so it is these entrained organisms that will experience the highest temperatures.

137 The proposed cooling water system for HPC includes (a) an acoustic fish deterrent (AFD) system and (b) a fish recovery and return (FRR) system. The AFD system is located near the seawater intakes to provoke an avoidance reaction in certain species of fish. The FRR system will form an integral part of the design to sensitively recover (capture) and return impinged species back to the Bristol Channel via a dedicated FRR outfall tunnel.

4.8.5 Control of biological fouling

138 Biological fouling (or biofouling) refers to the growth or colonisation by bacteria, fungi or other species, such as the blue mussel within the cooling water system. Without appropriate control measures the abstraction of seawater for cooling would present considerable operational risks due to biofouling, particularly in the condensers, where significant colonisation of organisms entrained with the cooling water would reduce the overall efficiency of the power station. The potential for biofouling increases as sea temperature rises. A sea water temperature of 10°C is typically regarded as the point at which operators would begin dosing the incoming cooling water with biocide to control the growth of

undesirable organisms. The operational requirement to achieve and then maintain a level of control over biological growth in the cooling water system tends to focus on techniques involving (a) the intrinsic design of the system where specialised materials, paints and coatings can be used, and (b) chemical dosing of the incoming cooling water with an appropriate biocide, for example sodium hypochlorite. The most appropriate strategy for any given location depends on site-specific factors, with careful consideration needed to determine the best system of control.

139 The proposals for controlling biofouling at HPC involves intrinsic design measures together with risk- based intermittent chemical dosing. Based on experience at HPB, NNB GenCo concludes that chemical dosing is unlikely to be required. Nevertheless, for operational efficiency (and safety) reasons, it must retain the ability to dose (chlorinate) if conditions require it. Within the application NNB GenCo has provided outline details of its proposed strategy for chlorination of the incoming cooling water and an associated risk assessment, looking at the potential impact of residual oxidant and chlorination by-products in the receiving water.

140 NNB GenCo has stated that the information contained within the permit application presents a worst case scenario in terms of the contaminants associated with chlorination. It proposes to finalise their biofouling control strategy for HPC, based on the lessons learnt through commissioning and early operation of the EPR being built at Flamanville in France. We consider this to be acceptable and have included a pre-operational measure in our permit which requires NNB GenCo to confirm and justify their final control strategy for HPC.

4.9 The water discharge activity

141 Given that a water discharge activity is the “the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any (i) poisonous, noxious or polluting matter, (ii) waste matter, or (iii) trade effluent or sewage effluent”, in making an environmental permit application NNB GenCo has a duty to describe such *matter* or *effluent* in its application.

142 NNB GenCo has described the various waste streams that would make up the water discharge activity at HPC, and these are summarised in Table 4 below.

Waste stream	Effluent type	Brief overview
A	Trade – returned abstracted water	Return of abstracted cooling water, which will be characterised by thermal content and will potentially be dosed with sodium hypochlorite to prevent biofouling of the cooling water infrastructure. This will be the most significant discharge in terms of flow.
B	Trade – known volume	Trade effluent from operations within the nuclear island, excluding effluent from the steam generator blowdown system.
C	Trade – known volume	Trade effluent from the steam generator blowdown system.
D	Trade – known volume	Trade effluent from the turbine hall and uncontrolled area floor drains, excluding effluent from the steam generator blowdown system.
E	Trade – known volume	Trade effluent associated with water potentially contaminated with hydrocarbons from the areas where oils are used (for example workshops, diesel generators and transformers), which will pass through an oil/water interceptor before joining the main discharge.
F	Trade – known volume	Trade effluent from the production of demineralised water, which will be treated to neutralise extremes of pH before joining the main discharge.
G	Domestic sewage	Sanitary effluent from administration and mess facilities, which will be treated in an appropriate effluent treatment plant before joining the main discharge.

Table 4. Water discharge activity contributory waste streams (source: NNB GenCo)

Notes: Effluent types are as described on our application form (Form EPB: Application for an Environmental Permit - Part B6 Water Discharge Activity).

143 Various treatment systems will be applied to waste streams B-G to reduce the contaminant concentrations, and to enable the recycling of boron and water in the primary circuit. The proposed treatment techniques include filtration, membrane filtration, ion exchange, degassing, evaporation and oil/water separation. The type of treatment is specific to both the origin and nature of the waste stream and the required treatment objectives.

144 NNB GenCo describes a procedure for each waste stream where the effluent will be received in monitoring tanks and then sampled before being discharged. If the sample exceeds environmental permit limits, then the effluent can be re-circulated through the treatment system again and either discharged when within environmental permit specification, or tankered off-site for disposal.

145 Following treatment, all of the individual waste streams will be combined with the returned cooling water in an outfall pond before being discharged to the Bristol Channel. The outfall pond (sometimes also referred to as a ‘seal pit’ or ‘surge chamber’) is a large concrete basin structure set into the ground, which allows the operator to regulate the water level and control the pressure head on the discharge side of the system. It is part of the cooling water system infrastructure and is located within the nuclear licensed site boundary. The HPC

design incorporates two outfall ponds, one for each UK EPR unit. Figure 3 below is a conceptual view of the waste streams and the treatment facilities that make up the water discharge activity during standard operation.

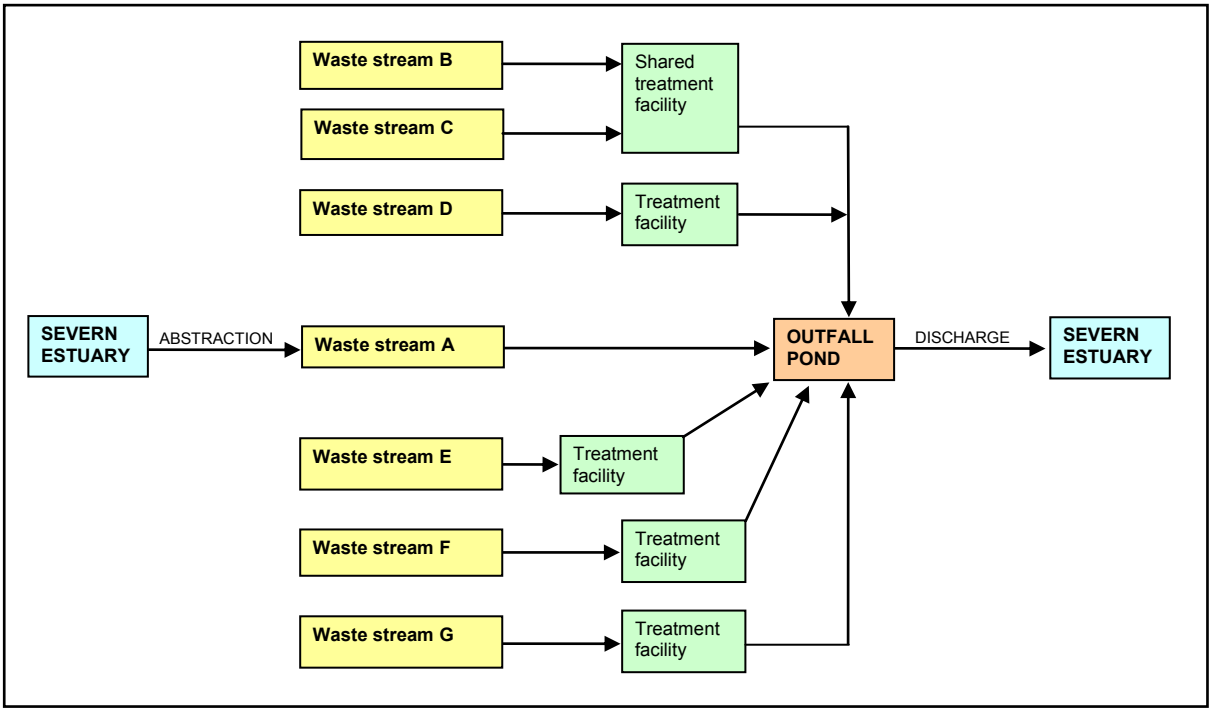

Figure 3. Conceptual view of HPC waste streams and treatment facilities

146 In order to characterise each waste stream, NNB GenCo has provided estimated emissions data, comprising maximum daily and annual loadings and maximum concentrations for each substance. The loading data refers to the maximum amount of the substance (in kilograms) resulting from the waste stream, while the substance concentration refers to the value in the waste stream before it is combined (diluted) with the flow of returned cooling water.

147 In Tables 6-9 below the substance concentration is the maximum concentration that could occur on any one day. Although not true for all substances it typically represents the maximum short term concentration associated with periods outside of standard operation when the plant is not running at full load on both units, for example, during a planned refuelling and/or maintenance outage. Maximum concentrations arising during the day to day running of HPC will for most substances be considerably less than those stated below.

148 NNB GenCo state that the estimated emissions from HPC are derived from operational experience and feedback from nuclear power plants operated by EDF in France. They have stated that the information contained within the permit application presents a worst case scenario in terms of emissions. Nevertheless, they propose to confirm proposed emissions from HPC based on further design evolution and lessons learnt through commissioning and early operation of the UK EPR being built at Flamanville in France. We consider this to be

an important and necessary step and have therefore included the requirement for NNB GenCo to confirm the proposed emissions via a pre-operational measure on our permit.

149 We have also attached two further pre-operational measures to our permit which concern the preparation (for approval by the Environment Agency) of an Emissions Management Plan (EMP). This is a standard permitting requirement and will set out how the operator plans to prevent, or where that is not practicable, minimise, any emissions not covered by limits in our permit.

4.9.1 Waste stream A

150 Waste stream A comprises seawater abstracted from the Bristol Channel for direct cooling of the condensers and various auxiliary systems. The cooling water is passed once through the cooling water system and discharged via the outfall tunnel with the addition of waste heat and possibly total residual oxidant (TRO) as a consequence of biofouling control (chlorination). Chlorination would also result in chlorination by-products (CBPs) being produced due to the interaction of chlorine with seawater.

Flow and temperature

151 The cooling water discharge is characterised predominantly by the heat load or excess temperature, that is the temperature rise above ambient experienced by the sea water as it passes through the cooling water system. The temperature rise above ambient (ΔT) largely depends on the instantaneous cooling water flow rate together with the load on the reactors. The amount of cooling water available is influenced by the state of the tide, with higher flow rates at high tide and lower flows rates at low tide, due to the variation in pressure head above the intakes. The number of main cooling water pumps in operation will also influence the flow rate. While the nature of the cooling water discharge is influenced both by environmental and operating factors, on average (over the tidal cycle) with both reactors at maximum load, the cooling water flow rate will be in the order of 125m^3/s.

152 NNB GenCo has used the scenarios described in Section 5.7 to define the key discharge parameters for waste stream A, as shown in Table 5.

Scenario	EPR Unit 1			EPR Unit 2			HPC (2 x EPRs)		
	No. of CRF pumps	Flow rate # (m^3/s)	ΔT (°C)	No. of CRF pumps	Flow rate # (m^3/s)	ΔT (°C)	No. of CRF pumps	Flow rate # (m^3/s)	ΔT (°C)
Standard operation	2	58-67	12.5-10.7	2	58-67	12.5-10.7	4	116-134	12.5-10.7
								125*	11.6*
Maintenance test (RF3) **	1	32-41	25.0-18.5	2	58-67	12.5-10.7	3	90-108	-
								99*	15.1*
Outage **	0	2.4 (min)	-	2	58 (min)	-	2	60.4 (min)	-
Maintenance test (RF2) **	1	32-41	25.0-18.5	1	32-41	25.0-18.5	2	64-82	25.0-18.5
								73*	-

Table 5. Cooling water flow rate and temperature data for waste stream A

Notes: * Averaged over a tidal cycle

** EPR Units 1 & 2 are interchangeable in the context of the number of operational pumps

Flow rate varies over the tidal cycle - figures are representative of low tide and high tide respectively unless stated

Chlorination

153 If chemical dosing of the cooling water system is required to control biofouling, an initial dose of 0.58mg/l of biocide (sodium hypochlorite) would be injected into the cooling water downstream of the drumscreens but before the condensers, to protect the very fine heat exchanger tubes within the condensers from biological growth taking hold. Once mixed with the cooling water, the sodium hypochlorite will form a number of oxidants, which typically include hypobromous acid/hypobromite as the dominant species. These biocidal oxidants are unstable and rapidly degrade in the presence of the organic matter in the cooling water. Nevertheless, there will be a degree of residual contamination in the cooling water discharge. The level of contamination is measured as total residual oxidant (TRO). The proposed dosing regime for HPC is aimed at achieving a residual level of TRO of 0.2mg/l downstream of the condensers. In addition to TRO, other non-oxidising agents are formed by chlorine interacting with seawater, and these are collectively known as chlorinated by-products (CBPs). The most prevalent species include bromoform and trihalomethanes.

Suspended solids

154 The marine waters of the Bristol Channel are characterised by high concentrations of suspended solids due to sediment mobilisation from the sea bed caused by the highly dynamic tidal regime. Results from NNB GenCo's marine water quality campaign during 2009 showed the mean suspended solids concentration to be 264mg/l, with a maximum recorded value of 1795mg/l and a trend of increasing concentrations with depth.

155 Abstracting seawater for direct cooling will cause the suspended solids (silt) naturally present in the water column to be drawn through the cooling water system and discharged back to source. The passage of silt through the system offers certain benefits in terms of biofouling control, acting as a mild abrasive to limit scope for biological growth. Nothing more than sodium hypochlorite is potentially added to the cooling water, therefore under normal operations its subsequent discharge does not present any environmental concerns.

156 Over time silt will accumulate within the cooling water forebays as the incoming flow velocity is reduced and the finer material settles out. While intrinsic design measures are used to minimise the potential for silt accumulation, it will need to be periodically removed from the forebays. NNB GenCo suggests that, when necessary, it is likely to simply re-suspend the accumulated silt within the forebays for discharge within the normal flow of cooling water.

157 NNB GenCo has made a commitment in its permit application to submit a detailed method statement for de-silting the forebays (incorporating an impact assessment) when the design of the cooling water system is further advanced, and before commissioning commences. Given the lengthy time frames involved until the system would be operational, we consider this to be acceptable. From a regulatory viewpoint, de-silting the forebays does not present any concerns in principle. However, it is important that the activity is considered as part of the overall water discharge activity. We have, therefore, included the requirement to submit a detailed method statement (and impact assessment) as a pre-operational measure in our permit.

4.9.2 Waste streams B & C

158 Waste stream B is mainly associated with let-down (draining) from the primary circuit, which is required to maintain correct circuit chemistry. The let-down water is treated and recycled, where possible, with any non-recyclable (spent) effluent being processed further before final discharge. A number of additional, smaller sources also contribute effluent to waste stream B, including the hot laundry, hot workshops, facilities for decontamination, the interim storage facility for spent fuel, and the segregated drains of the nuclear vent and drain system.

159 Waste stream B comprises demineralised water and residual dosing chemicals. The dosing chemicals are required to 'condition' the circuit, that is to control pH levels and eliminate oxygen, reducing the potential for corrosion. They include lithium hydroxide, ammonia, hydrazine, morpholine and ethanolamine. Chemical conditioning however, will not totally eliminate corrosion, and the effluent will contain metals used in the fabrication process such as aluminium, copper, chromium, iron, manganese, nickel, lead and zinc. Additionally, boric acid is used as a neutron absorber within the primary circuit to control the reactivity of the fission process.

160 Waste stream C results from the need to continually “bleed” water from the steam generators to maintain the correct chemistry within the secondary circuit. It comprises largely of demineralised water, residual dosing chemicals and dissolved salts. To counteract the effect of losing water due to blowdown, there is a corresponding top up with fresh demineralised water. The steam generator blowdown system also treats and recycles the blowdown water back into the secondary circuit. Any non-recyclable, spent effluent is processed further before it is finally discharged.

161 In determining the application, we have considered waste streams B and C as a single, combined effluent. This is because NNB GenCo was unable to separate out waste streams B and C in order to characterise them individually. It says this is because the chemical loadings submitted in the application have been derived from measurements on existing French nuclear power plants and the capability to monitor the waste streams on these plants only exists after the point where waste streams B and C merge. Therefore, following agreement with us, the data they submitted represented the combined contribution of waste streams B and C. Given that the effluents from these waste streams are similar in composition, with both arising on the ‘nuclear island’, and the fact that at HPC they would share a common treatment facility and discharge tanks, considering them together is sensible and practical. The maximum daily discharge volume of waste streams B and C is 1500m^3/d, equivalent to the contents of the two 750m^3 tanks that serve these waste streams. NNB GenCo proposes to empty each tank once a day, although not at the same time, at a maximum rate of discharge of 70l/s. Table 6 shows the maximum daily and annual loads and the maximum concentration for each substance present in waste streams B & C as provided by NNB GenCo.

Substance	Waste streams B & C		
	Daily load kg/d	Annual load kg/yr	Concentration mg/l
Boric acid	5625	14000	3750
Boron	984	2448	656
Lithium hydroxide	4.40	8.73	5.82
Hydrazine	1	3	0.67
Morpholine	75	210	50
Ethanolamine	15	65	10
Nitrogen (as N)	8	10	5.33
Nitrogen (as NH_4^+)	1.83	15	1.22
Phosphate	150	602.5	100
Detergents	270	3200	180
Suspended solids	20.24	134.96	13.50
COD	39.27	600.95	26.18
Aluminium	0.09	0.41	0.06
Copper	0.01	0.03	0.007
Chromium	0.14	0.65	0.09
Iron	0.6	2.7	0.4
Manganese	0.06	0.26	0.04
Nickel	0.01	0.03	0.01
Lead	0.01	0.02	0.007
Zinc	0.1	0.46	0.07

Table 6. Substance loading and concentration data for waste streams B & C

162 In addition to the substances above, the effluent will contain small quantities of cadmium and mercury which are present in trace amounts within the raw materials used in the treatment process.

163 NNB GenCo has demonstrated via a screening assessment that the amount of cadmium and mercury present in the discharge would not be environmentally significant. We have confirmed that the concentrations of cadmium and mercury before discharge to the environment are less than 0.1% and less than 0.5% percent respectively of the relevant short term Environmental Quality Standard (EQS). Nevertheless, cadmium and mercury are defined as Priority Hazardous Substances under the Water Framework Directive. We have therefore included a pre-operational measure in our permit requiring the operator to submit for approval by the Environment Agency a plan that describes how they intend to manage the use of chemicals so as to gradually cease or phase out discharging Priority Hazardous Substances, in accordance with the objectives set out under the Water Framework Directive.

4.9.3 Waste stream D

164 Waste stream D results from leakage and/or drainage (not blowdown) from the secondary circuit within the turbine hall and its floor drains. It comprises largely demineralised water

with residual dosing chemicals, dissolved salts, oils, greases and lubricants. The maximum daily discharge volume of waste stream D is 1500m^3/d, equivalent to the contents of the two 750m^3 tanks that serve this waste stream. NNB GenCo proposes to empty each tank once a day, although not at the same time, at a maximum rate of discharge of 90l/s. Table 7 shows the maximum daily and annual loads and the maximum concentration for each substance present in waste stream D as provided by NNB GenCo.

Substance	**Waste stream D**		
	Daily load kg/d	**Annual load kg/yr**	**Concentration mg/l**
Hydrazine	3	24.3	2
Morpholine	17.25	1464	11.5
Ethanolamine	9.75	854	6.5
Nitrogen (as N)	320	10120	213.3
Nitrogen (as NH_4^+)	71.3	12994	47.53
Phosphate	202.5	187.5	135
Suspended solids	399.8	2665	266.53
COD	290.7	4449	193.8
Aluminium	1.01	4.85	0.67
Copper	0.074	0.39	0.05
Chromium	1.56	7.72	1.04
Iron	6.55	32.27	4.37
Manganese	0.61	3.07	0.41
Nickel	0.083	0.41	0.06
Lead	0.055	0.28	0.04
Zinc	1.1	5.54	0.73

Table 7. Substance loading and concentration data for waste stream D

4.9.4 Waste stream E

165 Waste stream E comprises oily water from the oily water drainage network, which serves those areas on site where oils and hydrocarbons are used and which, therefore, present a risk of contamination. These areas include the back-up diesel generators, transformer compounds, electrical substations, oil and grease store, oil and hydrocarbon offloading areas and various workshops.

166 Waste stream E results from the incidental collection of hydrocarbons in the site oily water system, rather than a planned introduction of a substance to the waste stream. NNB GenCo proposes to install a Class 1 oil interceptor specified to achieve a maximum hydrocarbon concentration of 5mg/l. With a maximum daily discharge volume of 240m^3/day, the resultant maximum daily and annual loading of hydrocarbons would be 1.2kg and 438kg respectively. The maximum rate of discharge is 2.8l/s.

4.9.5 Waste stream F

167 Waste stream F results from the process of producing high quality demineralised water to supply the primary and secondary circuits. At HPC this would be carried out using a combination of membrane technology and ion exchange processes within a demineralisation plant. However, the final design of the HPC demineralisation plant has not yet been completed, so NNB GenCo has not been able to provide accurate data for emissions arising from the proposed process. The data submitted in the application is based on the design provided as part of GDA, which included desalination of seawater, rather than just treatment of mains (potable) water as proposed for HPC. This means that the emissions data submitted, which is reproduced in Table 6 is conservative and bounding, that is it represents a worst case, upper limit, which the actual emissions will not exceed. The emissions of several substances from the HPC demineralisation plant would be considerably less than those below, for example, chloride, iron and suspended solids, due to the fact that desalination technology will not be used.

168 The demineralisation plant effluent will also contain sequestering agents, which are used to prevent mineral deposits from blocking the reverse osmosis membranes. Proposals for HPC are to use a sodium polymer based sequestering agent comprising alkyl-phosphonic acid (in this case HEDP) and sodium polyacrylate, with small amounts of acetic acid, phosphoric acid and acrylic acid. However, using amino tri-methylene phosphonic acid (ATMP) is also being considered. The type of sequestering agent used will depend on the final design of the demineralisation plant.

169 The maximum daily discharge volume is 4000m^3/d and the maximum rate of discharge is 46m^3/s. Table 8 shows the maximum daily and annual loads and the maximum concentration for each substance present in waste stream F as provided by NNB GenCo.

Substance	**Waste stream F**		
	Daily load kg/d	**Annual load kg/yr**	**Concentration mg/l**
Detergents	-	624	0.43
Sulphates	2000	98400	500
Sodium	855	52400	213.75
Amino tri-phosphonic acid (ATMP)	45	9100	11.25
Hydroxy Ethylidene-Diphosphonic acid (HEDP)	4.5	890	1.13
Acetic acid	0.1	14	0.03
Phosphoric acid	0.1	12	0.03
Sodium polyacrylate	40	8030	10
Acrylic acid	1	165	0.25
Iron	250	46000	62.5
Suspended solids	450	88000	112.5
Chloride	450	87100	112.5

Table 8. Substance loading and concentration data for waste stream F

4.9.6 Waste stream G

170 Waste stream G results from the collection of sanitary effluent (domestic sewage) from staff welfare facilities across the site. The effluent, which will be treated before final discharge will be characterised by biochemical oxygen demand (BOD), suspended solids and ammonia. The maximum daily discharge volume is 175m^3/d, based on 1750 staff generating 100l/day of effluent per person. The maximum number of staff takes into account the significant increase in staff that would be present on site during a planned outage. Table 9 shows the maximum daily and annual loads and the maximum concentration for each substance present in waste stream G as provided by NNB GenCo.

Substance	**Waste stream G**		
	Daily load kg/d	**Annual load kg/yr**	**Concentration mg/l**
Nitrogen (as N)	4	1278	23
Un-ionised ammonium	1	150	6
Total ammonia	3.5	1278	20
Suspended solids	5.3	1916	30
Biochemical oxygen demand (BOD)	3.5	1278	20

Table 9. Substance loading and concentration data for waste stream G

4.10 General issues

4.10.1 Administrative issues

171 NNB GenCo is the sole operator of the regulated facility.

172 We are satisfied that NNB GenCo is the company that would have control over the operation of the regulated facility after the permit had been granted; and that NNB GenCo would be able to operate the regulated facility so as to comply with the conditions included in the permit. We took this decision in accordance with our guidance note RGN 1 on Understanding the meaning of operator.

4.10.2 Management

173 NNB GenCo has stated in its application that it will implement an environment management system (EMS) that will be certified under ISO14001. We have included a pre-operational measure in our permit that requires the operator to provide a summary of the EMS before the plant is commissioned, and to make all EMS documentation available for inspection. We recognise that the EMS cannot be certified until the regulated facility is operational. Therefore, we have also included an improvement condition in our permit requiring the

operator to report progress towards gaining accreditation of its EMS after commissioning of the power station has begun.

174 We have no evidence to suggest that the operator will not have the management systems to allow it to comply with the permit conditions. We took this decision in accordance with our guidance note RGN 5 on Operator Competence.

4.10.3 Accident management

175 NNB GenCo has submitted an example environmental risk assessment of potential accidents at HPC relevant to the water discharge activity. The assessment identifies a range of accidents that could occur, their potential environmental consequences, and comments on the control measures that would be applied. At this stage, a quantitative assessment of the risk associated with each accident or hazard has not been made. NNB GenCo has stated that it will provide this when detailed design data is available. Having considered NNB GenCo's outline approach to developing an accident management plan and other information submitted in its application regarding preventing and controlling pollution, we are satisfied that appropriate measures will be in place to make sure that accidents that may pollute the water environment are prevented and that, if they should occur, their consequences are minimised.

176 NNB GenCo has made a commitment in its permit application to provide a detailed accident management plan for surface water discharge activities before commissioning. This plan should form part of the EMS and, as such, this requirement is covered in a pre-operational measure referred to under Section 4.10.2.

4.10.4 Consideration of foul sewer

177 Providing several kilometres of pipeline and the associated pumping infrastructure to enable process effluent and/or treated sewage effluent to be discharged to the public foul sewer is environmentally unsustainable. Furthermore, it does not offer significant environmental benefits over a discharge out into the Bristol Channel, where there is much greater capacity to dilute and disperse effluent, rather than for example, to the Parrot Estuary, where most of the local public sewage treatment works ultimately discharge. We agree with NNB GenCo's justification for not connecting to the foul sewer.

4.10.5 Operating techniques

178 We have specified that NNB GenCo must operate the regulated facility in accordance with the documents contained in the application, as shown in Table 10.

Description	Parts included	Justification
Description of the treatment systems used to remove contaminants before discharge.	Main application document, Sections 2.3.2 - 2.3.7.	To make sure that the underlying principles and the techniques are adopted for treating effluent from each waste stream.
Prevention of unplanned emissions of oils from heat exchangers.	Main application document, Section 2.6.2.	To make sure that environment oil coolers are not used.
Hot functional testing (HFT)	Main application document, Section 2.7.2. Further information in Schedule 5 Notice responses, dated 13/02/12 and 27/03/12 respectively.	To make sure that HFT does not involve dosing with anything other than the chemicals that will be used during normal operation of the power station, and which have been included under this permit application.
Minimisation of impingement and entrainment of marine life.	Main application document, Section 3.1.3.	To make sure the multi-staged approach is adopted as stated, with respect to intake design, behavioural deterrents, (AFD), and exclusion systems, including FRR.
Oily water treatment.	Main application document, Section 3.5.	To make sure the installation of oil-water interceptor(s) follows best practice, for example, Pollution Prevention Guidance Note 3 (PPG3).
Strategy for minimising chlorination.	Main application document, Section 3.7.3.	To make sure that the in-principle strategy based on risk-based intermittent dosing is developed.
Sanitary effluent.	Main application document, Section 3.8.	To make sure a suitably size sewage treatment plant is provided to accommodate peak flows during outage, and the waste hierarchy is applied, to include the separation of uncontaminated surface water run-off from foul flows.

Table 10. Operating techniques as specified in the application

179 We have also specified that NNB GenCo must operate the regulated facility in accordance with the plans shown in Table 11 below. It must submit these plans to us for approval as part of a package of pre-operational measures included in our permit, before the hot functional testing phase of the commissioning process begins.

180 Due to the lengthy design process and construction period associated with Hinkley Point C, certain aspects of the detailed design are ongoing and evolving. We are, therefore, using these pre-operational measures in many instances to require the operator to confirm that the details and procedures proposed in the application have been adopted or implemented before commissioning begins. If designs change after the application was made, then the conditions require the operator to validate the original application data and, if necessary, demonstrate how any changes will prevent or minimise impacts on the environment and ensure compliance with our permit.

Description	Parts included	Justification
Emissions management plan.	As approved in accordance with pre-operational measure PO5 in Table S1.4.	These plans have been referred to where appropriate in the main text of this consultation document.
Commissioning discharges management plan.	As approved in accordance with pre-operational measure PO6 in Table S1.4.	
Operational strategy for the control of biofouling.	As approved in accordance with pre-operational measure PO7 in Table S1.4	
Commissioning plan for AFD and FRR systems.	As approved in accordance with pre-operational measure PO8 in Table S1.4.	
Forebay de-silting plan.	As approved in accordance with pre-operational measure PO9 in Table S1.4	
Hydrazine removal plan.	As approved in accordance with pre-operational measure PO10 in Table S1.4.	
Environmental monitoring plan.	As approved in accordance with pre-operational measure PO11 in Table S1.4	
Priority Hazardous Substances management plan.	As approved in accordance with pre-operational measure PO12 in Table S1.4.	
Effluent monitoring plan.	As approved in accordance with pre-operational measure PO15 in Table S1.4.	
Hydrodynamic modelling review plan.	As approved in accordance with pre-operational measure PO16 in Table S1.4	

Table 11. Operating techniques linked to pre-operational measures

181 The details set out above form part of the permit through permit condition 2.3.1 and Table S1.2 in the Schedules.

4.11 The environmental impact of the water discharge activity

182 NNB GenCo has considered the impact of the proposed water discharge activity by referring to our H1 Guidance, Annex D[13], which gives advice on assessing impacts from surface water discharges when applying for a bespoke permit under EPR 10.

4.11.1 Assessment methodology

183 The H1 methodology is essentially a screening procedure to determine which substances (releases) in the discharge are environmentally insignificant and which require no further assessment, that is they can be 'screened out', and those substances which cannot be screened out, are potentially significant and require further investigation. The methodology has five steps:

[13] H1 Annex D - Basic Surface water discharges (Environment Agency, 2011)

- calculate the process contribution (PC) for either a release to sewer, river, estuary or coastal water;
- screen out insignificant releases;
- carry out detailed modelling (if required);
- assess the acceptability of releases, including the assessment of any mixing zones;
- summarise risks to water.

184 The procedure is not considered suitable for screening all substances, particularly those where a modelling approach to assessment is more suitable from the outset, for example, ammonia and temperature.

Calculate the process contribution

185 The H1 methodology uses a concept of "process contribution (PC)", which is the concentration of each effluent constituent in a surface water after dilution. For discharges to coastal waters, the assessment of the PC is based on the initial dilution (ID).

186 ID is the dilution given to a buoyant discharge as it rises from near the sea-bed to the surface. It depends on a number of factors, including diffuser geometry, water depth, the buoyancy of the effluent, the magnitude of the discharge, and the strength of the ambient current. The buoyancy results mainly from the difference in density between the 'freshwater' discharge and the saline receiving water. There may also be a small additional buoyancy if the discharge is warmer than the receiving water, as is often the case, but the opposite can occur. ID will vary significantly at different states of the tide, being lowest at low water slack (low water depth, low ambient currents, lower buoyancy). We have developed a simple spreadsheet for calculating ID, available on our website.

Screen out insignificant releases

187 Once PCs have been calculated, the next step of the assessment is to screen out releases emitted in such small quantities that they are unlikely to cause a significant impact on the receiving water. The PCs are compared against environmental quality standards (EQS). The EQS is a safe chemical standard, conservatively derived on a substance-specific basis to protect the most sensitive species.

188 Many of the substances in the proposed discharges from HPC do not have an established EQS. NNB GenCo has, therefore, used appropriate substitute benchmarks to define the threshold for potential environmental harm. This includes using background (ambient) data from its marine water quality surveys, predicted no effect concentration (PNEC) and no observable effect concentration (NOEC) values, based on ecotoxicological studies. PNEC for example, is the concentration below which a specified percentage of species in an ecosystem is expected to be protected. We consider using these substitute environmental benchmarks to be a valid and practical approach.

189 PCs are considered insignificant if either the short-term or long-term process contribution is less than four per cent of the EQS. The four per cent threshold suggested for screening releases does not take the background environmental quality into account, which may dominate long-term process contributions. This threshold is based on the judgement that:

- it (the threshold) is substantially below the acceptable environmental concentrations for protecting the environment and allows a substantial margin of safety;
- since the process contribution of each pollutant resulting from the discharge is a small percentage of the EQS concentration, it can only make a small contribution to any EQS exceedance;
- there is insufficient information for releases to water to justify selecting a less stringent screening criterion, although this may change in the future.

190 For releases where the above screening criterion is exceeded, the predicted environmental concentration (PEC) should be determined for both long-term and short-term releases. This is the calculated concentration in the environment, not the additional concentration resulting from the release. The PEC is the sum of the process contribution and background concentration.

191 The long- and short-term PECs are used to further assess the acceptability of the discharge, to decide whether detailed modelling is needed.

Carry out detailed modelling (if required)

192 If a release has not been screened out as insignificant (based on the PC being less than four per cent of the EQS), then it may still be acceptable. In order to determine the acceptability of the release, further detailed modelling may be required. In these circumstances, the H1 guidance suggests that in terms of coastal waters, detailed modelling should be considered particularly where:

- the long-term PEC is above 100 per cent of the relevant EQS-AA (annual average) or the short-term PEC is above 100 per cent of the relevant EQS-MAC (maximum allowable concentration);
- nature conservation sites, sensitive ecological receptors or protected habitat such as shellfish beds or fisheries are nearby.

Assess the acceptability of releases

193 For discharges to coastal waters, the PEC refers to the concentration after initial dilution - a relatively small area of impact. So, for example, the PEC may be more than the EQS. In these circumstances, further modelling is required to determine the size and location of the mixing zones (long term and short term) associated with each substance.

194 Under the EQS Directive, defined mixing zones are permitted. A mixing zone is defined in European guidance[14] as “that part of a body of surface water restricted to the proximity of the discharge within which the Competent Authority is prepared to accept EQS exceedence, provided that it does not affect the compliance of the rest of the water body with the EQS”. The guidance describes a tiered approach to assessing discharges, and gives guidance on the acceptability of mixing zones.

[14] Common Implementation Strategy guidance on setting Mixing Zones under the EQS Directive (2008/105/EC)”

195 In terms of our H1 assessment methodology, mixing zones only become an issue for coastal and estuarine waters (and for lakes and canals) for substances which are not insignificant. If detailed modelling is required, it will identify the size and location of mixing zones. One of the key issues is the location of mixing zones in relation to the designations and other uses outlined above. A mixing zone that is acceptable in one location may not be acceptable in another.

Summarise risks to water

196 The final step of the assessment is only required if the applicant is carrying out a best available technique (BAT) assessment, and comparing a number of different options.

4.11.2 Applying the guidance to the application

197 NNB GenCo has carried out a screening assessment of the proposed discharge through the cooling water outfall tunnel to the Bristol Channel, in order to screen out those releases that could be considered insignificant and for which detailed modelling is not necessary in line with Annex D of our H1 guidance.

198 NNB GenCo's H1 assessment refers to version 2.1 of Annex D, rather than our current guidance (version 2.2) available since December 2011. While the principles of the guidance have not changed, there are a couple of notable differences in terms of the screening procedure for discharges to coastal waters. These are set out below:

- For calculating the PC, version 2.1 of H1 Annex D contained dispersion rate constants for a range of nominal dilution conditions, to represent the dilution given to a submerged discharge as it ascended from the sea bed to the surface. The guidance went on to suggest that ideally, site-specific dispersion rates should be used, where possible, to obtain a more accurate picture of the dilution available. As mentioned above, version 2.2 of our guidance has refined and reinforced our position. We now require a site-specific assessment of the initial dilution to be used to calculate the PC. We provide applicants with a spreadsheet tool to help with this assessment.

199 In this case, NNB GenCo has developed site-specific dilution factors, derived from its hydrodynamic three-dimensional modelling of the marine waters off Hinkley Point. Dilution factors were estimated for maximum values, bed values, surface values and depth averaged values for both spring and neap tide periods, at intervals of 100m up to a maximum distance of 1500m from the proposed discharge. These predictions were compared with dilution values determined using data from the existing cross-shore discharge from Hinkley Point B power station, as a confidence check on the modelling. NNB GenCo has used the mean depth averaged values at distances of 100m and 500m from the discharge point in its H1 screening assessment. It states that it chose the 100m value on the assumption that it reflected an immediate near field dilution effect from the discharge point and the 500m value provided information on potential water quality impacts further away. We consider its assumption about near field mixing to be acceptable given the nature of the discharge in question.

200 Furthermore, we consider that the methodology followed in determining the dilution factors discussed above, and described in full within the supporting information to NNB GenCo's permit application, is acceptable and is consistent with the aim set out in our current H1 guidance, that is using a site-specific estimate of the initial dilution around the proposed discharge to calculate the process contribution.

- Version 2.2 of H1 Annex D uses an insignificance threshold of four per cent for EQS (both annual average (AA) and maximum allowable concentration (MAC)), whereas version 2.1 used one per cent for EQS (both AA and MAC). NNB GenCo has used the more stringent one per cent insignificance threshold and has, therefore, carried out a more precautionary assessment than our current requirements. We have taken this into account in our audit of their assessment.

201 Substances associated with waste stream A, namely sodium hypochlorite for the dosing of the incoming cooling water, and the release of heat have not been included in NNB GenCo's screening assessment. These have instead been subject to detailed modelling. In recognising that the screening procedure outlined above is not suitable for assessing all substances, we accept NNB GenCo's approach to assessing temperature and TRO in waste stream A.

202 For substances contained with waste streams B, C, D, F and G, NNB GenCo has carried out a screening assessment for several scenarios as described earlier in section 5.7, namely (a) standard operation, (b) maintenance test RF3, and (c) maintenance test RF2. Scenarios (a) and (b) have been assessed as annual (long-term) discharges, while scenario (c) has been assessed as a 24-hour (short-term) discharge, although NNB GenCo does not consider this to be part of normal operation.

203 For each substance and scenario combination, PCs have been calculated at 100m and 500m from the proposed discharge using site-specific dilution factors. Substance concentrations following dilution in the returned cooling water, but before discharge through the outfall tunnel have also been calculated. The predicted dilution factors used for each scenario are presented in Table 12.

Scenario	Cooling water flow rate (m^3/s)	Distance from proposed discharge	Predicted dilution factor
Standard operation	116	100m	0.43
		500m	0.27
Maintenance test (RF3)	90	100m	0.33
		500m	0.18
Maintenance test (RF2)	64	100m	0.30
		500m	0.16

Table 12. Cooling water flow rates and dilution factors for H1 assessment

204 NNB GenCo states that the flow rates in Table 10 represent low tide conditions and, in terms of impact assessment, reflect a conservative, worst-case situation. This means that

the flow rates above represent the minimum amount of cooling water available under each scenario for dilution of the other waste streams before they are discharged to the Bristol Channel. This approach results in the highest expected discharge concentrations being used in the assessment, even though they would only be experienced for short periods of time during each tidal cycle.

205 In terms of steps 1 and 2 of the H1 procedure, for those substances for which the screening is suitable, NNB GenCo's assessment showed that apart from hydrazine, morpholine, iron and manganese, all substances screened out as insignificant at the one per cent significance level. For the ones that did not screen out (>1% EQS [*]), the results are summarised in Table 13 below.

Process contribution (PC)	**Cooling water flow rate**	**Hydrazine**	**Target or standard**	**Morpholine**	**Target or standard**	**Iron**	**Manganese**
Target or standard	**-**	**-**	**-**	**-**	**-**	EQS 1000µg/l	Mean ambient conc. of 3.5µg/l
PC_{100m} (µg/l)	116m^3/s Standard operation	0.00329	No EQS. Chronic (long term) saltwater PNEC of 0.0004µg/l	0.197	No EQS. Chronic (long term) saltwater PNEC of 17µg/l	-	-
PC_{100m}/EQS [*] (%)		823		1.16		-	-
PC_{500m} (µg/l)		0.00207		-		-	-
PC_{500m}/ EQS [*] (%)		517		-		-	-
PC_{100m} (µg/l)	90m^3/s Maintenance test RF3	0.00326		0.195		-	-
PC_{100m}/ EQS [*] (%)		815		1.15		-	-
PC_{500m} (µg/l)		0.00178		-		-	-
PC_{500m}/ EQS [*] (%)		445		-		-	-
PC_{100m} (µg/l)	64m^3/s Maintenance test RF2	0.217	No EQS. Acute (short term) saltwater PNEC of 0.004µg/l	5.15	No EQS. Acute (short term) saltwater PNEC of 28µg/l	13.90	0.0365
PC_{100m}/ EQS [*] (%)		5425		18.39		1.39	1.04
PC_{500m} (µg/l)		0.116		2.75		-	-
PC_{500m}/ EQS [*] (%)		2900		9.82		-	-

Table 13. Significant releases from H1 screening assessment (at one per cent significance level)

[*] (EQS, or other relevant environmental standard or benchmark)

206 We have considered the results for hydrazine, morpholine, iron and manganese in light of the four per cent significance screening level as per our current H1 Annex D guidance to

see whether it makes a difference to NNB GenCo's results, as we feel this is fair and reasonable. Applying the four per cent threshold to the above results means that morpholine (during standard operation and maintenance test RF3) would screen out. However, it does not screen out under maintenance test RF2 due to the PC at both 100m and 500m exceeding the four per cent significance screening level, being 18.41 per cent and 9.82 per cent of the EQS respectively. Morpholine, therefore, proceeds to the next assessment step.

207 Iron and manganese (under maintenance test RF2), having just exceeded the one per cent significance level, both screen out at the four per cent significance level and, therefore, do not require further assessment.

208 As morpholine and hydrazine did not screen out, they were progressed to the next assessment step. NNB GenCo referred to a TGD methodology[15] for environmental risk assessment, which uses a risk index based on the PEC/PNEC ratio, with a ratio greater then one reflecting a discharge of potential environmental significance. Following this assessment, morpholine was screened out due to the PEC/PNEC ratios all being less than one. The results for hydrazine gave PEC/PNEC ratios of 8.2 and 5.2 (at 100m and 500m respectively) during standard operation, that is the scenario for which the highest operational concentrations were predicted. This means that the predicted concentration in the environment is roughly eight times the PNEC at 100m and five times the PNEC at 500m from the proposed discharge. NNB GenCo concluded, therefore, that hydrazine should be investigated further using detailed modelling.

209 After NNB GenCo submitted its H1 assessment, we received further information in response to our Schedule 5 notice of 15 May 2012. This indicated that the cooling water flow rate could drop to 60.4m^3/s during an outage. This compares with the 64m^3/s specified under the theoretical RF2 scenario. In order to assess the worst-case scenario, we assumed that the emissions stated could occur during outage, and applied the lower cooling water flow rate to NNB GenCo's data. We found that at the four per cent significance level, that is in line with our current guidance, the reduced cooling water flow did not make any difference to the outcome of the screening assessment.

4.11.3 Summary

210 Overall, NNB GenCo's H1 assessment is comprehensive in scope and precautionary in its methodology. We agree with its conclusions that virtually all of the substances for which the H1 screening procedure is suitable, are not significant and can be 'screened out'. We also agree that the discharge of hydrazine cannot be screened out and requires further investigation using detailed modelling.

[15] Technical Guidance Document in support of commission directive 93/67/EEC on risk assessment of new identified substances and commission regulation (EC) no. 1488/94 on risk assessment for existing chemical substances, EC-1996, revised 2003

4.12 Consideration of detailed modelling

211 Detailed hydrodynamic modelling forms an essential part of the HPC design process. This section outlines the approach NNB GenCo took for its detailed modelling of the proposed discharge. In general, for schemes such as HPC, modelling will be required to make sure that:

- the abstraction is located to minimise ecological and fisheries impacts;
- the abstraction and discharge points are located such that interaction between the two is minimised, for example, to minimise the re-entrainment of heated water from the discharge back through the intake, reducing efficiency of the power station;
- the impact of excess temperature in the thermal plume is understood and minimised, particularly in sensitive areas;
- any secondary impacts are understood and minimised, particularly in sensitive areas.

212 As well as the primary impact of the thermal plume, secondary impacts will also result, examples of which include:

- changes in speciation of ammonia as a result of the elevated temperatures;
- changes in salinity as a result of the abstraction/discharge regime;
- changes in dissolved oxygen (DO) as a result of elevated temperatures.

213 Assessing impacts associated with using anti-fouling biocides, including the formation of by-products, and the discharge of other process chemicals can also be assessed through detailed modelling.

214 In 2010, we produced guidance[16] which outlined our requirements for the modelling that should be carried out. The guidance did not specify in detail the type of model to be used or the modelling runs that are necessary, as the operator is expected to produce the detailed specification for the modelling, to be agreed with us on a site-by-site basis. The guidance did however define the main requirements that should be met when carrying out detailed modelling and post-project appraisal.

215 NNB GenCo has used two different hydrodynamic models, the main differences between the two being the way that they model heat loss, and their grid resolution. Most of the modelling carried out to assess the impact of the thermal and chemical plumes from HPC has used a site-specific hydrodynamic model based on the modelling structure known as the General Estuarine Transport Model (GETM). The GETM model was set up to run over a complete annual cycle, from 1 December 2007 to 31 December 2008, using meteorological forcing data from the European Centre for medium-range weather forecasting. It has a 100 metre x 100 metre grid resolution that has been used to simulate conditions over the entire Severn Estuary. In addition, a Delft 3D model was set up for use over shorter time periods, mainly a spring to neap tidal cycle of a fortnight, using a 50 metre x 50 metre grid resolution.

[16] Nuclear New Build - Guidance on Hydrodynamic Modelling Requirements (Environment Agency, 2010)

216 Both models were developed for NNB GenCo by outside consultants. In accordance with the requirements of our modelling guidance, the models were then audited; in this case by the Centre for Ecology, Fisheries and Aquaculture Science (Cefas).

217 Both models were used to produce time series, mean and average values associated with a number of runs, as listed in Table 14, allowing detailed thermal predictions to be made for various operational combinations of Hinkley Point B (HPB) and HPC.

Modelling run reference	Description
Run A	HPB operating at 70% power output
Run B	HPB operating at 100% power output
Run C	HPC operating at 100% power output
Run D	HPB operating at 70% power output + HPC operating at 100% power output
Run E	HPB operating at 100% power output + HPC operating at 100% power output

Table 14. Model runs with power stations operating descriptions

218 We consider that NNB GenCo's use of the GETM and Delft 3D hydrodynamic models meets the requirements of our modelling guidance. The output from its modelling work is discussed in the context of our legislative duties, mainly under the Water Framework Directive and the Habitats Directive, later in this section.

219 An important element of using hydrodynamic models during the design phase for predicting potential environmental impacts, is post scheme (or post project) appraisal. This is necessary to validate the original modelling predictions, based on operational experience and monitoring of the receiving environment. We have therefore included the following requirements in our permit:

- an improvement condition requiring the operator to review its hydrodynamic modelling within 5 years of the commencement of commercial operation of the second EPR unit, to validate their original modelling output; and
- a pre-operational measure requiring the operator to set out for approval by the Environment Agency, in a hydrodynamic modelling review plan, the sampling and monitoring that will be put in place to meet the requirement of the above improvement condition.

220 The potential influence of climate change should also be considered when carrying out this type of hydrodynamic modelling. Over the next century, surface temperatures of the sea are forecast to rise by between 0.5°C and 4°C and this will change the baseline ambient temperature of the Bristol Channel. Given the potential significance of climate change on ambient temperature in the medium- and long-term, we have decided to include in our permit a further improvement condition. This requires the operator to regularly review its hydrodynamic modelling and associated impact assessment in light of best available climate change projections, and to consider how these projections could influence the operation of the power station in the future.

4.13 Duties arising under legislation

221 In the following sections we describe how we have assessed the impact of the water discharge activity in relation to our duties under the legislation (or statutory provisions) relevant to this permit application.

4.13.1 Water quality assessment

222 In this section we describe how we have considered the impact of the proposed discharge on water quality, in relation to our duties under the statutory provisions listed in Table 15.

Statutory provision
Section 84(1) Water Resources Act 1991 (Duty to achieve and maintain water quality objectives) • The Surface Waters (Dangerous Substances) (Classification) Regulations 1989 (SI 1989/2286) • The Surface Waters (Dangerous Substances) (Classification) Regulations 1992 (SI 1992/337) • The Surface Waters (Dangerous Substances) (Classification) Regulations 1997 (SI 1997/2560) • The Surface Waters (Dangerous Substances) (Classification) Regulations 1998 (SI 1998/389) • The Bathing Waters (Classification) Regulations 1991 (SI 1991/1597) and Bathing Waters Direction; Bathing Water Regulations 2008 (SI 2008/1097) • The Surface Waters (Rivers Ecosystem) (Classification) Regulations 1994 (SI 1994/1057) • The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (SI 1996/3001) • The Surface Waters (Fishlife) (Classification) Regulations 1997 (SI 1997/1331) • The Surface Waters (Shellfish) (Classification) Regulations 1997 (SI 1997/1332)
Urban Waste Water Treatment Regulations 1994
Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

Table 15. Water quality statutory provisions

Section 84(1) Water Resources Act 1991 (Duty to achieve and maintain water quality objectives)

- The Surface Waters (Dangerous Substances) (Classification) Regulations 1989 (SI 1989/2286)
- The Surface Waters (Dangerous Substances) (Classification) Regulations 1992 (SI 1992/337)
- The Surface Waters (Dangerous Substances) (Classification) Regulations (SI1997/2560)
- The Surface Waters (Dangerous Substances) (Classification) Regulations 1998 (SI 1998/389)

223 The statutory instruments above transposed the Dangerous Substances Directive (76/464/EEC) into UK law. Dangerous substances, as specified under the Dangerous Substances Directive (DSD), are toxic and pose the greatest threat to the environment and

human health. We have considered the existing DSD requirements, now integrated under the Water Framework Directive (Directive 2000/60/EC), and which will be repealed in December 2012.

224 The DSD requires us to eliminate pollution by List I substances and minimise pollution by List II substances. It requires member states to prior authorise (permit) all substances that a discharge is "liable to contain". The Water Framework Directive (WFD) instead requires member states to prior authorise all substances in a discharge that are "liable to cause pollution." We define pollution by dangerous substances as exceeding environmental quality standards (EQSs) in the receiving water. The EQS defines a concentration in the water below which we are confident that the substance will not have a polluting effect or cause harm to plants and animals.

225 Many of the EQSs for substances specified under DSD have now been re-defined in "The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010", which have transposed elements of the WFD into UK legislation. The Directions include standards for five categories of chemical pollutants, namely priority substances, priority hazardous substances, other pollutants, specific pollutants and other substances. The standards that apply to these chemical groupings are defined by:

- Europe, in the case of priority substances, priority hazardous substances and other pollutants (mostly List 1 substances under DSD) through the EQS Directive (Directive 2008/105/EC), a daughter Directive of the WFD; and
- by individual member states, in the case of specific pollutants and other substances (mostly List 2 substances under DSD).

226 The majority of the modified EQSs have become more stringent and we are currently required to consider these new EQSs when assessing dangerous substances and setting permit limits. In addition, the WFD has introduced the requirement for member states to "cease and phase out" the discharge of priority hazardous substances.

227 In terms of the permitting of dangerous substances, it is clear that from a legislative viewpoint we are in transition from one system to another. Our former guidance on the permitting of dangerous substances, which was based upon the "liable to contain" principle from the DSD, has been superceded by guidance on the permitting of hazardous pollutants, based upon the "liable to cause pollution" principle from the WFD. This was necessary to ensure that we appropriately implemented the requirements of the EQS Directive and The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010.

228 We set out in our WFD assessment how we have ensured that in terms of dangerous substances, the conditions of the permit provide an appropriate level of environmental protection. In doing this, we are satisfied that the requirements of both the DSD and WFD will be met.

- The Bathing Waters (Classification) Regulations 1991 (SI 1991/1597) and Bathing Waters Direction; Bathing Water Regulations 2008 (SI 2008/1097).

229 We have considered the potential impact of the proposed discharge on the designated bathing waters located within about 20km of Hinkley Point, which is a single spring tidal excursion up-and down estuary from the proposed discharge. These include Minehead Terminus, Dunster North West, Blue Anchor West, Burnham Jetty, Berrow North of Unity Farm, Brean, Weston-super-Mare Uphill Slipway, Weston Main, and Weston-super-Mare Sand Bay. We have concluded that, for the following reasons:

(a) the proposed quality of the treated effluent to be discharged;
(b) the location of the proposed discharge almost 2km offshore;
(c) the highly dynamic tidal regime in the estuary;
(d) the significant dilution of the discharge within in the receiving water;

the proposed discharge will make an insignificant contribution to the bacterial levels in the receiving waters of the Inner Bristol Channel and the Severn Estuary.

- The Surface Waters (Rivers Ecosystem) (Classification) Regulations 1994 (SI 1994/1057)

230 Not applicable as the proposed discharge will be made to the marine waters of the Bristol Channel.

- The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (SI 1996/3001)

231 Not applicable as the proposed discharge will be made to the marine waters of the Bristol Channel.

- The Surface Waters (Fishlife) (Classification) Regulations 1997 (SI 1997/1331)

232 The discharge will not impact on any freshwater fish designated waters.

- The Surface Waters (Shellfish) (Classification) Regulations 1997 (SI 1997/1332)

233 The discharge will not impact on any shellfish waters. The nearest designated shellfishery is located 40km away at Porthcawl on the South Wales coast. Following consultation, Cefas has confirmed that there are no shellfisheries near the proposed discharge.

Urban Waste Water Treatment Regulations 1994

234 Regulation 5(7) requires that urban waste water entering ‘collecting systems’ from agglomerations with a population equivalent of less than 10,000, and thereafter discharging to coastal waters must be ‘appropriately treated’.

235 We are satisfied that the discharge will be ‘appropriately treated’ in this case. ‘Appropriate treatment’ is that which allows the receiving waters to meet the relevant water quality objectives, and the relevant provisions of EC Directives.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

236 The Water Framework Directive aims to introduce a simpler, integrated approach to water management throughout Europe, which historically has been subject to a range of inconsistent legislation applied by member states. The Directive will result in greater protection for the water environment and looks at both the ecological health of surface water bodies (defined as a slight variation from undisturbed natural conditions), as well as achieving traditional chemical standards.

237 In the UK the objectives of the Water Framework Directive (WFD) will be achieved through a system of river basin management planning. In the UK there are 11 river basin districts, with each subject to a River Basin Management Plan (RBMP). The RBMP sets out the programme of measures necessary to meet the objectives of the Directive at a local level. To facilitate this, each river basin district is subdivided into a number of waterbodies, with associated objectives and targets. Under WFD, the aim is to achieve 'good chemical status' and 'good ecological status' for surface water bodies by 2015, unless the waterbody is designated as 'heavily modified', due to the construction of flood defences for example, in which case the objective would be to achieve 'good ecological potential.' Tidal waterbodies are categorised as either coastal waters or transitional waters, that is, estuaries, and are collectively termed 'transitional and coastal waters', or TraC waters.

238 Regulation 3 of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 imposes a general duty on the Environment Agency to secure compliance with the requirements of the Water Framework Directive (WFD). We do this through, among other things, environmental permits. Additionally, under Regulation 17, in carrying out our role in relation to a particular river basin district, we must consider the River Basin Management Plan for that district (as approved under Regulation 14) or any supplemental plan prepared under Regulation 16.

239 The Bristol Channel near the proposed HPC discharge falls within the South West river basin district and, therefore, in making our assessment we have considered the River Basin Management Plan for this district, as approved under Regulation 14. Within the Bristol Channel, the WFD waterbodies potentially affected by the proposed discharge from HPC are:

- Bridgwater Bay (coastal waterbody, C21)

240 This is the waterbody into which the discharge will be made. It has objectives to reach good overall status and good ecological status by 2027. Achieving the objectives by 2015 has been deemed to be disproportionately expensive. The current overall status of the waterbody is moderate.

- Parrett Estuary (transitional waterbody, T18)

241 The existing discharge from Hinkley Point B power station is to the Parrett Estuary transitional waterbody. This is a heavily modified waterbody for reasons of coastal protection, with objectives to reach good chemical status by 2015, good ecological potential

by 2027, and good overall status by 2027. Achieving the objectives by 2015 has been deemed to be disproportionately expensive and technically infeasible. The current overall potential of the waterbody is moderate.

242 In addition, the Directive specifies that within each waterbody, any areas requiring special protection under other EC Directives and waters used for abstracting drinking water are identified as 'protected areas'. These protected areas have their own objectives and standards that apply as well as the general chemical and ecological objectives. In general, protected areas can include:

- areas designated for abstracting water for human consumption (drinking water protected areas);
- areas designated for protecting economically significant water species (freshwater fish and shellfish);
- bodies of water designated as recreational waters, including areas designated as bathing waters;
- nutrient-sensitive areas, including areas identified as nitrate vulnerable zones under the Nitrates Directive or areas designated as sensitive under the Urban Waste Water Treatment Directive (UWWTD);
- areas designated for protecting habitats or species where maintaining or improving the status of water is an important factor in protecting them, including relevant European sites designated under the Habitats Directive and Birds Directive, that is water dependent SACs and SPAs.

243 The EC Directives that apply to Bridgwater Bay and the Parrett Estuary WFD waterbodies and which we have considered in our assessment of protected areas are shown in Table 16.

WFD waterbody	EC legislation
Bridgwater Bay (C21)	• Habitats Directive • Birds Directive
Parrett Estuary (T18)	• Habitats Directive • Birds Directive • Bathing Water Directive

Table 16. Protected area legislation (from South West RBMP)

244 Under the Habitats Directive and the Birds Directive, the protected areas that we have to consider are the Severn Estuary Special Area of Conservation (SAC), designated under the EC Habitats Directive for supporting important high quality habitat sites; and the Severn Estuary SPA Special Protection Area (SPA), designated under the EC Birds Directive, and classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species. The overall objective for both the above protected areas is 'favourable conservation status', through protecting and, where necessary, improving the water or the water-dependent environment enough to maintain or improve to

favourable conservation status, the water-dependent habitats and species for which the protected area is designated.

245 Under the Bathing Water Directive, the protected areas that we have to consider are the designated bathing waters at (a) Brean, (b) Berrow North of Unity Farm and (c) Burnham Jetty. The objective for these protected areas is for them to be classed as "sufficient" under the new classifications within the Revised Bathing Water Directive (rBWD), when reported against for the first time in 2015. The “sufficient” standard is tighter than the current mandatory standard.

246 Article 4 of the WFD requires member states to achieve compliance with the standards and objectives set for each protected area by 22 December 2015. The Severn Estuary SAC and SPA are not meeting their environmental objectives and have been granted an extension to the deadline until 2021. In both cases, the reason for not achieving compliance by 2015 is related to issues caused by invasive freshwater species (the plant, Himalayan Balsam), and by coastal squeeze leading to intertidal habitat loss. In terms of the bathing water protected areas, we expect both Brean and Berrow North of Unity Farm to meet the “sufficient” standard under rBWD in 2015. However, we are concerned that Burnham Jetty will be classified as “poor” in 2015 and we are working with our partner organisations to identify and resolve the existing sources of pollution.

247 The key issue underpinning our assessment relates to the requirement on member states, under Article 4.1 of the Water Framework Directive, to *“implement the necessary measures to prevent deterioration of the status of all water bodies……”* For us, this means that we must take all practicable action to prevent deterioration in the status of all water bodies in England and Wales. However, permitting a discharge into a water body is always likely to cause some localised deterioration in water quality. We must question therefore, what is acceptable in the context of the prevailing environmental conditions and the water quality objectives for the receiving water. Under WFD, the deterioration from one status class to a lower one within a water body is not permitted.

248 Any assessment of the potential impact of the proposed discharge from HPC on the WFD waterbodies needs to address both physico-chemical parameters, as well as the ecological elements that form the basis of the ecological classification of TraC waterbodies.

249 The physico-chemical parameters and standards for TraC waterbodies are defined in The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. There are no statutory standards defined for water temperature for TraC waters in the document. However, we did produce guidance on temperature standards in 2010[17], which summed up our requirements for thermal discharges to estuaries and coastal waters as follows:

- the Environment Agency will use the cold water draft UK Technical Advisory Group for the Water Framework Directive (UKTAG) standards as the basis for determining conditions for environmental permits for cooling water discharges from new nuclear power stations;

[17] Nuclear New Build - Temperature Standards and Environmental Permit Requirements (Environment Agency, 2010).

- the temperature at the edge of the allowed mixing zone shall not exceed an annual 98 percentile of 23^{o} Centigrade;
- outside the mixing zone a temperature uplift in the thermal plume above ambient background shall not exceed 3^{o} Centigrade. In waters of High ecological status, the uplift shall not exceed 2^{o} Centigrade;
- in addition to the above draft WFD standards, other temperature standards may need to be considered in relation to conservation designations and specific conservation objectives;
- the Environment Agency will consider evidence relevant to the proposed discharge location provided by the applicant supporting different temperature standards, and may adjust its permitting requirements accordingly if persuaded by that evidence.

250 Boundary values for the status of different biological elements for TraC waterbodies are also defined in the above Defra guidance. The biological elements and the waters to which they apply are listed in Table 17.

Transitional waters	Coastal waters
• Phytoplankton • Macroalgae (opportunistic macroalgae – bloom assessment) • Fucoid extent • Angiosperms (sea grass bed assessment) • Fish fauna	• Phytoplankton • Benthic invertebrates (benthic invertebrates in soft sediments, dog whelk imposex) • Macroalgae (opportunistic macroalgae – bloom assessment) • Rocky shore macroalgae – reduced species • Angiosperms (sea grass bed assessment)

Table 17. WFD biological elements for TraC waterbodies

Initial assessment

251 The initial assessment is based on the changes to the physico-chemical parameters of the coastal and transitional waters affected by the proposed discharge from HPC. This assessment essentially considers the relative contribution of the seven waste streams to contaminant levels in the receiving waters of the Bridgwater Bay Coastal waterbody and the Parrett transitional waterbody.

252 This section, therefore, looks at the nature of the various discharges within the permit application, and what aspects exceed a likely significant effects test. The likely significant effects tests applied here are:

- Does the level of a contaminant in the discharge exceed EQS or target, before being discharged into the cooling water?

- Is the level of a contaminant more than 10 per cent of the EQS or target or ambient background value following dilution in the cooling water discharge?

253 If the answer to the last test is yes, then the relative proportion of the EQS or target or ambient background has been considered further, to assess the relative deterioration and whether the contaminant concentration remains greater than the EQS or target, following dilution within the cooling water.

254 We consider that the above assessments provide a clear indication of the potential for dangerous and hazardous substances contained within the proposed HPC discharge to be "liable to cause pollution".

Discharge volumes and composition

255 The summary data in this section for each waste stream is based on the information in the permit application, and any additional supporting information that has been provided in response to our Schedule 5 notices. The estimated emissions data supplied by NNB GenCo is derived from operational experience and feedback from nuclear power plants operated by EDF in France.

Waste stream A

256 The amount of cooling water flow varies depending on the tidal state at the intake heads, and the number of reactors in use. Under normal operations, the power station will abstract between 116m^3/s and 134m^3/s. The higher flows are abstracted at high water spring tides, and the lower flows at low water spring tides. There is, therefore, a tidally varying flow rate passing through the cooling water system that will influence the subsequent temperature increase across the condensers and the maximum temperature of the returned cooling water.

257 The contaminants contained within the returned abstracted cooling water are excess heat gained from the condensers in the secondary steam generating circuit, and total residual oxidant (TRO) should it prove necessary to control biofouling in the cooling water system. NNB GenCo does not envisage that there will be a need to control biofouling based on the past experiences at Hinkley Point B power station. However, for operational reasons, it needs to retain the option to chlorinate if this is required, so dosing proposals have been included in the permit application. If chlorination is required, risk-based dosing will be carried out by injecting sodium hypochlorite into the abstracted cooling water upstream of the condensers. TRO is used as the relevant measure for assessing the level of chlorine in seawater, because of the chemical interactions that occur when chlorine or hypochlorite is added to seawater.

258 The predicted temperature rise in the cooling water across the condensers, and the maximum level of TRO in the cooling water downstream of the condensers, should chlorination be required, are shown in Table 18, together with the relevant cooling water flows. As stated earlier, the predicted temperature rise varies with the tidally varying cooling

water flow rate, the variation being 0.9ºC above or below the average temperature rise of 11.6ºC under normal operating conditions.

Waste stream A	**Max daily flow (m3/s)**	**Average daily flow (m3/s)**	**Min daily flow (m3/s)**	**Min flow during outage (m3/s)**	**Max volume (m3/day)**	**Maximum annual volume (m3/year)**
Flow (m3/s)	134	125	116	60.4	11,700,000	4,270,500,000
	∆T (deg C)					
	Based on max flow	**Based on mean flow**	**Based on min flow**			
Temperature differential (∆T deg C)	10.7	11.6	12.5	-	-	-
	Max daily load (kg/day)	**Max conc in cooling water discharge (µg/l)**				
TRO (from chlorination if used)	-	200	-	-	-	-

Table 18. Temperature and TRO values for waste stream A with respect to cooling water flow rate

259 There are also planned periods when a reactor is closed down (outages), for example for refuelling or plant maintenance, as well as unplanned periods of shutdown that may occur if the plant breaks down. NNB GenCo have stated that during normal operations there would always be a minimum of two cooling water pumps operating. This would result in an average flow rate through the cooling water system of about 64m^3/s and a minimum flow of 60.4m^3/s. This latter flow rate of 60.4m^3/s has been taken to be the minimum flow that will be maintained in the cooling water system and that will, therefore, be available for dilution of the other seven waste streams before they are discharged into the Bristol Channel through the outfall tunnel.

260 Unplanned shutdown or maintenance of a UK EPR unit is considered to be an emergency or abnormal situation and, as such, are not subject to permit control like normal operational discharges. Any environmental permit would require NNB GenCo to manage the power station according to a written environmental management system that identifies and minimises the risks of pollution, including those caused by maintenance, accidents and incidents. The operator would also have to consider, by developing an emissions management plan, how emissions not covered by emission limits in the permit will be prevented, or where that is not practicable, minimised. Any liquid waste produced during unplanned situations would fall under these requirements.

Waste streams B & C (combined), D, E, F, and G

261 We have assessed the potential environmental significance of the substances contained within the above waste streams, as summarised below.

262 We calculated contaminant concentrations, both as short-term values and long-term average values for each waste stream before they were diluted in the cooling water flow. The short-term values are based on a maximum loading during a 24-hour period and the maximum daily discharge volume, while the long-term average values are based on the loading over the year and an assumed average flow of half the daily discharge volume. We also calculated the expected concentration of the contaminants from each waste stream after being diluted in the cooling water return flow. For the long-term average situation, we have assumed that the treated waste stream effluent will be discharged into a cooling water flow of 116m^3/s. Meanwhile for the short-term situation, we have assumed that the treated waste stream effluent will be discharged into a cooling water flow of 60.4m^3/s. These represent the minimum (or worst-case) cooling water flows available for diluting other waste streams in the long and short term respectively.

263 In order to assess the potential impact of the discharges from the different waste streams, we need to compare the concentrations of the contaminants in the waste streams with relevant environmental standards and targets. We used various standards and targets, ranging from statutory environmental quality standards (EQSs), for example, as defined in the EQS Directive 2008, to operational targets for Special Areas of Conservation agreed between the Environment Agency, Natural England, and the Countryside Council for Wales. We compared the concentrations of the contaminants in each waste stream both before and after being combined with the cooling water return flow with the relevant EQSs and targets. This comparison showed that the concentrations of the contaminants generally exceed the EQSs or targets before being combined with the cooling water in the outfall pond, but all, except excess temperature and TRO in waste stream A, hydrazine and morpholine in waste stream B & C (combined), and hydrazine in waste stream D, are less than the EQSs or targets when diluted with the cooling water.

264 To help compare the available EQSs and target values and the concentrations of the contaminants, we calculated the relative contribution of the contaminants within each waste stream as a percentage of the relevant EQS or target, both before and after being combined with the cooling water flow. We compared the concentrations calculated for the long-term scenario with annual average EQSs or targets. We also compared the concentrations for the short-term scenario with maximum allowable concentrations (MAC), where these were available; otherwise we just compared them with annual average EQSs or targets. We also considered the relative contribution of the contaminants in each waste stream as a percentage of the ambient background levels of the contaminants, which were measured during the four marine sampling surveys carried out between January and September 2009.

265 The above assessments are intended to indicate which contaminants exceed the relevant EQS or target before being combined with the cooling water, and which contaminants remain a concern after being diluted with the cooling water flow. This is not quite the same as the H1 Annex D screening assessment submitted by the NNB GenCo, as it includes specific comparison with the ambient background levels, as well as with the EQSs or targets.

266 The contaminants that were not considered to be a concern in the waste streams before being combined with the cooling water are shown in Table 19. These contaminants are not more than 10 per cent of the EQS/target as an average or maximum, or are less than the ambient background level as an average or maximum when there is no EQS/target.

Waste stream B & C (combined)	**Waste stream D**	**Waste stream F**	**Waste stream G**
Suspended solids	Suspended solids	Sulphates	Suspended solids
COD	-	Sodium	-
Aluminium	-	Suspended solids	-
-	-	Chloride	-

Table 19. Contaminants in waste streams before being combined with cooling water which are < 10% of target or the ambient background level

267 Based on this initial assessment of the concentration of contaminants before being combined with the cooling water, the contaminants in the effluent from the waste streams shown in the table above will not have any significant effect on the TraC waterbodies.

268 The contaminants that remain a concern after being diluted in either a cooling water flow of 116m^3/s or 60.4m^3/s are given below in Table 20. A criterion of 10 per cent of the target concentration or ambient background levels has been used, but here a value of >10 per cent is considered to be potentially significant, and needs further consideration. This criterion of >10 per cent for the target values is simply a screen to define the relative significance of the contaminant in the discharge. The main factor defining whether the contaminant has a likely significant effect is if the concentration exceeds the EQS or target. The >10 per cent criterion in relation to ambient background levels defines whether the discharge needs further consideration. However, this criterion needs to be balanced against the existing water quality, and the contaminant levels in the discharge relative to the EQS or target.

Waste stream A		**Waste stream B & C (combined)**		**Waste stream D**		**Waste stream F**	
EQS or target	**Back-ground**	**EQS or target**	**Back-ground**	**EQS or target**	**Back-ground**	**EQS or target**	**Back-ground**
Excess Temp. TRO	Excess Temp. TRO	Hydrazine Morpholine Ethanolamine	Morpholine Ethanolamine Phosphate Detergents	Hydrazine Morpholine Ethanolamine	Morpholine Ethanolamine Phosphate Chromium	-	Iron

Table 20. Contaminants in waste streams after dilution in cooling water which are greater than 10% of target or background

269 None of the contaminants in waste streams E and G are greater than 10 per cent of either the target values or the ambient background levels after being diluted in the cooling water.

270 Both the excess temperature and TRO in waste stream A exceed the relevant targets in the receiving water and, therefore, require an assessment on the size of the mixing zone and its potential impact on the TraC waterbodies.

271 Hydrazine exceeds both the average and maximum target values by a significant amount, indicating that further dilution and decay of the discharge would be required. However, we concluded in our Habitats Regulations Assessment that hydrazine will need to be removed before discharge. We have included a pre-operational measure in our permit that requires the operator to submit for approval, before HFT commissioning, a hydrazine removal plan, describing how hydrazine would be removed from the effluent before discharge. Therefore hydrazine is not considered any further here.

272 All other contaminants in the waste streams are on average less than 10 per cent of either the EQS/ target and/or the average ambient background level. However, the maximum values may be greater than 10 per cent of the EQS/target or the maximum ambient background level on occasions, so that there may be some intermittent marginal deterioration in the levels of some of the contaminants near the discharge location.

273 The only exceptions to this are chromium, iron and morpholine. For chromium and iron, the concentrations in the discharge are > 10 per cent of the average and maximum ambient background levels, however, in both cases, the concentrations in the discharge are < 0.1 per cent of the EQS on average and < 5 per cent of the EQS for the maximum concentration. The morpholine concentration only just exceeds the maximum target level, therefore the mixing zone is predicted to be very small and not significant in relation to the Bridgwater Bay waterbody. Furthermore, the treatment which will be applied to remove hydrazine is also likely to reduce the levels of morpholine in the discharge.

274 The annual and maximum concentrations of mercury are less than one per cent compared with both the EQSs and the ambient background levels, therefore it was not included in table 18. However, the MAC of the EQS is exceeded in the receiving waters, based on the marine water quality monitoring data collected on behalf of EDF in 2009, so the proposed input of mercury needs to be considered further. Four exceedances of the MAC were reported from the above water quality monitoring; three from the sampling in January and one from the sampling in May. In contrast, no exceedances were recorded from the sampling in June and September. Occasional high values for dissolved mercury, which would have exceeded the current MAC, were also noted at various locations from the marine water quality sampling in 2004 to 2005, which was carried out throughout the Severn Estuary SAC for the Environment Agency's Review of Consents[18]. The occasional high values occurred at different locations at various times of the year, and did not appear to be related to specific discharges. This type of occurrence would suggest that mercury is being intermittently adsorbed and desorbed from the fine sediments in the Severn Estuary and Inner Bristol Channel, probably as a consequence of intermittent deposition and erosion, although the exact mechanisms are not fully understood. Copper shows a similar behaviour in the Severn Estuary.

[18] Environment Agency. Severn Estuary SAC and SPA Habitats Directive Review of Consents. Stage 3. November 2009.

275 It would appear therefore that the exceedances of mercury reflect the effect of biogeochemical processes in the Severn Estuary and Inner Bristol Channel on the historical legacy of mercury, which was discharged from a variety of sources, but which is now closely associated with the fine sediments.

276 The concentrations of mercury in the proposed discharge from Hinkley Point C compared with the EQSs are very small, being 0.05 per cent of the annual average, and 0.28 per cent of the MAC. This would suggest that the effective contribution of mercury from Hinkley Point C will be insignificant, and we have concluded that the discharge of mercury has no likely significant effect on the WFD waterbodies.

277 It should also be borne in mind that mercury arising from waste streams B and C (combined) and waste stream D is due to impurities in the raw materials used. It would be prudent for NNB GenCo to source raw materials with the lowest level of metal impurities, particularly mercury and cadmium, as discussed earlier in this section.

278 Therefore, we concluded that there will be no significant deterioration on average in the contaminant levels within the TraC waterbodies of Bridgwater Bay and the Parrett Estuary.

Other physico-chemical parameters

279 There are three other physico-chemcal parameters that need to be considered in relation to WFD. These are dissolved oxygen (DO), unionised ammonia (UIA), and dissolved inorganic nitrogen (DIN).

Dissolved oxygen and ammonia

280 Increasing temperature affects both the solubility of oxygen in seawater, as well as the speciation of ammonia. For dissolved oxygen, increasing the seawater temperature reduces the amount of oxygen held in solution. For ammonia, increasing the seawater temperature increases the proportion of ammonia that is unionised; unionised ammonia is the more toxic form.

281 In order to assess the effect of increasing temperature on the waters off Hinkley Point, we have considered DO data we collected from six sites near Bridgwater Bay. The data was collected each month over the period 2007 to 2010, although some data was collected at a few sites in 2004 and 2005. The minimum DO concentration from the data was 7.01 mg/l and the 5%ile DO concentration was 7.46 mg/l. By increasing all the measured seawater temperatures by 3 ºC, and recalculating the DO using the UNESCO formula[19] and the measured temperature and DO saturation level, the minimum DO concentration decreased to 6.59 mg/l and the 5%ile DO concentration to 7.01 mg/l. This demonstrates that the increase in temperature arising from the thermal plume from HPC would not significantly affect the DO levels of the waters off Hinkley Point, and would not compromise the WFD classification of the TraC waterbodies.

[19] UNESCO 1973, International Oceanographic Tables Vol 2. National Institute of Oceanography of Great Britain, and UNESCO, Paris. 141 pp.

282 We used the same data to assess the effect of temperature on the speciation of ammonia in the waters off Hinkley Point. Using the measured temperature, salinity and pH data, we calculated a mean and maximum value for the percentage of UIA using the formula developed by Clegg and Whitfield. [20]. The mean percentage was 2.3 per cent and the maximum percentage was 4.4 per cent. In order to result in a value of UIA of 21µg/l, which is the EQS value as an annual average, the resulting total ammonia levels would have to be 922 and 477 µg/l. When the measured seawater temperatures are increased by 3 ºC, the resulting mean percentage of UIA becomes 2.8 and the maximum percentage 5.4. In order to result in a value of UIA of 21µg/l, the resulting total ammonia levels would have to be 737 and 386 µg/l. The maximum measured value for total ammonia (filtered) from our data was 45.7µg/l. This demonstrates that the effect of any temperature rise on the level of UIA in the waters off Hinkley Point due to the thermal discharge from HPC is very small, and does not result in any significant increase in UIA concentrations or compromise the WFD classification of the TraC waterbodies.

Dissolved inorganic nitrogen

283 Dissolved inorganic nitrogen levels in TraC waterbodies are a supporting element to the ecological classification of WFD waterbodies. The total annual load of DIN from the proposed discharges from HPC would result in an increase in the average concentration of 3.43µ/l (or 0.25 µM). This increase represents 0.28 per cent of the average DIN values in the Bridgwater Bay waterbody of 1244.5µ/l (or 88.89 µM). We do not consider this increase to be significant, and it will not compromise the WFD classification of the TraC waterbodies.

Mixing zones for excess temperature and TRO

Excess temperature

284 The mixing zones for the proposed WFD target values of a temperature differential of 3ºC and a max temperature of 23ºC as a 98%ile as an area (in hectares) within each of the TraC waterbodies, Bridgwater Bay and the Parrett Estuary, are given below in Table 21. The sizes of the mixing zones for Hinkley Point B running at 100 per cent and 70 per cent efficiency are also included for comparison. The two efficiency values for Hinkley Point B are provided, as these have been used in the modelling and impact assessment. Hinkley Point B is at present operating at about 70 per cent efficiency. The sizes of the mixing zones have been provided by NNB GenCo and derived from modelling output.

[20] Clegg S.L. and Whitfield M. 1995 A chemical model of seawater including dissolved ammonia and the stoichiometric dissociation constant of ammonia in estuarine water and seawater from -2 to 40°C. Geochimica et Cosmochimica Acta 59, 2403-2421.

Scenario	WFD Parrett Estuary waterbody (area of mixing zone in hectares)		WFD Bridgwater Bay waterbody (area of mixing zone in hectares)	
Temperature targets	Max 23 ºC	ΔT 3 ºC	Max 23 ºC	ΔT 3 ºC
HPB 70% (Surface)	4	0.8	0.1	0
HPB 70% (Bed)	0.4	0.03	0	0
HPB 100% (Surface)	193	85	4	1.4
HPB 100% (Bed)	106	41	0.1	0
HPC (Surface)	0	0	38	9
HPC (Bed)	0	0	2	0.4

Table 21. Mixing zones for temperature as area of WFD waterbody

285 The extent of the mixing zones as a percentage of the area of the waterbodies is given below in Table 22.

Scenario	WFD Parrett Estuary waterbody (% of waterbody area)		WFD Bridgwater Bay waterbody (% of waterbody area)	
Temperature targets	Max 23 ºC	ΔT 3 ºC	Max 23 ºC	ΔT 3 ºC
HPB 70% (Surface)	0.044	0.009	0.001	0.000
HPB 70% (Bed)	0.004	0.000	0.000	0.000
HPB 100% (Surface)	2.102	0.926	0.056	0.020
HPB 100% (Bed)	1.154	0.447	0.001	0.000
HPC (Surface)	0.000	0.000	0.536	0.127
HPC (Bed)	0.000	0.000	0.028	0.006

Table 22. Mixing zones for temperature as a percentage of WFD waterbody area

286 Based on these figures, it is clear that the areas of the mixing zones for the proposed cooling water discharge from Hinkley Point C are very small, being < 1 per cent at the surface and 0.1 per cent at the bed in Bridgwater Bay, and 0 per cent in the Parrett Estuary waterbodies respectively. The mixing zones are, therefore, not considered to be significant, and we do not believe that the WFD classification of the TraC waterbodies will be compromised.

287 It is anticipated at present that the cooling water discharge from HPB will continue until 2023. There is, therefore, a period between about 2019 and 2023 when the cooling water discharge from HPC will occur at the same time as that from HPB. During this time, there will be mixing zones related to the proposed WFD targets as a consequence of the combined thermal plumes. The extent of the mixing zones for the combined thermal plume

in terms of the area covered within Bridgwater Bay and the Parrett Estuary waterbodies are given below in Table 23.

Scenario	**WFD Parrett Estuary waterbody (area of mixing zone in hectares)**		**WFD Bridgwater Bay waterbody (area of mixing zone in hectares)**	
Temperature targets	Max 23 ºC	∆T 3 ºC	Max 23 ºC	∆T 3 ºC
HPB 70% & HPC (Surface)	812	385	246	41
HPB 70% & HPC (Bed)	879	384	57	6
HPB 100% & HPC (Surface)	1023	692	401	147
HPB 100% & HPC (Bed)	1062	764	163	42

Table 23. Mixing zones for temperature as area of WFD waterbody

288 The extent of the mixing zones as a percentage of the area of the waterbodies is given below in Table 24.

Scenario	**WFD Parrett Estuary waterbody (% of waterbody area)**		**WFD Bridgwater Bay waterbody (% of waterbody area)**	
Temperature targets	Max 23 ºC	∆T 3 ºC	Max 23 ºC	∆T 3 ºC
HPB 70% & HPC (Surface)	8.843	4.193	3.473	0.579
HPB 70% & HPC (Bed)	9.573	4.182	0.805	0.085
HPB 100% & HPC (Surface)	11.141	7.536	5.661	2.075
HPB 100% & HPC (Bed)	11.566	8.321	2.301	0.593

Table 24. Mixing zones for temperature as a percentage of WFD waterbody area

289 These figures indicate that the areas of both waterbodies are now considerably increased, being up to 11 to 12 per cent at the surface and the bed for the Parrett Estuary waterbody with HPB running at 100 per cent, and about 5.7 per cent at the surface and 2.3 per cent at the bed for the Bridgwater Bay waterbody, with HPB running at 100 per cent. It is anticipated that HPB will be running at between 70 and 80 per cent, which means that in the Parrett Estuary, these areas are close to 10 per cent of the waterbody. This is not expected to result in a change in the intertidal benthic community, that is, the community of organisms which live on, in, or near the seabed, between high and low tide marks, of the Parrett Estuary waterbody, and, therefore, is not expected to compromise the WFD classification for the waterbody over the short period when the combined plumes would occur.

Total residual oxidant

290 The mixing zones for TRO as an area (in hectares) within each of the TraC waterbodies, Bridgwater Bay and the Parrett Estuary, are given below in Table 25. The size of the mixing zones for Hinkley Point B chlorinating at its permit limit is also included for comparison. A TRO target of 0.01mg/l as a 95 percentile has been used in identifying the extent of the mixing zones. The sizes of the mixing zones have been provided by NNB GenCo and derived from modelling output.

Scenario	WFD Parrett Estuary waterbody (area of mixing zone in hectares)	WFD Bridgwater Bay waterbody (area of mixing zone in hectares)
HPB 100% (Surface)	46	46
HPB 100% (Bed)	67	2
HPC (Surface)	0	159
HPC (Bed)	0	63

Table 25. Mixing zones for TRO as area of WFD waterbody

291 The extent of the mixing zones as a percentage of the area of the waterbodies is given below in Table 26.

Scenario	WFD Parrett Estuary waterbody (% of waterbody area)	WFD Bridgwater Bay waterbody (% of waterbody area)
HPB 100% (Surface)	0.501	0.649
HPB 100% (Bed)	0.730	0.028
HPC (Surface	0.000	2.244
HPC (Bed)	0.000	0.889

Table 26. Mixing zones for TRO as a percentage of WFD waterbody area

292 Based on these figures, it is clear that the areas of the mixing zones for the proposed cooling water discharge from Hinkley Point C are small, being 2.2 per cent at the surface and 0.9 per cent at the bed in Bridgwater Bay, and 0 per cent in the Parrett Estuary waterbodies respectively. The mixing zones are, therefore, not considered to be significant, and we believe that the WFD classification of the TraC waterbodies would not be compromised.

293 It is anticipated at present that the cooling water discharge from HPB will continue until 2023. There is, therefore, a period between about 2019 and 2023 when the cooling water discharge from HPC will occur at the same time as that from HPB. During this time, there will be mixing zones related to the each of the cooling water discharges. The extent of the

mixing zones from HPB and HPC in terms of the area covered within Bridgwater Bay and the Parrett Estuary waterbodies are given below in Table 27.

Scenario	WFD Parrett Estuary waterbody (area of mixing zone in hectares)	WFD Bridgwater Bay waterbody (area of mixing zone in hectares)
HPB 100% & HPC (Surface)	46	205
HPB 100% & HPC (Bed)	67	65

Table 27. Mixing zones for TRO as area of WFD waterbody

294 The extent of the mixing zones as a percentage of the area of the waterbodies is given below in Table 28.

Scenario	WFD Parrett Estuary waterbody (% of waterbody area)	WFD Bridgwater Bay waterbody (% of waterbody area)
HPB 100% & HPC (Surface)	0.501	2.894
HPB 100% & HPC (Bed)	0.730	0.918

Table 28. Mixing zones for TRO as a percentage of WFD waterbody area

295 Based on these figures, it is apparent that there is a slight increase in area of the mixing zone in Bridgwater Bay at the surface and the bed, but these are not considered to be significant. We believe, therefore, that the WFD classification of the TraC waterbodies would not be compromised.

Ecological elements

296 Each of the ecological elements that could be relevant to either the coastal waterbody of Bridgwater Bay or the transitional waterbody of the Parrett Estuary are considered in the sections below.

Phytoplankton

297 Primary productivity in the water column of Bridgwater Bay and the Parrett Estuary is very low due to the high suspended sediment levels limiting light levels, so that chlorophyll levels are very low. The mean chlorophyll from our data for Bridgwater Bay for the period 2007-2011 is 2.2µg/l, while only seven per cent of samples exceeded 5µg/l, and none exceeded 10µg/l. The phytoplankton community also has a limited composition, being dominated by a few species of diatoms.

298 Based on the outcomes of our Habitat Regulations Assessment, neither the abstraction nor the discharge of cooling water from HPC is predicted to have a significant effect on the phytoplankton community in Bridgwater Bay and the Parrett Estuary. We reached a similar conclusion when we considered the combined effects of the abstractions and discharges from HPC and HPB during their potential overlap period up to 2023.

299 We, therefore, believe that the WFD classification of the TraC waterbodies with respect to the phytoplankton element would not be compromised.

Benthic invertebrates

300 Based on the outcomes of the Habitat Regulations Assessment, neither the abstraction nor the discharge of cooling water from HPC is predicted to have a significant effect on the structure of either the subtidal or the intertidal benthic communities in Bridgwater Bay and the Parrett Estuary. We reached a similar conclusion when we considered the combined effects of the abstractions and discharges from HPC and HPB during their potential overlap period up to 2023.

301 We, therefore, believe that the WFD classification of the TraC waterbodies with respect to the benthic invertebrate element would not be compromised.

Rocky shore macroalgae

302 The shoreline of the Bridgwater Bay waterbody is not affected by the mixing zone of the HPC thermal plume, and the predicted level of impact on the rocky shore is between 0.5 and 1.5ºC as an excess temperature. The present cooling water discharge from Hinkley Point B has a limited localised effect on the rocky shore macroalgae at Hinkley Point. The cooling water discharge from HPC is, therefore, not expected to have any significant effect on the rocky shore macroalgal community in Bridgwater Bay, and we, therefore, believe that WFD classification of the coastal waterbody with respect to the rocky shore macroalgal element would not be compromised.

Opportunistic macroalgae

303 The extent of opportunistic macroalgal cover in both the Bridgwater Bay and the Parrett Estuary waterbodies is very limited, on account of the turbidity and strong tidal currents. No significant increase in opportunistic macroalgal cover is expected as a result of the cooling water discharge from HPC.

304 We, therefore, believe that the WFD classification of the TraC waterbodies with respect to the extent of opportunistic macroalgal cover would not be compromised.

Fucoid extent

305 This element only applies to the Parrett Estuary waterbody, and the fucoid extent is not expected to be affected by the cooling water discharge from HPC.

306 We, therefore, believe that the WFD classification of the Parrett Estuary with respect to the fucoid extent would not be compromised.

Seagrass beds

307 The nearest seagrass beds to the proposed cooling water discharge are in the Severn Estuary in the Severn Lower waterbody. The cooling water discharge from HPC would have no effect on the seagrass beds in this waterbody.

Salt marsh

308 Based on the outcomes of our Habitat Regulations Assessment, the discharge of cooling water from HPC would have no effect on the salt marsh community in the Parrett waterbody.

309 We, therefore, believe that the WFD classification of the Parrett Estuary with respect to salt marsh element would not be compromised.

Fish

310 Based on the outcomes of our Habitat Regulations Assessment, neither the abstraction nor the discharge of cooling water from HPC is predicted to have a significant effect on the fish fauna or fish interest features of the Severn Estuary SAC and Ramsar.

311 We, therefore, believe that the WFD classification of the Parrett Estuary and of the various transitional waterbodies in the Severn Estuary with respect to the fish fauna would not be compromised.

Overall conclusion

312 As required by regulations 3 and 17 of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, in reaching our conclusion, we have carried out our role to secure compliance with the Water Framework Directive (2000/60/EC) and have considered the River Basin Management Plan for the South West river basin district, which has been approved under regulation 14 of the Regulations. We are satisfied that the proposed water discharge activity at HPC would not:

- cause the current status of WFD waterbodies, Bridgwater Bay (C21) and Parrett Estuary (T18), to deteriorate; or
- prejudice the aim of achieving the respective objectives of each waterbody, including associated ‘protected area’ objectives.

4.13.2 Habitats Regulations Assessment

313 In this section we summarise how we have considered the impact of the water discharge activity in relation to our duty under The Conservation of Habitats and Species Regulations 2010 (known as the Habitats Regulations).

314 The conclusions in this section have been taken from our wider Habitats Regulations Assessment[21], which considered all relevant Environment Agency permissions. Due to the level of detail in our Habitats Regulations Assessment, it is not appropriate to reproduce entire sections in this document, however the full document is available to view on our website.

315 The natural environment of the Severn Estuary is highly significant and important both nationally and internationally and is subject to a number of statutory conservation designations to make sure the species and habitats present are appropriately managed and protected. The designated sites (also known as 'European sites', or 'Natura 2000' sites in the context of the Habitats Regulations) relevant to this application are:

- the Severn Estuary Special Area of Conservation (SAC), designated under the EC Habitats Directive for supporting important high quality habitat sites;
- the Severn Estuary Special Protection Area (SPA), designated under the EC Birds Directive, and classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species;
- the Severn Estuary Ramsar, designated under the Ramsar Convention as a wetland of international importance. Government policy gives Ramsar sites broad equivalence to those designated under the Birds and Habitats Directives.

316 Under The Habitats Regulations we are required to assess the impact of any new plans, projects and permissions on conservation sites given protection as set out in Regulation 61 (SACs, SPAs and Ramsar sites). We are initially required to assess whether any of the potential impacts of the water discharge activity are likely to have a significant effect on any of the protected sites listed above. We then consult with the relevant conservation body, in this case both Natural England (NE) and the Countryside Council for Wales (CCW) due to the cross border nature of the Severn Estuary. We have carried out an assessment of likely significant effect (known as an Appendix 11) for the proposed water discharge activity and formally consulted NE and CCW on our conclusions. Our Appendix 11 assessment dated 23 January 2012 concluded that we could not be satisfied that there would not be a likely significant effect from the proposed discharge either alone or in combination with permissions, plans or projects of other competent authorities and that an appropriate assessment (Appendix 12) was, therefore, necessary. Both NE and CCW agreed with our conclusions.

317 An appropriate assessment is a detailed examination of all potential impacts that are not initially screened out as unlikely to have a significant effect, both alone and in combination with other plans, projects or permissions (set in the context of prevailing environmental conditions). The purpose of such an assessment is to ascertain, in view of the conservation objectives of the European sites, whether any of the identified likely significant effects are enough to compromise the integrity of any protected site as a whole. Although it is not defined in the Regulations, 'integrity' has been described in UK Government and EU guidance as '…the coherence of the site's ecological structure and function, across its

[21] Hinkley Point C Appropriate Assessment for related environmental permits, Revised Final Version: March 2013, (Environment Agency, 2013)

whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified'. We have carried out an appropriate assessment and have summarised our main conclusions below, with respect to the water discharge activity.

Our 'appropriate assessment' for WDA

318 Our appropriate assessment was carried out in view of the conservation objectives for the Severn Estuary Natura 2000 sites, as determined by both Natural England and the Countryside Council for Wales. We used a large amount of information from technical reports written by Cefas on behalf of Électricité de France (EDF) and NNB GenCo, along with scientific papers for our desk-based research.

319 The complexity of the Severn Estuary sites, the need to make certain reasonable assumptions within the models used to predict environmental changes and minor scientific uncertainties about the precise biological responses to environmental change, meant that along with the desk-based research we have used expert judgement to reach our conclusions about effects and impacts.

320 Internal and external experts have confirmed that the models used have been judged to be fit for purpose and robust, having been developed over many years using measured information. The source data, assumptions and the approach we used in reaching our conclusions have been verified by national experts with particular knowledge of the Severn Estuary.

321 The major factors of potential concern we focused on included toxic contamination, thermal impacts, and entrainment and impingement of fish and planktonic organisms. Each section for the three main areas of concern described below includes both assessments for alone and in combination effects. Assessments related to "alone" are described first in each instance followed by in combination and cumulative effects.

322 The main concerns from both cumulative and in combination effects occurred from the effects of the overlap period of HPC together with HPB. As with the alone assessment, the major factors of potential concern where we focused on were toxic contamination, thermal impacts, entrainment and impingement of fish and planktonic organisms. The key potential impacts on birds were from indirect effects on bird prey availability, which was covered under the estuaries feature of the HRA.

323 As well as these, there were also minor in combination effects noted for both of the Bristol Port and Environment Agency Steart Peninsula Projects, and for the combined construction activities.

324 The conclusions reflect our findings for the Severn Estuary Natura 2000 sites and also cover any potential impacts to associated sites; River Usk SAC; River Wye SAC; and River Tywi SAC.

- Toxic contamination

325 Total residual oxidant (TRO) and hydrazine in the operational discharges were shown to be above the relevant standard within the cooling water. The resultant mixing zone for TRO identified through modelling was not considered to be significant, being restricted to small areas around the outfall diffusers. However, it was apparent that the maximum load for hydrazine and the potential mixing zone for this maximum load was potentially significant. It was, therefore, not possible to conclude that there was no adverse effect on site integrity due to the discharge of hydrazine. Hydrazine will, therefore, need to be removed before discharge. To achieve this, it will be a requirement of the environmental permit for the operational discharges that hydrazine is removed from the relevant waste streams before discharge.

326 The in combination effects of the chemical discharges focused on the discharge of TRO from HPB and HPC, together with the discharge of hydrazine from HPC alone, as HPB does not have a permit to discharge hydrazine. It was apparent that the mixing zones of TRO and hydrazine from the HPC operational discharges are not quite coincident spatially, while that for TRO from the HPB operational discharges is spatially separate. However, the maximum concentration of hydrazine against the acute PNEC was modelled and found to be 40 times greater than that of the average scenario and, therefore, the potential size of the mixing zone could be significant. Hydrazine could act together with TRO to increase the toxicity further. Consequently, as with the alone assessment, it was not possible from the available information to conclude that the discharge of hydrazine would not have an adverse effect on the integrity of the site.

327 Apart from hydrazine which the operator will not be permitted to discharge, we concluded that the levels of all other toxic contaminants in the operational discharges from HPC, either alone or in combination, would not have an adverse effect on site integrity.

- Thermal impacts

328 The main effect of the thermal plume from HPC on the features of the Severn Estuary SAC was the potential impact of increased water temperatures on the subtidal and intertidal benthic communities, and the bivalve *Macoma balthica* in particular. This bivalve provides the greatest source of bird food within the subtidal and intertidal benthic invertebrate communities. It is also considered to be the species most at risk from increases in seawater temperature. Therefore, it has been the key study species within our HRA in relation to the intertidal and subtidal areas.

329 Evidence on *Macoma balthica* and other benthic invertebrates, which are found within the mudflat area of Steart flats affected by the existing thermal plume from Hinkley Point B (HPB), indicated no difference from those found outside the thermal plume. This evidence supports the view that there would be no significant effect from the thermal plume from HPC on the intertidal benthic invertebrate communities. The subtidal benthic invertebrate community is generally lower and is only affected by water temperatures higher than those on the intertidal area immediately near the outfall diffusers. These factors, together with the lack of any significant effect from the increased water temperatures on the intertidal mudflat area, indicate that any effect on the subtidal benthic invertebrate community will also not be significant.

330 In terms of in combination effects, a major factor was the close proximity of the HPB discharge to the proposed cooling water discharge from HPC. As discussed in the alone assessment, the species considered to most likely be affected by the potential rise in water temperature from the combined thermal plumes from HPB and HPC is the Baltic tellin, *Macoma balthica*. However, using a mix of desk-based studies along with comparative studies from the Gironde Estuary in France and historical data from Hinkley Point A, it has been concluded that the combined thermal plume from HPB and HPC, which will exist until 2023 (with current information), will not compromise the conservation objectives for the 'estuaries' feature and the communities and species that live within it. Therefore, we have concluded that the thermal impacts would not have an adverse effect on site integrity. We also considered the thermal effects on fish both 'alone' and 'in combination' in relation to direct effects and effects of thermal occlusion. We concluded that these thermal effects would not significantly impact on the migratory fish or fish assemblage features of the Severn Estuary SAC and Ramsar either alone or in-combination.

331 We have, therefore, concluded for both alone and in combination assessments, the changes in thermal regime due to the operational discharges from HPC would not have an adverse effect on site integrity.

- Entrainment and impingement of fish and planktonic organisms

332 The preventative (mitigation) measures proposed for HPC included the intake design being a low velocity intake, acoustic fish deterrent (AFD) system and a fish recovery and return (FRR) system. We describe the FRR system in more detail in our assessment under the Eels Regulations, in Section 4.13.3 of this decision document. We took the above measures into account when calculating impingement losses from HPC, and these were predicted to be similar or less than those of the existing Hinkley Point B power station.

333 Based on the information provided in EDF's report to support the HRA and supporting technical documents, and on the conclusions from our assessments, we conclude that the predicted rates of fish impingement and entrainment at HPC alone appear to be at a level that would not adversely affect either the protected species or estuarine assemblage (other fish species), in view of their conservation objectives, and there will be no adverse effect on the integrity of the site.

334 However, given the wide variables influencing impingement and entrainment within the Severn Estuary/Bristol Channel and the high dependency on the proposed mitigation measures, there is still scope for potential improvements to these systems, to improve their predicted performance rates and therefore, protect more fish. We therefore consider it extremely important that the final designs of both the FRR and AFD are tested well in advance of the operation of HPC, preferably at the commissioning stage, to give enough time to reach maximum performance before operation begins.

335 We have, therefore, advised the competent authorities, the National Infrastructure Directorate of the Planning Inspectorate (NID), and the Marine Management Organisation (MMO), to make sure that, before any water is abstracted (including for any trials), a comprehensive ecological monitoring and contingency plan is developed that identifies the measures necessary for identifying and tackling any changes that may cause environmental

or ecological harm. This would make sure that any measures provide the maximum protection to the environment and ecology.

336 In addition, our permit includes a pre-operational condition requiring the operator to submit for approval a commissioning plan for the AFD and FRR systems. This should describe how it intends to optimise these systems to minimise impacts on fish.

337 We assessed the cumulative effects of impingement and entrainment, together with the in combination effects of HPB and HPC. The species that required detailed investigation included the brown shrimp, *Crangon crangon*, whiting, *Merlangius merlangus*, sprat, *Sprattus sprattus* and cod, *Gadus morhua*. Extensive desk-based studies, along with comparisons of The International Council for the Exploration of the Sea (ICES) sector allocations for area VIIf which covers the Bristol Channel, have shown that the impacts of HPC and HPB will not have a significant effect on these species during the timeframe considered. Although, it should be noted that if HPB requires further extension beyond 2023, then a further Habitats Regulations Assessment will be needed.

Overall conclusion

338 Our appropriate assessment has taken into account all relevant factors and has been subjected to an internal peer review as well as consultation with Natural England and Countryside Council for Wales. As the competent authority for permits associated with this proposed site, we have concluded that:

- The maximum load for hydrazine and the potential mixing zone could have a potentially significant impact on features of the site. Removing hydrazine from the relevant waste streams before discharge will eliminate this risk.

- Temperature increases from the discharge of cooling water create a plume of water with an increase in temperature, particularly when HPB and HPC are run in parallel with each other. The most vulnerable species is called the Baltic clam, *Macoma balthica* and other benthic invertebrates found in the mudflat areas of Steart flats are also at risk. Evidence based on modelling, research into similar sites and the response of the species in the existing plume from HPB alone indicates that there would be no significant effect on these intertidal invertebrate communities.

- The preventative measures of a fish recovery and return system and an acoustic deterrent system in the design of the intake for the proposed HPC site has led to a conclusion of no adverse effect on fish with the site operating alone with these systems in place. However, given the complex nature of the estuary and the dependence on the proposed mitigation measures we consider it appropriate that the final designs are tested at the commissioning stage of the set up, well in advance of the full operation of HPC to allow maximum performance prior to starting the full operation.

339 Detailed evidence and reasoning for making the above conclusions is included in the technical sections of the appropriate assessment.

Consultation with Natural England and the Countryside Council for Wales

340 On 21 May 2012 we consulted Natural England (NE) and Countryside Council for Wales (CCW) on our wider Habitats Regulations Assessment, incorporating our Appendix 12 (Appropriate Assessment) for the water discharge activity permit application. Tables 29 and 30 below show the consultation comments from NE and CCW where there is a resulting action for us. We have not included comments where NE and CCW have agreed with our assessment. The tables also confirm how we have dealt with those actions.

Natural England comments	Environment Agency response
The Environment Agency's HRA conclusion identifies the impacts to shad as being less than those identified in the information for the HRA (impacts to shad at a population level) supplied by EDF. Could the Environment Agency please clarify this?	We reviewed the assessment for shad within the HRA and discussed it further with Natural England. Natural England has agreed that the approach used in the HRA is conservative and based on a smaller population estimate for shad, and therefore represents 'worst-case' scenario.
In combination assessment for fish for the combined impingement and entrainment does not include assessment of impacts to Annex II species. Have the residual mortalities from these impacts been considered 'in combination'?	No Annex II species are thought to be affected by entrainment (only impingement), therefore it is not possible to do a combined assessment of impingement and entrainment impacts. The HRA has been updated to make the assessment more clear in both the alone and in combination assessments.
Clarification of how Table 6.10.8 accounts for the mortality to sea lamprey as a consequence of HPB being operational for at least two years at 100 per cent capacity in parallel with HPC (c.2020-2023). Mortality after mitigation results in an annual loss of 0.27 per cent (80 per cent survival with FRR) for HPC alone, but total mortality is identified as 0.28 per cent for B & C together. Are these percentage figures an annual average loss calculated for the operational period of B & C together?	The figures for lamprey and shad were presented incorrectly and have now been amended. Total mortality of sea lamprey with HPC and B together now equated to 0.54 per cent. This does not change the overall conclusions. The table in Annex B showed a more detailed representation of table 6.10.8. This table has now been put into the main body of the HRA for clarity. The percentage figures are predicted annual loss.
NE recommends acknowledging CCW issues regarding in combination within our HRA – that is the thermal plume not considered an issue alone but requires consideration in combination with residual mortality from the intake.	This has been assessed within the in-combination section of the HRA. Clearer cross-referencing between different sections of the HRA document has been done to link the 'alone' assessment to the subsequent 'in-combination' assessment.
The assessment states that Macoma is reported to only feed when the sea water temperature exceeds 15 degrees C. We have assumed this is a typo and should read that they only feed below 15 degrees C.	This was a 'typo' and the HRA has now been corrected to state that Macoma stop feeding when sea water temperature exceeds 15 degrees C.

Table 29. HRA comments from Natural England and Environment Agency response

CCW comment	Environment Agency response
The following aspects should be monitored to ensure that they are within the range assessed within the HRA. Characteristics of each waste stream before discharge. Monitoring of habitat features: ➢ Population of phytoplankton to make sure potential changes are of the order predicted. Also require further clarification of conclusion of Mysid entrainment element, particularly the term 'there would not be a negligible increase'. ➢ Population of Macoma Balthica pre & post operation to make sure any unexpected change to their biology can be identified. ➢ Subtidal sandbanks – to ensure any scouring effects are as predicted. ➢ Fish population in the event of chlorination occurring to make sure behaviour is as predicted. This is in combination with conditions on potential use of chlorination to ensure effective control. ➢ Eel and salmon movements; if the thermal conditions described in the assessment occur during key migratory periods. ➢ Fish fauna – to make sure any changes are of the scale predicted, particularly under certain meteorological conditions. Monitoring should include direct impacts and those associated with changes to DO, increased toxicity and salinity. ➢ DO – to make sure levels are maintained within the WFD threshold.	Our permit requires NNB GenCo to monitor and report sample data to the Environment Agency. Pre-operational measure PO11 within our permit requires that an environmental monitoring plan for the Severn Estuary SAC, SPA and Ramsar is put in place with our approval to monitor and mitigate any changes to the biology, chemistry and physical characteristics of the areas impacted by the water discharge activity. This monitoring strategy will need to include all the features listed within CCW's comments. This monitoring would enable early detection of potential impact on species whether as a result of the discharge, abstraction or other aspects of the development.
Clarification of why changes to water chemistry are not seen as a hazard to estuarine birds (if generic tables are not agreed with CCW/NE). Clarification that physical damage includes potential disturbance/displacement effects on mobile species such as fish and birds, either directly as a result of changes to physiochemical regime or hydrology, or as a result of changes to prey species distribution. Recommendation that 'competition from non-native	Tables to be updated to reflect potential indirect impact on birds of changes to water chemistry. Agreed with CCW at meeting on 28 June 2012 that the Environment Agency definition of physical damage is correct and that disturbance/displacement effects are considered under a separate heading of disturbance as opposed to under physical damage.

CCW comment	Environment Agency response
species' is included in this section and appropriately assessed, due to the potential for them to be found in warmer areas associated with the discharge.	HRA has been updated to consider this potential impact. This does not alter the overall conclusion of our HRA.
Clarification of why detergent is classified against toxic contamination in one table and organic enrichment in the other.	Detergent can be toxic and, depending on the type of detergent, can also contribute to organic enrichment of the water. HRA updated to include both potential hazards in respect of detergents in all tables.
Physical damage – change in physiochemical conditions should be considered here.	Agreed with CCW at meeting on 28 June 2012 that the Environment Agency definition of physical damage is correct and that changes in physio/chemical conditions need not be considered under physical damage.
Toxic contamination should be considered as a potential hazard from the production of demineralised water within Table 2.3.2.1.	The HRA has been updated to reflect this. This does not alter the overall conclusion of our HRA.
pH should be included in list of hazards in Table 2.3.3.1 in respect of effluent from the primary circuit. Also other discrepancies between what is listed here and in the previous table.	Table 2.3.3.1 updated to include pH as a potential hazard and to be consistent with Table 2.3.2.1.
Bird features should be considered within Table 2.4.4.1 of the HRA as the abstraction and discharge of water may indirectly impact upon birds due to the potential displacement of prey species.	The HRA has been updated to reflect this. This does not alter the overall conclusion of our HRA.
Should also refer to conservation objectives within the section that discusses relevant environmental standards and targets.	HRA updated to reflect this.
Further clarification of the statement 'it is not expected that there will be a long term build-up of temperature in the waters off Hinkley', for both the commissioning and operation phases.	HRA has been updated to give greater justification for this statement. This does not alter the overall conclusion of our HRA.
Note that ambient temperatures of sea water tend to be higher within Bridgwater Bay – could this be due to the impact of water discharge from Hinkley Point B. If pre-construction of Hinkley Point A and B temperature range data is available it should be used here for comparison of relative temperatures within the Severn Estuary SAC.	Analysis of data shows that the ambient temperatures in Bridgwater Bay are higher during the summer months but lower than some areas of the Severn Estuary at other times of the year. HRA has been updated to analyse this data. This does not alter the overall conclusion of our HRA.
The HRA has used arithmetic mean as per standard procedure but this can skew the data due to small number of high summer values, use of median values would be more realistic.	The arithmetic mean leads to a worst-case scenario when assessing against lethal temperatures for habitat species. Therefore, in using the arithmetic mean we have used a conservative approach. As no adverse impact is expected based on arithmetic means, then the same conclusion would be reached if median values were used.
Lithium, hydroxide, suspended solids, COD, sodium, sulphates, & chloride should be considered 'in combination' unless levels can be considered de-minimis, in which case this should be stated.	HRA has been updated to include consideration of these contaminants both 'alone' and 'in-combination'. This does not alter the overall conclusion of our HRA.

CCW comment	Environment Agency response
Morpholine, ethanolamine, and detergents. Further clarification required on conclusions of this element and the justification of 'no likely significant effect'. Also requires consideration of potential 'in combination' effects.	HRA has been updated to include consideration of these contaminants both 'alone' and 'in-combination'. This does not alter the overall conclusion of our HRA.
Chromium & iron – potential in combination effects should be acknowledged & assessed.	HRA has been updated to include consideration of these contaminants both 'alone' and 'in-combination'. This does not alter the overall conclusion of our HRA.
Loadings of contaminants – while largely accept the argument that total loadings from Hinkley Point C on the Severn Estuary as a whole as being insignificant, recommend that further consideration is given to potential loadings within Bridgwater Bay sediment cell to ensure localised loading impacts are fully assessed.	HRA has been updated to include consideration of these contaminants both 'alone' and 'in-combination'. This does not alter the overall conclusion of our HRA.
Confirmation that a 'worst-case scenario' was used for assessment of discharges, in terms of volumes and composition.	This is confirmed – worst-case scenarios have been used in terms of volumes and composition. The limits set on the permit reflect the levels used within the assessment.
The uncertainty within the report BEEMS TR186 over potential hydrazine concentrations is cause for concern. Does not appear to be a precautionary approach or demonstrate the worst-case scenario. Therefore, CCW question the assertion that a relatively small percentage of the estuary feature would be affected, as this could be as high as eight per cent. The use of 'percentage area of feature affected' may need further justification/clarification, as this does not necessarily relate directly to the potential significance of the impact.	This concern is noted. Pre-operational measure PO10 within our permit requires that NNB GenCo agrees with us a process for removing hydrazine before commencement of commissioning. This will make sure that hydrazine is not released and no impact results from the use of hydrazine on the site.
Whilst CCW don't necessarily disagree with conclusion of 'no likely significant effect' of by-products of chlorination, there is still a need to consider potential 'in combination effects' & whether the use of 'area of feature affected' is adequate justification for there being no adverse effects.	HRA has been reviewed. This does not alter the overall conclusion of our HRA. Pre-operational measure PO7 within our permit requires NNB GenCo to assess in detail the requirement for chlorination and the potential impact of their chlorine dosing regime before commencement of commissioning.
Entrainment – note that twaite shad also spawn in the River Tywi SAC.	This is noted. We have concluded that HPC (alone and in combination) will not have an adverse effect on the twaite shad populations designated under the Severn Estuary SAC and Ramsar as a result of entrainment. We can, therefore, conclude that populations within the River Tywi will not be adversely affected.

Table 30. HRA comments from Countryside Council for Wales and Environment Agency response

4.13.3 Conservation duties (other than Habitats Regulations)

341 In this section we describe how we have considered the impact of the proposed discharge in relation to our duties under other statutory conservation provisions as listed in Table 31.

Statutory provision
Section 6(1) Environment Act 1995 (conservation duties with regard to water)
Section 6(6) Environment Act 1995 (conservation duties with regard to fisheries)
Section 7 Environment Act 1995 (pursuit of conservation interests)
Section 8 Environment Act and Section 28I Wildlife and Countryside Act 1981
Section 28G Wildlife and Countryside Act 1981
Section 85 Countryside and Rights of Way Act 2000
Section 40 Natural Environment and Rural Communities Act 2006
The Eels (England and Wales) Regulations 2009

Table 31. Other statutory conservation provisions

Section 6(1) Environment Act 1995 (conservation duties with regard to water)

342 We have considered whether we should impose any additional requirements in relation to our duty to promote the conservation and enhancement of the natural beauty and amenity of coastal waters, and the conservation of flora and fauna that depend on the water environment under section 6(1) of the Environment Act 1995. We believe that the conditions of the environmental permit will be sufficient, and, therefore, have not identified any other requirements.

Section 6(6) Environment Act 1995 (conservation duties with regard to fisheries)

343 Section 6(6) of the Environment Act 1995 imposes a duty to maintain, improve and develop fisheries. We have taken account of this duty, particularly with respect to the passage of migratory species in terms of potential impacts associated with the cooling water abstraction and the resultant thermal plume. We are satisfied that the permit conditions are sufficient to make sure we carry out our duties appropriately. For that reason, we do not consider that different or additional measures are needed.

Section 7 Environment Act 1995 (pursuit of conservation interests)

344 Section 7(1)(c) of the Environment Act 1995 places a duty on us when considering any proposal to consider the effect this would have on the economic and social well-being of local communities in rural areas, and to take into account any effect the proposal would have on the beauty or amenity of any rural area.

345 We consider that the conditions of the environmental permit are sufficient in this case.

Section 8 Environment Act and Section 28I Wildlife and Countryside Act 1981

346 Under Section 28I of the Wildlife and Countryside Act 1981, we have a duty to consult the relevant conservation body (Natural England (NE) or Countryside Council for Wales (CCW) in relation to any permit that is likely to damage a Site of Special Scientific Interest (SSSI).

347 We have considered the application in the context of the Severn Estuary SSSI, Blue Anchor to Lilstock Coast SSSI and Bridgwater Bay SSSI, and concluded that the proposed discharge will not adversely affect any of the SSSIs. We issued notice of our conclusion to NE and CCW in line with our statutory duty on 29 June 2012 (in a document known as an Appendix 4 Formal Notice).

348 We have taken into account the advice we received from NE and CCW following consultation with them, as required under section 28I WCA 1981 (as amended by schedule 9 to the Countryside and Rights of Way (CRoW) Act 2000), when deciding to permit the discharge(s) and in determining any conditions, and it is felt that existing conditions are sufficient in this regard and no other appropriate requirements have been identified.

Section 28G Wildlife and Countryside Act 1981

349 Under Section 28G of the Wildlife and Countryside Act 1981, we have a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest (SSSI). As mentioned above, we have formally given notice to NE and CCW on our conclusion that the proposed discharge will not adversely affect either the Severn Estuary SSSI, Blue Anchor to Lilstock Coast SSSI or Bridgwater Bay SSSI.

350 We have considered whether we should impose any further requirements, but believe that existing conditions in the permit are sufficient.

Section 85 Countryside and Rights of Way Act 2000

351 Section 85 of the Countryside and Rights of Way Act 2000 places a duty on us to consider conserving and enhancing the natural beauty of the Area of Outstanding Natural Beauty (AONB) when carrying out any of our work in relation to, or so as to affect, land in such an area.

352 We have considered the application in the context of the Quantock Hills AONB, part of which comprises a section of Jurassic coastline located approximately 5km due west of the HPC development site and which is next to the Blue Anchor to Lilstock SSSI, cited for its rich geological heritage.

353 We have considered whether we should impose any further requirements, but believe that existing conditions in the permit are sufficient.

Section 40 Natural Environment and Rural Communities Act 2006

354 Section 40 of this Act requires us to have regard, so far as is consistent with the proper exercise of our functions, to the purpose of conserving biodiversity. ‘Conserving biodiversity’

includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat.

355 We have concluded that a permit with appropriate conditions will meet our responsibilities and, therefore, do not consider that we need different or additional measures.

The Eels (England and Wales) Regulations 2009

356 The Eels (England and Wales) Regulations 2009 (Statutory Instrument No. 3344) came into force on 15 January 2010. These Regulations implement Council Regulation (EC) No 1100/2007 (OJ No L 248, 22.9.2007), establishing measures for the recovery of the stock of European eel in England and Wales. As part of the Regulations we have to consider screening and passage for eels. We have assessed the potential impacts of the HPC discharge on the European eel through our Habitats Regulations Assessment (HRA) because the European eel is a designated migratory species under the Severn Estuary Ramsar feature. We are satisfied that in carrying out our HRA assessment, we have also fulfilled our duty to consider the requirements of the Eels Regulations.

357 The European Eel is a 'catadromous' species, meaning that it returns to the marine environment to spawn. The species is believed to breed in the Sargasso Sea, with the early planktonic life stages migrating across the Atlantic via oceanic currents, until when about 12-18 months old, the larvae metamorphoses into a transparent *glass eel* while still in the ocean. Further transformation occurs as they enter estuaries and become pigmented, at which point they are commonly known as *elvers*. They leave our rivers, for example, the River Parrett, as *silver eels,* on their way back to the Sargasso Sea to breed. The Severn Estuary, therefore, provides a vital corridor between freshwater and marine habitats, critical for the completion of their life cycle.

358 European eels are present in the Severn Estuary throughout the year, although there are large seasonal variations in their numbers. Glass eels enter the Bristol Channel/Severn Estuary in large runs, moving upriver in the spring, while downstream runs of European silver eels typically start in the autumn and may last until early spring. The Severn Estuary and its rivers constitute the largest eel fishery in the UK, and accounts for 95 per cent of all glass eels caught in England and Wales. The River Parrett is reported to support one of most productive elver fisheries in England.

359 In our Habitats Regulations Assessment we have considered how both the abstraction of cooling water and its subsequent discharge at elevated temperature, along with the discharge of chemical effluent could impact on the European eel. The assessment has been defined by reference to the Conservation Objectives for the designated site. We have considered potential impacts on the target species both alone and in combination with other permissions, plans or projects (PPPs). Although we consider numerous other PPPs in our HRA, arguably the most relevant to this discussion is Hinkley Point B power station, which is planned to continue operating until 2023.

360 With regard to the HPC cooling water abstraction, we have looked at potential impacts due to physical damage caused by both (a) impingement upon the cooling water drum screens, and (b) entrainment through screens within the flow of cooling water. With regard to the HPC discharge, we have looked at potential impacts due to the following hazards: (a) toxic

contamination from TRO, CBPs and hydrazine, (b) non-toxic contamination in terms of nutrients enrichment and organic loading, (c) effects due to the increased temperature of the discharge, and (d) increases in turbidity and suspended sediments.

361 The above hazards are those that relate to our 'alone' assessment. For our 'in-combination' assessment we also considered impacts due to (a) change in salinity regime, (b) habitat loss, and (c) disturbance.

362 The key point in terms of the Eels Regulations that underpins our assessment is whether the proposals could potentially cause a barrier to migration. We have considered this in our HRA as the following conservation objective wording is common to the assessment of each hazard:

"The migratory passage of both adults and juveniles through the Severn Estuary between the Bristol Channel and their spawning rivers is not obstructed or impeded……"

363 We have summarised our conclusions below.

Conclusions for abstraction:

- the predicted increase in mortality caused by entrainment is not significant and will not have an adverse effect on the population of European eel in the Severn Estuary. We acknowledge that the calculations that support this conclusion are very conservative and present a worst- case scenario;

- provided that the relevant mitigation is in place, the abstraction will not have an adverse effect on the population of European eel as a result of impingement.

364 The mitigation proposed for the cooling water abstraction system at HPC is an acoustic fish deterrent (AFD) and fish recovery and return (FRR) system. However, epibenthic species, that is, those living at the surface of the seabed, such as the European eel are unlikely to be deterred by the AFD system. The effectiveness of any AFD system will depend on the hearing sensitivity of individual species, which, in turn, depends on their physiology in terms of both the presence/absence of a swimbladder and the connection between the swimbladder and inner ear. Species fall into three broad categories: *non-specialists*, which have no swim bladder, *generalists*, which have a swimbladder but no special connection between it and the inner ear and *specialists*, which not only have a swimbladder but also a connection between it and the inner ear, which can extend their hearing ability. The European eel has a swimbladder but no connection to the inner ear and, as such, are classed as hearing *generalists*, but they are thought to have fairly poor hearing capabilities. Therefore, the main measure to prevent high mortalities on this species will be the FRR system.

365 NNB GenCo has confirmed that the proposed FRR system will be designed in accordance with Environment Agency guidance[22,23], although the finalised design is not yet available. The basic operation of the FRR system proposed for HPC is described below.

[22] Screening for Intakes and Outfalls: a best practice guide, (Environment Agency, 2005)

366 Cooling water abstracted via the intake tunnels will be directed to two onshore cooling water pump houses. Each will each contain a large rotating drum screen that will prevent smaller debris, which has passed the coarse screens on the intake heads, from entering the cooling water system. These drum screens have been designed to facilitate an FRR system and, in particular, will include the following features in line with our guidance:

- smooth-finish 5 mm drum-screen mesh;
- fish bucket design suitable for retaining sinuous species such as adult eels and lampreys, and other fish and crustacean species;
- continuous screen rotation at an elevation rate at least 1.5 m per minute;
- low pressure (<1 bar) backwash sprays to remove fish from screens with minimum of harm;
- hopper geometry to minimise the risk of fish recycling within the screen-well;
- smooth-finish troughs with horizontal and vertical bend of at least 3 m radius.

367 The inner circumference of each drum screen will have elevator ledges or 'buckets', which lift debris and marine life clear of the seawater surface. As stated above, the buckets will be designed for retaining sinuous species such as eel, lamprey and other fish and crustacean species. The designers of HPC propose a further improvement, using an auxiliary screen mesh attached along the top lip of the bucket to further improve retention. Continuous wash-water sprays will flush the collected material and organisms to collection troughs, from which they will then be flushed to a gully. The fish and debris will go through a series of pipes before being returned to the estuary. The chosen route for fish return to the sub-tidal estuary will be via a dedicated bored tunnel driven from landward, under the seawall and inter-tidal shore, to a specific point on the tidally scoured rock exposure below Low astronomical tide (LAT) but above the sub-tidal muddy plain.

368 We are satisfied that the proposed FRR system is being designed according to our published current best practice. However, as the final design has not been confirmed, we have included a pre-operational measure in our permit requiring NNB GenCo to submit details of the FRR before the power station is commissioned. We have also included a further pre-operational measure requiring the company to confirm how it intends to optimise the FRR system to minimise impacts on fish before any operational discharges take place.

369 It should be noted that of prime concern during our assessment were the small glass eels migrating from the Atlantic through the estuary and down towards the River Parrett. Although the migration routes up river are not known, we recognised that the proposed 5mm drum-screen mesh would still result in most glass eels, if near the HPC intakes, being entrained through the cooling water system. We, therefore, considered this potential impact as part of our entrainment assessment. Most of those glass eels impinged on the screens will be returned to the estuary by the FRR system, and we also considered these in our assessment.

[23] Cooling Water Options for the New Generation of Nuclear Power Stations in the UK, (Environment Agency, 2010)

Conclusions for discharge:

370 In terms of the discharge of cooling water and process effluent and the potential impact on the European eel, we have concluded that there will be no adverse impact due to (a) toxic and non toxic contamination (apart from hydrazine, which NNB GenCo will not be permitted to discharge, see below), (b) the effect of the increased temperature of the discharge, and (c) increases in turbidity and suspended sediments. With regard to the potential for barriers to migration to be formed, our assessment of the evidence suggests that this will not be an issue.

371 For hydrazine we were not able to conclude "no adverse effect", and indicated that there would have to be some measures (mitigation) in place to treat or reduce the concentration of hydrazine before any discharges took place. NNB GenCo has proposed a methodology for the treatment of hydrazine in its permit application. We have reinforced this with a pre-operational measure requiring NNB GenCo to submit a hydrazine removal plan to us for approval before commissioning begins. The discharge of hydrazine is not authorised under our permit.

Overall conclusion:

372 Overall, we are satisfied that we have appropriately considered the requirements of the Eels Regulations. Apart from the pre-operational measures described above, we do not consider we need to include different or further measures in the permit.

4.13.4 Other duties

373 In this section we describe how we have considered the impact of the proposed discharge in relation to our duties under the other (remaining) statutory provisions relevant to this permit application, as listed in Table 32.

Statutory provision
Section 4 Environment Act 1995 (pursuit of sustainable development)
Section 5 Environment Act 1995 (preventing, minimising, remedying or mitigating the effects of pollution of the environment)
Section 15 Water Resources Act 1991 (particular regard to duties of sewerage undertaker)
Marine and Coastal Access Act 2009
Schedule 22 Environmental Permitting (England and Wales) Regulations 2010 (and regulation 35) - Groundwater Activities
Human Rights Act 1998
Regulation 59 Environmental Permitting (England and Wales) Regulations 2010 (duty to involve)

Table 32. Other statutory provisions

Section 4 Environment Act 1995 (pursuit of sustainable development)

374 We have considered the principal aim of the Environment Agency, set out in Section 4 of the Environment Act 1995 (EA 95), which relates to sustainable development and the guidance issued to:

- the Environment Agency in December 2002 (*The Environment Agency's Objectives and Contributions to Sustainable Development: Statutory Guidance, December 2002*)[24] and links to the *UK Sustainable Development Strategy (A Better Quality of Life: A strategy for sustainable development in the UK* (May 1999), Cm 4345), although we note that this strategy has now been updated, see below;

- the Environment Agency by the Welsh Assembly in November 2003 (*The Environment Agency's Objectives and Contribution to Sustainable Development in Wales: Statutory Guidance from the National Assembly for Wales*).

375 Both documents provide guidance to us on areas such as developing approaches that we should take to our work, decisions about our priorities and our allocation of resources. We are required under Section 4(4) of EA95 to consider the statutory guidance in carrying out our role, but it does not directly apply to our individual regulatory decisions.

376 The guidance states that our main contribution to sustainable development will be to meet our objectives in a way that takes account (subject to and in accordance with EA 95 and any other enactment) of economic and social considerations.

377 The UK Sustainable Development Strategy was updated in 2005 with the publication of *The UK Government's Sustainable Development Strategy* (March 2005), Cm 6467. This states that: 'Our [UK] Strategy for sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations' and introduces five guiding principles. These are:

- Living Within Environmental Limits: respecting the limits of the planet's environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations.
- Ensuring a Strong, Healthy and Just Society: meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity for all.
- Achieving a Sustainable Economy: building a strong, stable and sustainable economy which provides prosperity and opportunities for all, and in which environmental and social costs fall on those who impose them (polluter pays), and efficient resource use is incentivised.
- Using Sound Science Responsibly: ensuring policy is developed and implemented on the basis of strong scientific evidence, whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values.

[24] http://archive.defra.gov.uk/corporate/about/with/ea/documents/ea-susdev-guidance.pdf

- Promoting Good Governance: Actively promoting effective, participative systems of governance in all levels of society – engaging people's creativity, energy and diversity.

378 The Government published further guidance on "mainstreaming sustainable development"[25] in 2011.

379 We consider that the overall approach described in this decision document, and in particular the assessment of the impact of the water discharge activity on members of the public and the environment, contributes appropriately to the aim of achieving sustainable development, having regard to the statutory guidance. We have considered whether we should impose further requirements in relation to our principal aim, but we believe that existing requirements are sufficient.

Section 5 Environment Act 1995 (preventing, minimising, remedying or mitigating the effects of pollution of the environment)

380 Section 5 of the Environment Act 1995 sets out the statutory purpose for which the Environment Agency's pollution control powers, including our powers under EPR 10, must be exercised, namely: 'preventing or minimising, or remedying or mitigating the effects of, pollution of the environment'.

381 We consider that we have properly exercised our pollution control powers contained in Section 5 of EA 95, in that:

- we have set appropriate permit limits and conditions as specified in the statutory guidance, having regard to Government policy;
- the potential for impact of the permitted discharges on members of the public and the environment is minimised.

Section 15 Water Resources Act 1991 (particular regard to duties of sewerage undertaker)

382 We have a duty under Section 15 of the Water Resources Act 1991 to consider whether granting an environmental permit is likely to affect the duties of any water or sewerage undertaker. We have considered whether we should impose any further requirements in terms of this duty, but we believe that the existing conditions are sufficient.

Marine and Coastal Access Act 2009

383 We have considered the new duties placed upon us under the Marine And Coastal Access Act 2009, one of the most important of which is set out in Part 3, Chapter 4, Section 58. This requires that any authorisation decision taken by a public authority must be in accordance with the appropriate marine policy documents, that is the relevant Marine Plan or the Marine Policy Statement (MPS); unless relevant considerations indicate otherwise.

384 The MPS outlines the Government's policies for achieving sustainable development in the marine environment around the UK, while at a local level, Marine Plans will be developed to provide the statutory basis for decision making on activities within that area. There is

[25] http://sd.defra.gov.uk/documents/mainstreaming-sustainable-development.pdf

currently no Marine Plan for the Severn Estuary, with the first two proposed Marine Plans in England being developed for the waters off the North Yorkshire coast. The proposed HPC discharge will, however, be made into waters that fall within the proposed future South West Inshore Marine Plan, in England. As a cross-border estuary the marine area potentially affected by the water discharge activity will also be subject to a future Marine Plan developed by Welsh Assembly Government.

385 The decision at which we have arrived affects the marine waters of the Severn Estuary SAC and so it has been made with reference to the Marine Policy Statement. We believe that our decision is in accordance with the Marine Policy Statement.

Schedule 22 to the Environmental Permitting (England and Wales) Regulations 2010 (and regulation 35) - Groundwater Activities

386 Under EPR 10, groundwater activities relate to inputs of pollutants to groundwater. This includes both those activities that require a permit, and those activities that are unlawful, for instance those that, either deliberately or accidentally, pollute groundwater. The proposed discharge is to surface waters, within the Severn Estuary, not 'groundwater'. So, this is not considered to be a groundwater activity within Schedule 22 of the 2010 Regulations. There are no planned releases to groundwater from the activities permitted by the permit.

387 The Regulations also require operators to take all necessary measures to prevent the input of any hazardous substances to groundwater, and to limit the input of non-hazardous pollutants into groundwater to prevent pollution. Having considered NNB GenCo's proposals for the on-site storage of oils, lubricants and process chemicals associated with the water discharge activity, we are satisfied that the proposed measures represent best practice in terms of pollution prevention, and should not result in fugitive (accidental) releases of hazardous substances or non-hazardous pollutants to groundwater.

Human Rights Act 1998

388 We have considered potential interference with rights addressed by the European Convention on Human Rights in reaching our decision. We consider that our decision is compatible with our duties under the Human Rights Act 1998. In particular, we have considered the right to life (Article 2), the right to a fair trial (Article 6) (which here includes the right to a reasoned decision – as provided in this document), the right to respect for private and family life (Article 8) and the right to protection of property (Article 1, First Protocol). We do not believe that Convention rights are engaged in relation to this determination.

Duty to Involve

389 Under Regulation 59 of EPR 10, we are required to prepare and publish a statement of our policies for carrying out our public participation duties. In February 2010 we published a document, entitled "Working together: your role in our environmental permitting." We are consulting on this application in line with our public participation statement, as well as with our guidance note RGN 6 on Sites of High Public Interest, which addresses specifically extended consultation arrangements for determinations where public interest is particularly high. This satisfies the requirements of the Public Participation Directive.

390 Section 23 of the Local Democracy, Economic Development and Construction Act 2009 requires us, where we consider it appropriate, to take steps to involve interested persons in carrying out our work by providing them with information, consulting them or involving them in any other way. Section 24 of the Act requires us to consider any Secretary of State guidance as to how we should do that.

391 We have described in Section 3 of this document our consultation in relation to this application and we have described how we have taken account of representations we have received to date in Annexes 2 and 4.

4.14 Setting permit limits

392 This section of the decision document describes and explains the permit limits (compliance limits) in our permit for the proposed water discharge activity. These will form the legal requirements against which we would regulate the permitted activity and through which would monitor operational performance. In deciding to apply these limits and conditions we have considered:

- NNB GenCo's H1 screening assessment;
- our own 'screening' assessment of the proposed waste streams;
- NNB GenCo's detailed modelling and assessment and what it shows to be an acceptable impact on the environment in the context of relevant environmental standards;
- our Habitats Regulations Assessment;
- the requirements of other applicable legislation.

393 We are satisfied that the limits and conditions as set out in the permit will ensure a high level of environmental protection.

4.14.1 Our approach to permitting

394 The water discharge activity being considered in this application will result in a single, continuous discharge to the Bristol Channel, comprising returned cooling water and several smaller waste streams. It could be argued, therefore, that only a single discharge to the environment needs to be permitted, with a single compliance point either at the outlet or at a point upstream where it is possible to obtain a reliable, representative sample of the discharge. However, we have decided that the various waste streams will be conditioned separately. This means that while our permit has two permitted outlets to the environment, via diffusers at the end of the outfall tunnel, we have proposed permit limits (compliance limits) on the individual waste streams before they are combined with the returned cooling water in the outfall pond, as well as on the cooling water itself. Our reasons for this is are as follows:

- there is the considerable practical problem of obtaining a representative sample of the discharge. We cannot sample at the end of the outfall tunnel, submerged and almost 2km out in the estuary. We also consider that the highly turbulent mixing environment

within the discharge pond would prevent us from obtaining a truly reliable, representative sample of the combined discharge at that point;

- NNB GenCo has confirmed that it is not possible to obtain a sample of the combined cooling water flow before it is discharged through the common outfall tunnel. This means that for waste stream A, each UK EPR unit will need to be sampled separately in its respective turbine hall;
- despite the practical issues above, we consider that a single compliance point does not allow enough control of the discharges from the individual processes, or sufficient flexibility in assessing new or varied discharges that may be produced during the operation of the power plant, for example due to process development;
- future changes in environmental legislation may drive changes in the chemicals used in individual processes, or the processes themselves. In this case, we would want to be able to regulate the individual waste streams.

395 Other important reasons for this proposed approach are that it allows the impact of each discharge to be assessed alone and 'in combination' for Habitats Regulations Assessment purposes, as well as allowing the definition of any treatment measures which are needed to mitigate the potential impact of a particular waste stream to be clearly made.

396 Permit limits are normally set as concentrations in the final effluent and, if relevant, as loads (based on measured flows and concentrations in the final effluent) over a time period. Other types of permit limit can be used, for example, differential concentrations between cooling water intake and discharge, but these are not considered to provide a simple means of regulating the various process discharges, apart from the cooling water. We have applied a combination of limits to our permit, that is effluent concentrations, loads (daily and annual), and differentials, depending on the most suitable measures for each waste stream.

397 In setting permit limits and conditions, we have thought about what is necessary in terms of our main objective to protect the environment, and also what is acceptable from a regulatory viewpoint. At the same time, and where our permitting guidance allows, we have respected the need for the operator to be able to manage the power station to maximise output and feed the national grid, without being overly constrained by the permit. We have set out below our reasons for the limits in our permit.

Waste stream A

398 The cooling water discharge will be characterised by flow rate, heat load (both in terms of maximum temperature and the temperature rise above ambient) and total residual oxidant (TRO) if it is necessary to control biofouling by injecting sodium hypochlorite into the cooling water system. For waste stream A, permit limits have been applied to both the combined discharge of cooling water from the two UK EPR units, and that from each UK EPR unit individually.

399 For the combined discharge of cooling water from the two UK EPR units, permit limits have been set for the maximum tidally-averaged flow; the maximum instantaneous flow as a 98 percentile; and the maximum cooling water temperature as a 99.5 percentile.

400 For each individual UK EPR unit, permit limits have been set for the maximum temperature increase compared with the inlet water temperature as a tidal mean, for both normal operation and during specific planned maintenance work; maximum total residual oxidant (TRO); pH; and oil and grease.

401 Our permit limits and conditions for flow rate, temperature, and TRO, are discussed below. The limits for pH and oil and grease are in accordance with our standard permitting requirements and are the same across all the waste streams.

- Flow rate

402 The cooling water flow rate will vary depending on the tidal state at the intake heads, and the number of main cooling water (CRF) pumps in use, which, in turn, is influenced by the operational state of the power station. During standard operation with both reactors operating at full load and all four CRF pumps running, the power station will abstract between 116m^3/s and 134m^3/s of cooling water. The higher flows are abstracted at high water spring tides, and the lower flows at low water spring tides. On average (over the tidal cycle) with both reactors at maximum load, the cooling water flow rate will be in the order of 125m^3/s.

403 NNB GenCo has confirmed that it will not be possible to monitor the combined cooling water flow from HPC, that is, the combined flow from both UK EPR units. This is due to the physical characteristics of the structures and the engineering difficulties involved. The point where the flows from each UK EPR meet, at the head of the common outfall tunnel, is almost 30 metres below ground. Cooling water flow monitoring will therefore be undertaken on each of the UK EPR units. To obtain combined flows from the two UK EPR units, the individual flows measured for each UK EPR unit at a given time will be added together.

404 In setting limits on flow rate, we have considered the possible need for (a) a maximum daily volume, (b) a maximum flow rate, and (c) a minimum flow rate. We have decided that the only flow controls we need relate to the maximum flow rate, and we have proposed two limits, a tidally averaged flow (or tidal mean) and a 98 percentile flow, that is the flow that must not be exceeded for 98 per cent of the time. These instantaneous flow limits are 127.0m^3/s as a tidal mean, and 134.6m^3/s as a 98 percentile, for the combined flows from the two UK EPR units. The maximum tidal mean flow rate is 2m^3/s greater than the average of 125.0m^3/s to take account of the variation in actual tidal heights off Hinkley Point, as the cooling water flows are assumed to be directly proportional to the tidal height, due to head effects on the CRF pumps.

405 These values have been based on an assessment of the variation in pumped cooling water flows calculated from actual tidal height data for the years 1995, and 2002 to 2008 measured at Hinkley Point. These measured tidal data were obtained from the data archive of the National Tidal and Sea Level Facility. The limits for the tidally-averaged flow do not take account of the accuracy of the measurement of the cooling water flow; they merely reflect the flow variations predicted to result from actual tidal levels. A more rigorous assessment of non-tidal residuals in the tidal elevation data may be required to refine these limits for the tidally-averaged flows, although this should be carried out when more information is available on the nature and operation of the cooling water pumps.

406 The 98 percentile flow of 134.6m^3/s is considered to represent an upper limit based on the ranked 98 percentile flows from the eight years of tidal data which was analysed, as the maximum 98 percentile instantaneous flow from the eight years was 134.46m^3/s (using tidal data for 1995). A percentile figure has been preferred to an absolute maximum, to allow for the effects of unpredictable tidal height variations on the cooling water flow rate.

407 We considered the need for a maximum daily discharge volume, but feel that it would not provide any additional benefit over the maximum flow rates discussed above. We are satisfied that these would provide sufficient control during standard operation of HPC.

408 We also considered the need for a minimum flow rate, particularly relevant when the power station is operating under a non-standard configuration. During an outage for example, the cooling water flow rate could be as low as 60.4m^3/s. In this situation, we would want to make sure that the amount of cooling water flowing through the system was sufficient to dilute the contaminants arising in the other waste streams before discharge, so that maximum short-term emissions did not exceed those stated in the permit application (and upon which the applicant's impact assessment has been based.)

409 We are satisfied in this case that a limit on the minimum flow rate will not be necessary. This is because NNB GenCo has stated that during an outage the amount of water needed to serve the UK EPR unit 'on outage' would be between 2.4-5.7m^3/s, while, at the same time, the other reactor would be operating normally on a minimum flow of 58m^3/s. The need for cooling water on the unit on outage is a safety related measure and, therefore, we consider that this flow will always be available and within the stated range. We expect that this control would be written into the operator's environmental management system. When combined with the cooling water serving the other reactor, we are satisfied that the overall dilution will be enough to make sure that short-term emissions will not differ significantly from those stated in the permit application.

410 Another situation that could occur with each UK EPR unit, and which the applicant has stated could be a normal operational circumstance, is where one of the two CRF pumps serving a UK EPR unit is undergoing routine planned maintenance, referred to as 'RF3 maintenance' in the application. As mentioned earlier, this pump maintenance would generally be scheduled to coincide with a planned outage, but this cannot be guaranteed.

411 Under this RF3 scenario, there will be only one CRF pump running for a UK EPR unit. The resulting average cooling water flow is stated to be 36.5m^3/s. Pump maintenance would not be expected to take longer than one month, and advanced notice would be needed. No change to the permit limits for the combined flows from the two UK EPR units is considered necessary for this situation.

- Temperature

412 The actual temperature of the cooling water being returned to the Bristol Channel will depend on the ambient water temperature at the intake heads, the thermal loading related to the output of the power station, and the cooling water flow, which depends on the tidal height at the intake heads. As the ambient water temperature of the cooling water inflow to a power station at any given time is an unknown, the temperature of the cooling water

outflow is usually quoted as a temperature differential (or ΔT), that is the excess temperature of the outflow compared with the inflow.

413 During standard operation with both reactors operating at full load and all four CRF pumps running, the temperature differentials related to the range of cooling water flow is 10.7ºC for 134m^3/s (which equates to 67m^3/s for one UK EPR unit) and 12.5ºC for 116m^3/s (which equates to 58m^3/s for one UK EPR unit). On average (over the tidal cycle) with both reactors at maximum load, the temperature differential is 11.6ºC, with the cooling water flow rate being in the order of 125m^3/s. Based on these temperature differentials and related cooling water flows (provided by the applicant), it has been assumed that the temperature differential is directly proportional to the cooling water flow, which is itself directly proportional to the tidal height at the intake heads (see discussion on flow above).

414 In setting limits on cooling water temperature, we have considered the possible need for (a) a maximum cooling water temperature, and (b) a maximum temperature differential. However, recognising the variation in cooling water flows over the tidal cycle, we have decided to control the cooling water temperature under normal operation for each UK EPR unit by using a tidally-averaged cooling water temperature differential. This limit is 11.8ºC as a tidal mean, for each UK EPR unit. The maximum tidally-averaged temperature limit is 0.2ºC greater than average of 11.6ºC to take account of the variation in actual tidal heights off Hinkley Point, as the cooling water flows are assumed to be directly proportional to the tidal height, due to head effects on the CRF pumps.

415 These values have been based on an assessment of the variation in pumped cooling water flows calculated from actual tidal height data for the years 1995, and 2002 to 2008 measured at Hinkley Point. These measured tidal data were obtained from the data archive of the National Tidal and Sea Level Facility. The limits for the tidally-averaged temperature flow do not take account of the accuracy of the measurement of the cooling water flow; they merely reflect the flow variations predicted to result from actual tidal levels. A more rigorous assessment of non-tidal residuals in the tidal elevation data may be required to refine these limits for the tidally-averaged flows, although this should be carried out when more information is available on the nature and operation of the cooling water pumps.

416 A 99.5 percentile cooling water temperature has also been set for the combined cooling water flows from the two EPR units. This 99.5 percentile limit is the cooling water temperature that must not be exceeded for 99.5 per cent of the time.

417 The 99.5 percentile cooling water temperature has been set at 35ºC in order to make sure that cooling water temperatures do not consistently exceed lethal temperatures for any entrained marine organisms. However, the percentile method does allow the standard to be exceeded on occasions, which would seem reasonable, as the ambient water temperature at the intake heads cannot be controlled. In addition, a percentile value allows time for the operation of the plant to be appropriately managed during a persistent period of exceedance.

418 In order to provide the necessary information to assess these cooling water temperature limits, the water temperatures in the cooling water inflow prior to the condensers, and the water temperatures in the cooling water outflow downstream of the condensers, before being discharged into the outfall ponds, will need to be continuously monitored. The

temperature limits set for the individual UK EPR units can be assessed directly from the monitoring data. To assess the maximum temperature limit set for the combined cooling water discharge from the two UK EPR units, the temperature of the combined cooling water discharge needs to be calculated from the temperature and instantaneous flow data measured for the individual UK EPR units. A simple mass balance calculation will be used to obtain the cooling water temperature for the combined flows from the two EPR units, assuming that the water temperature is constant in the two cooling water flows until they are fully mixed and discharged from the outfall.

419 As mentioned earlier, another situation that may occur with each UK EPR unit, and which the applicant has stated could be a normal operational circumstance, is where one of the two CRF pumps serving a UK EPR unit is undergoing routine planned maintenance, referred to as 'RF3 maintenance.' This pump maintenance would generally be scheduled to coincide with a planned outage, but this cannot be guaranteed.

420 In this situation, there would be only one CRF pump running for a UK EPR unit. The maximum tidally-averaged temperature limit in this situation would be 22.2ºC. This maximum tidally-averaged temperature limit is 0.5ºC greater than average of 21.7ºC, to take account of the variation in actual tidal heights off Hinkley Point, as the cooling water flows are assumed to be directly proportional to the tidal height, due to head effects on the CRF pumps. This higher permitted temperature differential could apply to each UK EPR unit, but not simultaneously, depending on which unit is undergoing pump maintenance at the time.

421 Pump maintenance would not be expected to take longer than one month, and advanced notice would be needed. It is recognised that the maximum cooling water temperatures could exceed the 35ºC 99.5 percentile limit for the combined cooling water flows, if planned pump maintenance was scheduled for the summer months. However, to avoid a prolonged period of cooling water temperatures exceeding 35ºC, no change to the 99.5 percentile is proposed, so that pump maintenance will need to be planned for those months when the ambient water temperatures allow the 35ºC maximum limit to be met.

- Total residual oxidant

422 Should it prove necessary to control biofouling in the cooling water system, then the discharge will contain TRO. While NNB GenCo does not envisage a need to control biofouling based on past experiences at Hinkley Point B power station, it must retain the right to chlorinate if needed, and so dosing proposals have been included in the permit application. If required, risk-based dosing will be achieved by injecting sodium hypochlorite into the abstracted cooling water upstream of the condensers. TRO is used as the relevant parameter for assessing the level of chlorine in seawater, because of the chemical interactions that occur when chlorine or hypochlorite is added to seawater.

423 NNB GenCo has stated in its permit application that the maximum concentration of TRO in waste stream A (the cooling water) would be 0.2mg/l (or 200µg/l). This is based on the need to achieve a chlorine residual of 200µg/l downstream of the condensers in order to achieve the required level of control over biological growth within the cooling water system. At this concentration, TRO exceeds the EQS of 10µg/l within the cooling water and, therefore, there will be a mixing zone upon discharge. However, we do not consider the mixing zone for TRO, as identified through hydrodynamic modelling, to be significant, as it is restricted to

a small area around the outfall diffusers. We, therefore, consider it appropriate, having taken into account Habitats Regulations and WFD requirements, to apply a limit of 200µg/l to our permit.

Waste streams B & C (combined), D and F

424 As shown in Section 5.9, NNB GenCo has provided emissions data in relation to waste streams B & C combined (from the 'nuclear island processes, including steam generator blowdown), waste stream D (mainly turbine hall drainage), and waste stream F (from the demineralisation plant). The information provided includes maximum daily and annual loadings, and maximum concentrations for the range of substances expected to be present in each waste stream.

425 As shown through screening assessment, all substances within these waste streams, apart from hydrazine, screen out as insignificant upon discharge. Furthermore, we have determined that at the maximum concentrations stated in the application, none of the substances exceed the relevant EQS or other standard following dilution within the returned cooling water. From a regulatory viewpoint, to make sure that the actual emissions are in accordance with those specified in the application, we have applied the proposed emissions to the permit, as formal numeric limits, both as maximum daily loads and maximum annual loads. We would require the operator to monitor and report against these limits by submitting calculated loads, associated effluent flow and substance concentration data. In order to do this, the operator would need to monitor flow and take samples of each waste stream before it entered the outfall pond.

426 In order to limit substance concentrations to the maximum levels stated, we have incorporated the 'pre-dilution concentration tables' from the application into the permit as an 'operating technique'. These are the maximum concentrations before mixing with the cooling water in the outfall pond. Although we do not feel it appropriate to include these concentrations as formal numeric limits, they are nonetheless important in making sure that the plant is operated such that the maximum levels quoted in the permit application are respected, as these form the basis of the impact assessment work. We expect that these limits would provide a useful benchmark for process control for the operator.

Waste stream E

427 Waste stream E comprises oily water from the oily water drainage network, which serves those areas on site where oils and hydrocarbons are used and which, therefore, present a risk of contamination. These areas include the back-up diesel generators, transformer compounds, electrical substations, oil and grease store, oil and hydrocarbon offloading areas and various workshops.

428 NNB GenCo proposes to install a Class 1 oil interceptor specified to achieve a maximum hydrocarbon concentration of 5mg/l. We have incorporated this proposal as an 'operating technique' in our permit. NNB GenCo has estimated that the maximum daily discharge volume would be 240m^3/day, and we have applied this figure to our permit as a limit. We have also applied a "visible oil or grease" limit that requires the operator to make a daily visual inspection of the discharge, with the compliance criteria being "no significant trace present". This is in accordance with our standard permitting procedures.

Waste stream G

429 NNB GenCo has stated in its permit application an effluent quality from the on-site sewage treatment plant of 20mg/l BOD (biochemical oxygen demand), 30mg/l suspended solids, and 20mg/l total ammonia (ammoniacal nitrogen, as N). The plant has been sized to take into account peak flows arising when maximum numbers of staff are on site, for example during an outage. The maximum daily discharge volume is quoted as being 175m^3/d.

430 We are satisfied that the plant has been sized appropriately and that the quoted performance is acceptable in terms of effluent quality. This will ensure that a good quality secondary treated sewage effluent is discharged. We have no environmental concerns with respect to a discharge at the standard quoted being made at the proposed location. We have already concluded that in terms of bacteriological load and the potential for impact on designated bathing waters, the discharge will make an insignificant contribution to the bacterial levels in the receiving waters of the inner Bristol Channel and the Severn Estuary. We have therefore applied the plant specification data above to our permit, adding also our standard controls for pH and oils.

4.15 Consideration of the discharge of hydrazine

431 To reduce maintenance time and cost, corrosion inhibitors and oxygen scavengers are often added to control the pH of water in boiler and cooling systems for various industrial processes. Hydrazine is a strong reducing agent that is frequently used in the cooling water circuits in nuclear power stations because of its anti-oxidant properties. This prevents corrosion associated with metals rusting in the steam generators. Hydrazine is an ammonia-derived compound, is toxic and a carcinogen.

432 NNB GenCo proposes to use hydrazine at HPC to dose the feedwater within the secondary circuit. It states that it has considered using several other oxygen scavengers, but that these either reduce the efficiency of the power station or are more harmful to the environment than hydrazine. Of those considered (carbohydrazide, diethyl hydroxylamine, methyl ethyl ketone, hydroquinone, erythorbic acid, and organic amines), NNB GenCo reports that none removed oxygen from the high temperature and pressure boilers as efficiently as hydrazine.

433 The fate of hydrazine in the water environment depends on dilution/dispersion and chemical and biological degradation as well as processes such as volatilisation and sedimentation, with hydrazine ultimately degrading to form nitrogen. The decomposition products, water and dissolved nitrogen gas are not toxic. It is thought that hydrazine can cause growth inhibition, immobilisation, anomalies and mortality within fish and other marine life. Hydrazine can also react with chlorine or hypochlorite to form chloramines, which can be persistent and have biocidal properties.

434 NNB GenCo has carried out studies into the fate and behaviour of hydrazine in seawater to support its impact assessment for the HPC development. It suggests that when introduced into seawater, hydrazine concentrations decrease with time and, although hydrazine will be present in toxic quantities, it is not expected to persist and its likely impact on organisms

associated with the seabed is predicted to be very low. Its main threat is, therefore, reported to be to species present in the water column such as fish and plankton.

435 There are two aspects concerning the potential impacts of hydrazine within the cooling water discharge:

- the impact of hydrazine on entrained organisms within the cooling water system before discharge;
- the impact of hydrazine within the cooling water plume on the receiving water and the sea bed as the plume dilutes and disperses, and the contaminants decay.

436 There is no formal environmental quality standard for hydrazine and there is uncertainty regarding the quality of toxicity data that has influenced the low predicted no effect concentration (PNEC) value derived by NNB GenCo.

437 As reported in our Habitats Regulations Assessment (HRA), due to the impact of hydrazine on entrained species, the survival rate for planktonic organisms and juvenile fish is likely to substantially decrease to the point where we are unable to conclude no adverse effect on the integrity of the estuaries feature in relation to planktonic organisms and the fish assemblage designated under the Severn Estuary SAC and Ramsar. Our HRA conclusion was that it is not currently possible with the available information to conclude that the discharge of hydrazine would not have an adverse effect on the integrity of the estuaries feature and, therefore, its sub feature migratory fish and fish assemblage designated under the Severn Estuary SAC and Ramsar.

438 We also considered the potential impact of hydrazine within the cooling water discharge plume. As the level of hydrazine exceeds the PNEC value in the discharge of cooling water, there is a need to define the extent of the contaminant plumes, and the areas at the sea surface and sea bed where the relevant targets are exceeded, that is, the size of the mixing zones. These provide an initial assessment of whether the likely scale of an impact is significant, and whether there may be an adverse effect on a species or habitat.

439 NNB GenCo's modelling work concluded that the potentially more sensitive areas both for migratory fish passage and for other species, such as the River Parrett, would be relatively unexposed to hydrazine and only for negligible areas above the proposed PNEC. We reviewed these conclusions as part of our HRA within our estuaries toxic contamination assessment. NNB GenCo defined mixing zones for hydrazine using output from the GETM hydrodynamic model, using an average cooling water flow of 125m^3/s. The extent of these mixing zones and the percentages of the estuaries feature that these areas represent are shown in Table 33.

Hydrazine	Total extent of mixing zone (ha)	Mixing zone in the SAC (ha)	Total extent of mixing zone as a percentage of the estuaries feature	Mixing zone in the SAC as a percentage of the estuaries feature
Surface	191	161	0.259	0.219
Bed	77	77	0.105	0.105

Table 33. Extent of mixing zones for hydrazine along with the percentages that these areas represent of the estuaries interest feature.

440 These areas and percentages on the face of it are not significant, being less than 0.3 per cent of the estuaries feature, and the mixing zones do not affect the more sensitive intertidal habitats of Bridgwater Bay. However, NNB GenCo did not model the maximum discharge concentration against the acute (short-term) PNEC. The loading from this scenario is about 40 times greater than for the average scenario and, therefore, the potential size of the mixing zone associated with this scenario could be around 40 times greater than current predictions. This is potentially significant and could represent more than 10 per cent of the estuaries feature.

441 While this is only an estimate of the potential size of the mixing zone for hydrazine, the uncertainty introduced in the modelling needs to be addressed, as it is not possible with the available information to conclude that the discharge of hydrazine does not have an adverse effect on the integrity of the designated site. We feel that the simplest option to manage this uncertainty is to mitigate the discharge of hydrazine by treating waste streams B, C, & D and reducing the concentration of hydrazine at source.

Proposed mitigation

442 It is recognised that EDF is assessing options for treating hydrazine. As part of its permit application, it submitted an overview of its proposed method of destroying hydrazine, which it would use if an unacceptable level of hydrazine was detected in the effluent tanks before discharge. It proposed that hydrazine would be destroyed by injecting hydrogen peroxide, possibly supported by the addition of a suitable catalyst, if hydrogen peroxide alone did not achieve the required rate of destruction.

443 NNB GenCo has also proposed to make available to us (before HFT commissioning) the results of a proposed optioneering exercise on the feasibility of minimising discharges of hydrazine, taking into account lessons learned from (a) early operation of the Flamanville 3 EPR in France, and (b) further design development.

444 Our overall HRA conclusion on hydrazine is that based on the available information, we have not been able to conclude that the discharge of hydrazine in the HPC operational discharge would not have an adverse effect on the integrity of the Severn Estuary SAC without mitigation. Furthermore, we have specified that hydrazine will need to be removed before discharge.

445 We intend to eliminate this potential impact by including a pre-operational measure in our permit that requires the operator to submit for approval, before HFT commissioning, a

hydrazine removal plan, which details how hydrazine would be removed from the effluent before discharge. The Plan should include the following:

- the methodology to be followed in removing hydrazine from the discharge;
- proposals for monitoring during the Hot Functional Testing phase of commissioning to demonstrate that the level of hydrazine in (i) waste streams B & C (combined), and (ii) waste stream D, is below the Limit of Detection of the analytical method, the use of which shall be approved by the Environment Agency;
- proposals for on-going process monitoring to make sure that the hydrazine removal process continues to be effective;
- details of contingency plans to deal with equipment failure and/or breakdown, or other reasonably foreseeable incidents that may affect the effectiveness of the hydrazine removal process.

446 Our permit does not authorise the discharge of hydrazine.

4.16 Monitoring

4.16.1 Scope of consideration

447 The monitoring systems associated with the water discharge activity are still being designed. It has, therefore, not been possible in NNB GenCo's application to specify the exact location of the monitoring points associated with each waste stream. The best available information that we have indicates that the monitoring points will be located as shown in Table 34.

Waste stream	Indicative location of monitoring points / building ref. no from application site plan	Indicative NGR of monitoring point
A	Turbine hall / Building 16 - one per EPR unit	ST 20400 46000 - Unit 1 inlet
		ST 20400 46000 - Unit 1 outlet
		ST 20150 46000 - Unit 2 inlet
		ST 20150 46000 - Unit 2 outlet
B & C (combined)	Effluent tanks / building 14 - shared facility	ST 20500 45800
D	Effluent tanks / building 14 - shared facility	ST 20500 45800
E	Attenuation pond / building 30 - shared facility	ST 20250 46050
F	Demineralisation station / building 31 - shared facility	ST 20500 45900
G	Sewage treatment plant / building 36 - shared facility	ST 20400 46150

Table 34. Indicative locations and NGR's of monitoring points

448 We have included a pre-operational measure in our permit, which requires the operator to confirm the locations of the monitoring points, including exact NGR's and site plans before the HFT phase of commissioning begins.

449 We have decided that NNB GenCo should carry out effluent monitoring for the following parameters listed in Table 35.

Waste stream A	**Waste streams B & C (combined)**	**Waste stream D**	**Waste stream E**	**Waste stream F**	**Waste stream G**
Flow rate - (15-minute instantaneous or integrated flow) Temperature (maximum & differential) Total residual oxidant (TRO)	Daily and annual loads for: Boric acid Boron (as B) Lithium hydroxide Morpholine Ethanolamine Nitrogen (as N) Ammoniacal nitrogen (as NH_4^+) Phosphate Detergents COD Aluminium Copper Chromium Iron Manganese Nickel Lead Zinc Cadmium Mercury	Daily and annual loads for: Morpholine Ethanolamine Nitrogen (as N) Ammoniacal nitrogen (as NH_4^+) Phosphate COD Aluminium Copper Chromium Iron Manganese Nickel Lead Zinc Cadmium Mercury	Visible oil or grease	Maximum daily volume Daily and annual loads for: Amino tri - phosphonic acid (ATMP) Hydroxy Ethylidene - Diphosphonic acid (HEDP) Acetic acid Phosphoric acid Sodium polyacrylate Acrylic acid Iron Annual load for: Detergents	Maximum daily volume

Table 35. Parameters to be monitored under water discharge activity permit

450 We have set these monitoring requirements in the permit in order to make sure that the level of emissions does not harm the receiving environment. We will also monitor certain aspects of the discharge as part of our routine compliance work.

451 Our permit also includes a pre-operational measure, which requires NNB GenCo to submit for approval an environmental monitoring plan for the Severn Estuary SAC, SPA and Ramsar, to be used for post-scheme appraisal. NNB GenCo will need to agree the scope of this plan with us.

452 In accordance with Environment Agency guidance, monitoring equipment, techniques, staff and organisations employed for the emissions monitoring programme and environmental monitoring shall have either MCERTS certification or MCERTS accreditation (as appropriate), where available, unless otherwise agreed in writing by us. MCERTS is our monitoring certification scheme. It provides the framework for businesses to meet our quality requirements. If an operator complies with MCERTS we have confidence in its monitoring of emissions to the environment. NNB GenCo will be required via a pre-operational measure in our permit to confirm the proposed monitoring procedures / techniques to be used, and its MCERTS status, before the HFT phase of commissioning begins.

4.17 Pre-operational conditions

453 Based on the information in the application, we consider that we need to impose pre-operational conditions ('measures'). These measures are set out below. We have also referred to them throughout this decision document, where appropriate. The pre-operational measures must be completed before the hot functional testing phase of plant commissioning begins. Many of the measures require the operator to submit a specific plan for our approval before a particular activity begins.

454 Due to the lengthy design process and construction period associated with Hinkley Point C, certain aspects of the detailed design are ongoing and evolving. Our pre-operational measures in many instances require the operator to confirm that it has adopted or implemented the details and measures proposed in its application before commissioning begins. We note that the UK EPR is an evolutionary design based on operational PWR power stations in France and Germany. The most recent French design was the N4, a predecessor of the UK EPR, brought into commercial operations in 1996 (Chooz B1). The most recent German design was KONVOI, brought into commercial operation in 1989 (GKN-2). We expect NNB GenCo to learn lessons from the detailed design and construction of the other EPRs under construction, in particular at Flamanville in France, and that this experience will inform its responses to our pre-operational measures. Where design amendments have taken place since the application was made, then the measures require the operator to validate the original application data and, where appropriate, demonstrate how any amendments will prevent or minimise impacts on the environment and ensure compliance with this permit.

Pre-operational measure PO1

455 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with Part 1 of How to comply with your Environmental Permit (EPR 1.00) and Horizontal Guidance note H6 on Environmental Management Systems; and shall include an Accident Management Plan for the Water Discharge Activity. The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.

Pre-operational measure PO2

456 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency a report which includes a completed, as-built description of the plant and infrastructure relevant to the Water Discharge Activity. Note that the report shall take into account the cooling water system in its entirety, including the design of the AFD and FRR systems.

457 In addition the report shall contain an updated site plan clearly showing all relevant buildings and structures and the route of the associated pipework, including all land-based infrastructure associated with the cooling water system.

458 Should the final design vary from that described in the permit application, the report shall include as appropriate, a risk assessment to demonstrate how the changes will prevent or minimise impacts on the receiving water environment, and ensure compliance with this permit.

Pre-operational measure PO3

459 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency a report which reviews the proposed substance loadings and emissions to surface water from Hinkley Point C. The report shall include, but not be restricted to the following:

- a summary of the lessons learnt through design evolution and/or commissioning and operating the EPR at Flamanville 3 in France, or any other EPR site worldwide;
- information from designers and suppliers which has influenced the final design with respect to the flow and composition of effluents;
- reference to outputs from the demineralisation plant (expected to be based on non-desalination technology in variance to the data provided in GDA and the permit application).

460 The report shall validate the proposed substance loadings and emissions from Hinkley Point C, fully describing and justifying:

- any expected variances from the substance loadings and emissions proposed in the permit application;
- any additional mitigation measures required to ensure compliance with this permit.

Pre-operational measure PO4

461 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a scoping document for development of an Emissions Management Plan, to show how emissions not covered by emission limits in Table S3.1, will be prevented, or where that is not practicable, minimised.

Pre-operational measure PO5

462 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Emissions Management Plan in accordance with the scope agreed under PO4.

Pre-operational measure PO6

463 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency a Commissioning Discharges Management Plan. The plan shall describe how the Operator intends to undertake Hot Functional Testing (HFT). The plan shall include, but not be restricted to the following:

- the timetable for HFT of both UK EPR units;
- a description of the HFT process;
- a description of associated effluent treatment measures;
- confirmation of the expected substance loadings and emissions to surface water;
- confirmation of the expected thermal loading, including the expected temperature of the discharge;
- proposals for effluent monitoring during the HFT process.

464 The plan should also demonstrate how the Operator's management and engineering controls will ensure that substance loadings and emissions to surface water do not exceed the levels stated in the permit application, with particular reference to how:

- environment impacts will be prevented or minimised; and
- compliance with this permit will be achieved.

Pre-operational measure PO7

465 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a report which confirms and justifies their operational strategy for the control of biofouling of the cooling water system. The report shall include, but not be restricted to the following:

- an appraisal of the operational conditions and chlorination strategy employed at Hinkley Point B power station, and a description of how this has been taken into account in defining the proposed strategy for HPC;
- the lessons learnt through design evolution and/or commissioning and operating the EPR at Flamanville 3 in France, or any other EPR site worldwide;

- details of how the operational strategy has been optimised to reduce the need for chemical dosing and the subsequent discharge of TRO and the formation of chlorinated by-products (CBP's);
- validation of the impacts of the proposed dosing regime, to include reference to numerical modelling and ecotoxicological studies as appropriate.

Pre-operational measure PO8

466 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Commissioning Plan for AFD and FRR Systems. The plan shall include, but not be restricted to the following:

- a description of how the Operator intends to optimise the AFD and FRR systems to minimise impacts upon fish;
- details of the monitoring proposed to facilitate optimisation and meet the above objective;
- confirmation of the timetable associated with the AFD and FRR system commissioning;
- proposals for demonstrating the effectiveness of the optimisation process to the Environment Agency prior to the start of Active Commissioning of Unit 1.

Pre-operational measure PO9

467 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Forebay de-silting Plan for the removal of accumulated silt from within the cooling water forebays. The plan shall include:

- verification of the initial impact assessment findings detailed in the permit application;
- a Method Statement for undertaking the de-silting activity.

Pre-operational measure PO10

468 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Hydrazine Removal Plan which details how hydrazine shall be removed from the effluent prior to discharge. The plan shall include, but not be restricted to the following:

- the methodology to be followed in removing hydrazine from the discharge;
- proposals for monitoring during commissioning (HFT) to demonstrate that removal of hydrazine is being achieved;
- proposals for on-going process monitoring to ensure that the hydrazine removal process maintains its effectiveness;

- details of contingency plans to deal with equipment failure and/or breakdown, or other reasonably foreseeable incidents which may compromise the effectiveness of the hydrazine removal process.

Pre-operational measure PO11

469 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Environmental Monitoring Plan for the Severn Estuary SAC, SPA and Ramsar, for the purpose of post-scheme appraisal.

470 The plan shall propose monitoring methods to determine the physical, chemical and biological characteristics of the area potentially affected by the Water Discharge Activity (including the abstraction of cooling water), and monitoring locations and frequencies. It shall also include the procedures for assessing any effects and reporting the results of the monitoring and assessment to the Environment Agency. The plan shall include, but not be restricted to the following aspects:

- thermal plume monitoring;
- subtidal and intertidal benthic ecology;
- water quality monitoring;
- sediment quality monitoring; and
- the quality assurance procedures in place; or
- the progress towards MCERTS certification or MCERTS accreditation, unless otherwise agreed in writing by the Environment Agency, and if necessary a timetable for achieving the MCERTS standard.

Pre-operational measure PO12

471 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Priority Hazardous Substances Management Plan. The plan shall describe how the Operator intends to manage the use of chemicals so as to gradually cease or phase out discharging Priority Hazardous Substances, in accordance with the objectives set out under the Water Framework Directive.

472 The plan will make reference to amongst other things, the cadmium and mercury which is present as trace contaminants in bulk raw materials, and will propose a timetable for the gradual phasing out of the use of such chemicals.

Pre-operational measure PO13

473 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency confirmation of the final national grid references (NGR's) for the individual diffuser heads on the cooling water outfall tunnel, to refine the NGR's in the permit application which were submitted with a 50m limit of deviation to allow for tunnel drilling contingency.

474 Following written approval by the Environment Agency, the NGR's shall be deemed to be incorporated under Table S3.2 of this permit.

Pre-operational measure PO14

475 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency:

- confirmation of the NGR's for the compliance monitoring points associated with each waste stream, as listed in table S3.3;
- confirmation of the monitoring point references, to be prefixed by 'M', for the waste stream compliance monitoring points; and
- detailed site plan(s) showing the exact location of the waste stream compliance monitoring points.

476 Following written approval by the Environment Agency, the NGR's and monitoring point references shall be deemed to be incorporated under Table S3.3 of this permit. The site plan(s) shall be deemed to be incorporated under Schedule 7 of this permit.

Pre-operational measure PO15

477 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Effluent Monitoring Plan which specifies the monitoring techniques and assessments to be used for monitoring of effluents under this permit. The Plan shall also include, but not be restricted to the following:

- the quality assurance procedures in place; or
- the progress towards MCERTS certification or MCERTS accreditation, unless otherwise agreed in writing by the Environment Agency, and if necessary a timetable for achieving the MCERTS standard.

Pre-operational measure PO16

478 Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Hydrodynamic Modelling Review Plan. The plan shall include a description of the sampling and monitoring regimes that will be put in place to meet the requirement of Improvement Condition IC2 in table S1.3 of this permit.

4.18 Improvement conditions

479 Based on the information in the application we consider that we need to set what are called "improvement conditions". In the case of a new regulated facility such as this, these are in fact conditions requiring measures to be undertaken which cannot be carried out before the grant of the permit (frequently to obtain operational information or environmental monitoring data for post-scheme appraisal); they are not measures to improve matters at a later stage. We are using these conditions to require the operator to provide the Environment Agency with details that need to be validated or confirmed during operation. These conditions are set out below and they have been referred to in the relevant section of this decision document.

Improvement condition IC1

480 The operator shall submit a written report to the Environment Agency on the implementation of its Environmental Management System and the progress made in the accreditation of the system by an external body or if appropriate submit a schedule by which the EMS will be subject to accreditation.

Improvement condition IC2

481 The operator shall review their hydrodynamic modelling for the purpose of post-scheme appraisal within 5 years of the commencement of commercial operation of Unit 2, to validate their modelling predictions. The review shall include re-calibration and validation of the hydrodynamic model(s) if necessary, as well as a reassessment of the assumptions concerning the near-field behaviour of the discharges.

482 The operator shall submit a written report to the Environment Agency on the review of their hydrodynamic modelling within 1 month of completion of the review.

Improvement condition IC3

483 The operator shall review their hydrodynamic modelling and associated impact assessment in light of the following:

- best available climate change projections;
- operational performance of the power station;
- the output from post scheme appraisal studies;

within 5 years of the commencement of commercial operation of Unit 2 and every 10 years thereafter unless otherwise agreed in writing by the Environment Agency.

484 The review will assess how the climate change projections could influence the operation of the power station in the future. The results of the review shall be reported to the Environment Agency in writing within 1 month of completion of each review.

4.19 Other considerations

4.19.1 Matters outside the Environment Agency's permitting remit

Location of the regulated facility

485 Decisions about land use are matters for the land-use planning system. The location of the facility is a relevant consideration for environmental permitting, as this could potentially have an adverse environmental impact on members of the public or sensitive environmental receptors. The impact on members of the public and the environment has been assessed as part of the determination process and has been reported upon earlier in the document.

Vehicle access to the facility and traffic movements

486 These are relevant considerations when granting planning permission, but do not form part of the environmental permit decision-making process.

Flood risk

487 We provide advice and guidance to the local planning authority on flood risk in our consultation response to the local planning authorities. Office for Nuclear Regulation (ONR) considers flood risk as part of the safety case under NIA65.

5. Our decision

488 We consulted on our draft decision that we should grant a permit, and on the conditions of the draft permit. We have now carefully considered all the consultation responses and consider that our original conclusions remain valid.

489 Our decision is that we should grant a permit for Hinkley Point C Power Station operated by NNB Generation Company Limited.

490 The permit number is EPR/HP3228XT.

491 See section 4 for more detailed discussion of these matters.

5.1 Conditions of permit

492 The permit contains conditions taken from our standard environmental permit templates. We have developed these conditions over a number of years and regularly review them to make sure that they are up-to-date and effective; that permits for specific sites properly protect people and the environment, and that they are consistent with the relevant legislation.

493 As well as the standard template conditions, our permit contains two bespoke conditions, regarding monitoring and reporting associated with the operation of HPC in RF3 maintenance configuration. We believe these are necessary to make sure that the permit achieves the required level of environmental protection.

494 The permit template and its conditions are described more fully in the document "How to comply with your Environmental Permit".

495 The standard permit template consists mainly of:

- an introductory note (this is not part of the permit);
- a certificate page granting the permit;
- Parts 1-4: standard conditions about management, operations, emissions and monitoring, and providing information;
- Schedule 1 - defining the activities permitted;
- Schedule 2 - specifying raw materials;
- Schedule 3 - specifying routes for, monitoring and limits on emissions to water;
- Schedule 4 - specifying reporting requirements;
- Schedule 5 - notification form;
- Schedule 6 - interpretation;
- Schedule 7 - a site plan showing the geographical extent of the regulated facility.

496 We have not modified the conditions in Parts 1-4 of our permit from the standard conditions of our template, with the exception of those relating to monitoring and reporting during operation in RF3 maintenance configuration.

497 In Schedule 1, we have included:

- three improvement conditions;
- 16 pre-operational measures;

for the reasons explained in Section 4.

498 Schedule 3 specifies the proposed point source releases and, as relevant, the proposed limits that apply to specific substances for each of the approved release points.

499 Since our consultation on the draft permit, we have made one minor change to pre-operational measure PO8 in Schedule 1, Table S1.4. At the request of NNB GenCo we have removed the words '(fuel loading)' from the final bullet point. NNB GenCo felt it was unnecessary to link fuel loading to the permitted activities. In agreeing to the removal of this term we are satisfied that the change does not alter the meaning or intent of the pre-operational measure.

500 We are of the view that our decision and permit conditions are consistent with the relevant legislation, and that we have determined the application having taken account of the statutory guidance concerning the regulation of discharges into the environment and relevant Government policy.

Glossary

Term	Meaning
AA	Annual average
Activity	A generic title for the practices or operations, which have to be permitted (unless exempted from the need for a permit)
AFD	Acoustic fish deterrent
AONB	Area of outstanding natural beauty
BAT	Best Available Techniques
BOD	Biochemical Oxygen Demand
CBP	Chlorinated by-product
CCW	Countryside Council for Wales
CFT	Cold flush testing
CROW	Countryside and Rights of Way Act
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
DSD	Dangerous Substances Directive
EDF	Électricité de France
EMP	Emissions Management Plan
EMS	Environmental Management System
EPR 10	Environmental Permitting (England and Wales) Regulations 2010 (SI 2010 No. 675)

Term	Meaning
EQS	Environmental quality standard
FRR	Fish recovery and return
FSA	Food Standards Agency
GDA	Generic Design Assessment
GDF	Geological Disposal Facility
HFT	Hot functional testing
HPA	Hinkley Point A
HPB	Hinkley Point B
HPC	Hinkley Point C
HSE	Health and Safety Executive. Regulator with responsibilities under IRR99 and NIA65, which it delivers through ONR
ICES	The International Council for the Exploration of the Sea
ID	Initial dilution
LAT	Low astronomical tide
MAC	Maximum allowable concentration
MPS	Marine Policy Statement
NID	National Infrastructure Directorate of the Planning Inspectorate
NLS	Nuclear Licensed Site: a site licensed under the Nuclear Installations Act 1965
NOEC	No observable effect concentration
ONR	Office for Nuclear Regulation: an agency within the HSE
PC	Process contribution
PCT	Primary Care Trust

Term	Meaning
PEC	Predicted environmental contribution
PHS	Priority Hazardous Substance
PNEC	Predicted no effect concentration
PPP(s)	Permissions, plans or projects
PPS	Public participation statement
PR	Public register
PWR	Pressurised water reactor
RBMP	River basin management plan
rBWD	Revised Bathing Water Directive
RGN	Regulatory Guidance Note
RTP	Rated thermal power
SAC	Special Area of Conservation
SHPI	Site of High Public Interest
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TraC (waterbody)	Transitional and coastal (waterbody)
TRO	Total residual oxidant
UIA	Unionised ammonia
UK EPR™	United Kingdom European Pressurised Reactor
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive

Annex 1 - Places where the application was advertised and could be viewed

Print and digital media

501 The application was advertised and consulted on from 1 November to 15 December 2011 in accordance with our public participation statement, our working together agreements and Regulatory Guidance Note 6 (RGN6) regarding sites of high public interest.

502 We placed an advert announcing the start of the consultation in The Somerset County Gazette, Western Daily Press and the Bridgwater Mercury. We also advertised in the South Wales Echo.

503 We issued a press release to key local media across the region.

504 We used social media such as Twitter and Facebook to help promote the consultation.

505 We sent letters to those people and organisations in our database for Hinkley Point consultations.

506 We updated our Hinkley Point webpages to link to the application documents and inform people about how to respond.

Locations where the documents could be viewed

Environment Agency
Rivers House
East Quay
Bridgwater
Somerset
TA6 4YS

Environment Agency Office
Rivers House
St. Mellons Business Park
Fortran Road
St. Mellons
Cardiff
CF3 0EY

West Somerset Council
West Somerset House
Killick Way
Williton
Somerset
TA4 4QA

West Somerset Council
Minehead Customer Centre
1-3 Summerland Road
Minehead
TA24 5BP

Sedgemoor District Council
Bridgwater House
King Square
Bridgwater
TA6 3AR

Burnham-on-Sea Library
Princess Street
Burnham-on-Sea
Somerset
TA8 1EH

Somerset County Council
Major Energy Projects
Environment Directorate
Somerset County Council
County Hall
Taunton
TA1 4DY

North Somerset Council
Corporate Services Unit
Somerset House
Oxford Street
Weston-super-Mare
BS23 1TG

Vale of Glamorgan Council
Pollution Control Team
Civic Offices
Holton Road
Barry
CF63 4RU

Consultees

507 We wrote to a wide range of organisations that we have working together agreements with or that we believed might be interested in the consultation.

- Health and Safety Executive (Office for Nuclear Regulation)
- Health and Safety Executive (Wales)
- Food Standards Agency
- Sedgemoor District Council
- West Somerset Council
- Somerset County Council
- North Somerset Council
- Mendip District Council
- Taunton Deane District Council
- Vale of Glamorgan Council
- Somerset Primary Care Trust
- Cardiff and Vale University Local Health Board
- Natural England
- Countryside Council for Wales
- Centre for Environment, Fisheries and Aquaculture Science
- Marine Management Organisation
- Association of Sea Fisheries Committees (Wales)
- Devon and Severn Inshore Fisheries and Conservation Authority
- Welsh Assembly Government, Fisheries Policy Branch.

Annex 2 - Consultation responses on the application

1) Consultation responses from statutory and non-statutory bodies

Response received from the **Health and Safety Executive (Office for Nuclear Regulation)**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues raised.	No action required.

Response received from the **Marine Management Organisation**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues raised.	No action required.

Response received from **English Heritage**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues raised.	No action required.

Response received from **South Gloucestershire Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
1) It did not anticipate any significant effects in its area due to the distance of the proposed project from South Gloucestershire.	We confirm that through our assessment, as detailed in this consultation document, the proposed activity will not have any significant effects in the area covered by South Gloucestershire Council.
2) It said that permits should only be granted for a new nuclear power station if the Environment Agency is satisfied that the internationally and nationally important biodiversity of the Severn Estuary will not be adversely affected by the direct and/or indirect impacts of the new power station or its associated development.	We have carried out a comprehensive Habitats Regulations Assessment of the impact of the proposed discharge on the marine ecology of Bridgwater Bay and the surrounding waters in response to our duty under The Conservation of Habitats and Species Regulations 2010, including consultation with Natural England and the Countryside Council for Wales. The details of this assessment are reported in Section 4.13.2 of this consultation document.

Response received from **Natural England**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
It stated that it did not intend to comment at this stage. It will await our statutory consultation with Natural England via the Appendix 11 and Appendix 4 processes.	We have consulted Natural England on our Appendix 11 and Appendix 4 assessments. As reported in Section 4.13.2, we have carried out an 'appropriate assessment' under Regulation 61 of the Conservation of Habitats & Species Regulations 2010.

Response received from the **Countryside Council for Wales**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
It stated that it had concerns about the proposals and that, at this time, it was not possible to say that the water discharge activity would not have adverse impacts on the Severn Estuary SAC, SPA, Ramsar, SSSI; River Usk SAC; River Usk (Lower Usk) SSSI; and River Wye SAC, SSSI. It, therefore, felt that it had no option but to express its concerns. It recommended that we carry out an appropriate assessment under Regulation 61 of the Conservation of Habitats & Species Regulations 2010.	We have consulted Countryside Council for Wales on our Appendix 11 and Appendix 4 assessments. As reported in Section 4.13.2, we have carried out an 'appropriate assessment' under Regulation 61 of the Conservation of Habitats & Species Regulations 2010.

Response received from the **Centre for Environment, Fisheries and Aquaculture Science**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
1) It confirmed that there are no shellfisheries near the proposed discharge. The surrounding area provides both a nursery ground for some fish species and an important migratory route for others.	Our Habitats Regulations Assessment has considered the potential impact on both designated migratory fish and the overall fish assemblage. We have considered the potential impact not only of the discharge, but also of the abstraction, in terms of entrainment and impingement.
2) Further information on the potential impacts of TRO due to biofouling control, particularly on the bivalve, *Macoma balthica,* needs to be further described once NNB GenCo has defined the exact nature of the chlorine dosing strategy to be used.	Pre-operational measure PO7 in our draft permit requires the operator to confirm and justify its operational strategy for controlling biofouling. It will need to validate the impacts of the proposed dosing strategy on the marine environment. We do not consider the potential impact of TRO, as shown through detailed modelling, to be significant, as the mixing zones are limited to small areas around the outfall diffusers.
3) Routine CBP monitoring at the point of	Pre-operational measure PO11 in our

discharge and within the TRO plume is necessary to confirm NNB GenCo's conclusion that discharges of CBPs should not represent a long-term threat to marine ecology. 4) CBP monitoring should be supported by an evaluation of the uptake and bioaccumulation of CBPs in organisms representing benthic communities in the locality of the TRO plume.	draft permit requires the operator to agree with us an environmental monitoring plan for the Severn Estuary SAC, SPA and Ramsar, to be used for post-scheme appraisal. This will need to include provisions for monitoring CBPs in the surrounding benthos.
5) It confirms that, in general, NNB GenCo's modelling work is very thorough, fit for purpose and robust. It has no reason to believe that the Environment Agency's modelling requirements were not met. 6) The modelling of diffusion and dispersion around the discharge points would benefit from further work, to get a better representation of plume stratification near to the outfalls. 7) It would be useful to carry out further work on the thermal impacts on *Macoma Balthica.*	We confirm that NNB GenCo's detailed hydrodynamic modelling meets our modelling requirements, as reported in Section 4.12. We agree that the model predictions for the thermal plume are 'considered precautionary', using an initial condition with the discharge fully mixed through the water column. The actual behaviour of the discharge in the near-field around the outfall diffusers is likely to vary considerably over the tidal cycle, because of the large variation in tidal heights and tidal current speeds, together with variations in local wind and wave conditions. NNB GenCo will need to re-assess the modelling assumptions as part of the hydrodynamic modelling review required as an improvement condition in our draft permit, and define how this will be done in the modelling review plan which is a pre-operational measure in the draft permit. The applicant will be required to carry out post-scheme appraisal monitoring of the impact of the discharge from Hinkley Point C on the intertidal and subtidal benthic ecology. This monitoring will include an assessment of the response of *Macoma balthica*.

8) It summarises by saying that it largely supports the conclusions made in the application, that there is unlikely to be a significant impact due to normal operational discharges and, therefore, it agrees to the permit being granted.	

Response received from **Aneurin Bevan Local Health Board**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
The geographical area covered by Aneurin Bevan Health Board is so far away from the Hinkley Point site that it is highly unlikely that any planned construction or normal operational activity at the site would have a significant impact on our population.	No action required.

Response received from **Cardiff Council**	
Brief summary of issues raised:	Summary of action taken / how this has been covered:
The Council had no technical or policy comments to make on the consultation.	No action required.

Response received from **Parrett Internal Drainage Board**	
Brief summary of issues raised:	Summary of action taken / how this has been covered:
No issues with respect to the water discharge activity.	No action required.

2) Consultation Responses from community organisations and members of the public

The responses summarised and addressed below are only those relevant to the water discharge activity permitted by permit EPR/HP3228XT during operation of the power station. Other comments received were addressed under the consultation document for the relevant activities. In particular, we did not consider radioactivity in determining this permit application. Radioactive substance activities were subject to a separate environmental permit application, reference EPR/ZP3690SY/A001.

a) Responses from Assembly Member (AM), councillors and Parish/Town/Community Councils, local boatowners' association, and pressure/action groups

Response received from **Burnham-On-Sea and Highbridge Town Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
1) The Council stated that it would like assurances regarding the potential impact of the discharge of cooling water and liquid effluent into the Severn Estuary on marine life and vegetation in this widely recognised important natural habitat. 2) It raised concerns about any impact on local fishing.	We have carried out a comprehensive Habitats Regulations Assessment of the impact of the proposed discharge on the marine ecology, including fish, of Bridgwater Bay and the surrounding waters in response to our duty under The Conservation of Habitats and Species Regulations 2010, including consultation with Natural England and the Countryside Council for Wales. The details of this assessment are reported in Section 4.13.2 of this consultation document.
3) Concerns were also raised about the potential impact on bathing water quality, and the impact this would have on the tourism industry.	As reported in Section 4.13.1, we have considered the potential impacts on local designated bathing waters. We conclude that the proposed discharge will make an insignificant contribution to the bacterial levels in the receiving waters of the inner Bristol Channel and the Severn Estuary.

Response received from **Selworthy and Minehead Without Parish Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues with respect to the water discharge activity.	No action required.

Response Received from **Stogursey Parish Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues with respect to the water discharge activity.	No action required.

Response received from **Weston-super-Mare Town Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues raised.	No action required.

Response received from **Watchet Town Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Concern regarding what provision will be made for it to understand the full nature of the process.	The draft decision document will be made available and will explain the operations and detail our assessment of any potential impact.

Response received from **Llangan Community Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues raised.	No action required.

Response received from **Williton Parish Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
No issues with respect to the water discharge activity.	No action required.

Response received from **Berrow Parish Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
As Berrow is a tourist resort, used by many thousands of people each year, the Council is concerned about the possibility of effluent being washed up onto local beaches.	In determining this water discharge activity application, we have examined thoroughly the fate of effluents discharged from HPC. We have considered potential impacts with regard to our duties under the Bathing Waters Regulations and the Water Framework Directive (Protected Areas objectives), as detailed in Section 4.13.1. We are satisfied that the proposed discharges will not impact on local tourist beaches.

Response received from **Dinas Powys Community Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Concerns raised regarding the possible pollution of the Severn Estuary, the loss of marine life and a consequent change in the estuaries internationally important biodiversity status. Concern about combined harmful effects due to climate change and other industrial developments in the Bristol Channel.	As reported in Section 4.13.2, we have carried out a comprehensive Habitats Regulations Assessment (HRA) into the impact of the proposed discharge on the marine ecology of the Severn Estuary in response to our duty under The Conservation of Habitats and Species Regulations 2010, including consultation with Natural England and the Countryside Council for Wales. The HRA included considering the potential impacts of the proposed discharge in combination with other permissions, plans and projects (PPPs), which include other industrial developments. We have concluded that with the appropriate measures in place, that is removing hydrazine from the discharge, and providing AFD and FRR systems, the proposed discharge will not have an adverse effect on the integrity of the designated biodiversity sites of the Severn Estuary. We also recognise the importance of considering the potential effects of future climate change. We have included an improvement condition in our draft permit, requiring the operator to regularly review its hydrodynamic modelling and associated impact assessment in light of best available climate change projections, and to consider how these projections could influence the operation of the power station in the future.

Response received from **AM, Welsh Assembly Government**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Objection to the application for an environmental permit to discharge cooling water and liquid effluents to the Severn Estuary.	In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C. We are satisfied that there will not be a significant impact on the marine environment of the Severn Estuary.

Response received from **Burnham Boat Owners Sea Angling Association**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Concern that the operation of Hinkley Point C will have a severe negative effect on the marine ecology of Bridgwater Bay for decades to come.	We are satisfied that there will not be a significant negative impact. We have carried out a comprehensive Habitats Regulations Assessment into the impact of the proposed discharge on the marine ecology of Bridgwater Bay and the surrounding waters, in response to our duty under The Conservation of Habitats and Species Regulations 2010, including consultation with Natural England and the Countryside Council for Wales. The details of this assessment are reported in Section 4.13.2 of this consultation document. The draft permit includes a pre-operational condition, requiring NNB GenCo to agree a plan with us for future (post-scheme) monitoring within the Severn Estuary SAC/SPA/Ramsar.

Response received from **Parents concerned about Hinkley**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Concern regarding the impact on human health of the discharges of cooling water and liquid effluent. It is claimed that liquid discharges are not carried out into the Atlantic Ocean but settle on the extensive mud flats in and around Bridgwater Bay, where radiation is then re-suspended into the atmosphere by the incoming tides and ingested by humans.	The fate and behaviour of radioactivity in the environment and its potential impact upon human health, following release from Hinkley Point C, is considered within environmental permit application, reference EPR/ZP3690SY/A001. The subject of this water discharge activity permit application, reference EPR/HP3228XT/A001 is non-radioactive liquid discharges from Hinkley Point C.

Response received from **Blackwater Against New Nuclear Group (BANNG)**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
The GDA fails to take account of the issues of cooling water abstraction in estuarial locations and its likely impacts. It also fails to consider the possibility of cooling towers and their potential impacts in locations where there is insufficient water for straight through cooling. BANNG believes the designs considered in the GDA are inadequate in their application to estuarial locations and that the regulators should indicate that such locations should be removed from the list of potential sites.	BANNG's response is a copy of its comments on our preliminary generic design assessment conclusions on the abstraction of cooling water. The high level issues raised, for example the appropriateness of our GDA to estuarial locations, and issues regarding the use of cooling towers where direct cooling is not feasible, are not directly relevant to this permit determination. The proposed abstraction from HPC is from coastal waters. The common themes cited in its response regarding impacts from the thermal plume and the use of biocides, have been considered during our determination process, as reported in this decision document.

b) Responses from individual members of the public

Responses were received from individual members of the public. The responses summarised and addressed below are only those relevant to the water discharge activity permitted by permit EPR/HP3228XT during operation of the power station. Other comments received were addressed under the consultation document for the relevant activities. In particular, we did not consider radioactivity in determining this permit application. Radioactive substance activities were subject to a separate environmental permit application, reference EPR/ZP3690SY/A001.

Response received from a **resident of Bridgwater**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Objection to the discharge of "contaminated water" in the form of cooling water and liquid effluent into the Severn Estuary.	We are satisfied that there will not be a significant impact on the marine environment of the Severn Estuary. In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document.

Response received from a **resident of Bury St Edmunds**	
Brief summary of issues raised:	Summary of action taken/how this has been covered.
Issue regarding the ownership of NNB Generation Company Ltd. Concerned that attributing liability or levying penalties for misdemeanours could be difficult.	NNB Generation Company Ltd - the operator - is responsible for compliance with the permit. Like all limited companies, it is a legal entity in its own right and can be subject to enforcement action in the same way as any other company.

Response received from a **resident of Somerset**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
General concern regarding the discharge of waste, in particular radioactivity.	In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document. We are satisfied that there will not be a significant impact on the environment. The fate and behaviour of radioactivity in the environment and its potential impact on human health, following release from Hinkley Point C, is considered within environmental permit application, reference EPR/ZP3690SY/A001.

Response received from a **resident of Somerset**	
Brief summary of issues raised:	Summary of action taken/how this has been covered.
Concern raised with respect to the impact on the local water environment, including the ecosystem of the River Parrett in Somerset, which supports the migration of eels from the Sargasso Sea.	We are satisfied that there will not be a significant impact on the local water environment. In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document. This has included a comprehensive Habitats Regulations Assessment. We have also taken into consideration our duty under The Eels (England and Wales) Regulations 2009, as reported in Sections 4.13.3.

Response received from a **resident of Timberscombe**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Concern that the Environment Agency is not planning any live monitoring of emissions and relying on the operator's results.	MCERTS accredited monitoring is required under condition 3.3.3 of the permit along with reporting requirements. We will also be monitoring the discharge as part of our routine compliance work.

Response received from a **resident of Somerset**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Objection to the discharge of any materials from Hinkley Point C into the Severn Estuary on environmental and public health grounds. Concern that the consultation process associated with our environmental permitting process is merely a public relations exercise.	In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document. The only potential impacts from the discharges will be on the water environment and there will be no wider impact on health. The Primary Care Trust (PCT) was consulted and did not raise any issues. While the requirement to consult the public on environmental permit applications is a statutory requirement under the Environmental Permitting (England and Wales) Regulations 2010, we do consider it to be a valuable part of the determination process. We have described in Section 3 how we will meet our obligations with regards to consultation.

Response received from a **resident of Somerset**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
General opposition to nuclear power production and in particular to the pollution of the local waters of the Severn Estuary.	We are satisfied that there will not be a significant impact on the local waters of the Severn Estuary. In determining this water discharge activity, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document. This has included a comprehensive Habitats Regulations Assessment.

Response received from **residents of Somerset**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
Objection to any additional discharges of effluent, radioactive contaminated liquids, or similar from the Hinkley Point site. Objection to new nuclear build in general at Hinkley Point, with particular reference to potential for flooding and earthquakes due to the Hinkley Point fault.	In determining this water discharge activity application, we have thoroughly examined the discharge of non-radioactive liquid effluents from Hinkley Point C, as reported in this consultation document. We are satisfied that there will not be a significant impact on the environment. The discharge of liquid radioactive effluent from Hinkley Point C is considered within environmental permit application, reference EPR/ZP3690SY/A001. There is negligible tidal or fluvial flood risk associated with the site. The Office for Nuclear Regulation will assess higher probability natural disasters as part of the site safety case. Site location and flooding will also be considered as part of the planning process.

Annex 3 : Places where the draft decision documents could be viewed

Environment Agency
Rivers House
East Quay
Bridgwater
Somerset
TA6 4YS

Environment Agency Office
Rivers House
St. Mellons Business Park
Fortran Road
St. Mellons
Cardiff
CF3 0EY

West Somerset Council
West Somerset House
Killick Way
Williton
Somerset
TA4 4QA

West Somerset Council
Minehead Customer Centre
1-3 Summerland Road
Minehead
TA24 5BP

Sedgemoor District Council
Bridgwater House
King Square
Bridgwater
TA6 3AR

Burnham-on-Sea Library
Princess Street
Burnham-on-Sea
Somerset
TA8 1EH

Somerset County Council
Major Energy Projects
Environment Directorate
Somerset County Council
County Hall
Taunton
TA1 4DY

North Somerset Council
Corporate Services Unit
Somerset House
Oxford Street
Weston-super-Mare
BS23 1TG

Vale of Glamorgan Council
Pollution Control Team
Civic Offices
Holton Road
Barry
CF63 4RU

See our website for further contact information and opening hours:
http://www.environment-agency.gov.uk/hinkleypoint

Annex 4 - Consultation responses on our draft decision

1) Consultation responses from statutory and non-statutory bodies

Response received from **Natural England (NE)**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
NE commended the Environment Agency on our overall approach to Habitats Regulations Assessment (HRA) for the HPC related Environment Agency permissions, particularly with regard to the structure and detail of the assessment. Several issues and recommendations were expressed about the HRA although these were not directly relevant to this permit application. These comments were in relation to (1) potential impacts upon intertidal habitats due to vessel movements and the upgrade of Combwich Wharf (2) potential impacts upon bird populations caused by vessels using the temporary jetty and Combwich Wharf, and (3) dredging in the River Parrett.	Minor amendments have been made to the HRA as a result of NE comments. NE was re-consulted on these amendments. A letter from NE was received on 01/03/13 which stated their satisfaction with the final HRA.

Response received from the **Countryside Council for Wales (CCW)**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
CCW gave broad support for our draft decision document and draft permit, including our appropriate assessment (HRA), in particular, our approach to permitting as detailed in section 4.14.1 and our proposed range of pre-operational conditions and improvement conditions, as detailed in sections 4.17 and 4.18 respectively. CCW summarised by saying that "…provided any permit issued includes the relevant conditions identified in your appropriate assessment, and the permit is fully enforced we are of the view that adverse impacts on the Severn Estuary SPA, SAC, Ramsar site; River Usk SAC, River Wye SAC, and River Tywi Sac would be avoided…"	With the exception of minor amendments to correct spelling errors, no further action required. We confirm that the conditions relevant to the water discharge activity identified in our appropriate assessment have been included in our permit.

Response received from the **Sedgemoor District Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
The Council was generally supportive of our draft permit, noting several key requirements for ongoing control, as follows: (i) implementation and accreditation of an Environmental Management System; (ii) periodic reviews to take into account the potential impact of future climate change; (iii) justification for the operational biofouling control strategy; (iv) environmental monitoring plan for the Severn Estuary SAC, SPA and Ramsar; (v) plan for phasing out the discharge of Priority Hazardous Substances under the Water Framework Directive. The Council referred to our pre-operational requirement for NNB GenCo to develop an Emissions Management Plan (EMP). They sought reassurance that relevant control measures required by the Development Consent Order (DCO) would also inform and guide the controls contained within the EMP. With respect to Habitats Regulations Assessment, the Council sought (a) assurance that all potential effects had been fully taken into account during the DCO examination; and (b) confirmation of the intention behind our pre-operational requirement for NNB GenCo to develop an Environmental Monitoring Plan for the Severn Estuary SAC, SPA and Ramsar.	Our pre-operational measures require NNB GenCo to submit an EMP scoping document for approval by the Environment Agency. Through the approval process we shall ensure that NNB GenCo's EMP is appropriately informed by any relevant DCO control measures. We confirm that all potential effects with respect to the WDA permit application have been fully addressed within our HRA, as detailed in section 4.13.2. We have been involved as a consultee throughout the planning process to ensure that the permit in conjunction with the DCO will provide adequate protection for human health and the environment. The Severn Estuary (SAC, SPA & Ramsar) Environmental Monitoring Plan will provide the means for validating the original impact assessments, enabling any negative trends to be identified and mitigated, thus providing for ongoing quality assurance and improvement in performance where appropriate.

2) Consultation Responses from community organisations

The responses summarised and addressed below are only those relevant to the water discharge activity permitted by permit EPR/HP3228XT during operation of the power station. Other comments received were addressed under the consultation document for the relevant activities. In particular, we did not consider radioactivity in determining this permit application. Radioactive substance activities were subject to a separate environmental permit application, reference EPR/ZP3690SY/A001.

Responses from Parish/Town Councils and local boatowners' association

Response received from **Berrow Parish Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
The Council re-iterated the concerns expressed in their previous consultation response, as detailed in Annex 2, regarding the potential for effluent to be washed up on the resort's beaches.	In determining this water discharge activity application, we have examined thoroughly the fate of effluents discharged from HPC. We have considered potential impacts with regard to our duties under the Bathing Waters Regulations and the Water Framework Directive (Protected Areas objectives), as detailed in Section 4.13.1. We are satisfied that the proposed discharges will not impact on local tourist beaches.

Response received from **Penarth Town Council**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
The Council raised a number of issues, some of which (but not all) were relevant to our determination of the application. The Council stated that effluent discharged into the Bristol Channel would be recirculated due to the prevailing conditions, thereby increasing and concentrating pollution prior to it being dumped on local beaches. They questioned what analysis has been made of these factors. The Council also questioned how the cumulative effects of the discharge in	In determining this water discharge activity application, we have examined thoroughly the fate of effluents discharged from HPC. We have audited the modelling undertaken by NNB GenCo, which was undertaken over a calendar year using observed meteorological conditions, to assess the potential impact of the discharge and the extent of the area of impact. We have considered potential impacts with regard to our duties under the

combination with influences from Hinkley Point B have been addressed, stating that these effects are likely to be of a geometric rather than arithmetic nature.	Bathing Waters Regulations and the Water Framework Directive (Protected Areas objectives), as detailed in Section 4.13.1. There is no debris of any nature within the discharge that could be concentrated by prevailing environmental conditions and subsequently washed up on local beaches. The effluent discharged will dilute and disperse within the dynamic tidal conditions of the receiving waters.Temperature and TRO (total residual oxidant) are the prime constituents of the discharge and their impact will reduce through mixing, loss, and decay. We have considered the potential impact of these substances with reference to the NNB GenCo's modelling work. All other substances in the discharge will be discharged at concentrations less than their respective Environmental Quality Standard and will then be subject to significant dilution and dispersion within the receiving waters. We are therefore satisfied that the proposed discharges will not impact on localbeaches. We have considered the proposed discharge from HPC in combination with other permissions, plans or projects, which include the operation of Hinkley Point B power station. We have also taken account and assessed the modelling undertaken by NNB GenCo of the combined plumes from HPB and HPC. The outcome of this work is summarised within this decision document, in section 4.13.1 where we consider 'Mixing zones for excess temperature and TRO' and in section 4.13.2, where we consider 'Our 'appropriate assessment' for WDA.'

Response received from **Burnham Boat Owners Sea Angling Association**	
Brief summary of issues raised:	Summary of action taken/how this has been covered:
As recreational anglers the Association is concerned about the impact on fishing, stating that "all avenues should be explored to ensure that the effects on fish are minimised if not eradicated." In particular they are concerned about the effectiveness of the proposed AFD and FRR systems, with respect to the following areas: (i) the design (ii) the commissioning process (iii) adaptive measures to improve performance during operation; and (iv) monitoring and recording of data relating to fish mortality.	Our assessment of the proposals for the AFD and FRR systems is described in full within our Habitats Regulations Assessment (HRA) for related Environment Agency permissions and summarised in the main body of this document in section 4.13.2, and in section 4.13.3 where we discuss the Eels Regulations. Our view is that the AFD and FRR systems in conjunction with the low velocity intake design will provide suitable protection, although we recognise that no system is 100% effective and there will be some residual impact upon fish in the vicinity of the cooling water intakes. Overall we are satisfied that the predicted rates of fish impingement and entrainment at HPC will not adversely affect either the protected species, the estuarine assemblage (other fish species) or integrity of the designated site. We have explained in detail within our HRA document how we have reached the above conclusions, in section 2.6.1.4.3 entitled 'Abstraction impacts on migratory fish and fish assemblage'. Given the many different factors influencing impingement and entrainment within the Severn Estuary and the reliance on the proposed preventative measures, we recognise that there is still scope for potential improvements to the AFD and FRR systems to increase their effectiveness and in turn, protect more fish. We therefore consider it extremely important that the final designs of both systems are tested well in advance of the operation of HPC.

	This is why we have included a pre-operational measure in our permit which requires NNB GenCo to submit for approval a Commissioning Plan for the AFD and FRR systems. This plan shall describe how they intend to optimise the systems to minimise the impacts upon fish. The plan will include proposals for system monitoring and for demonstrating the effectiveness of the optimisation process to the Environment Agency. The conditions of our permit will ensure that (a) the AFD and FRR systems reflect Environment Agency best practice guidance, and (b) appropriate testing takes place to optimise performance of these systems prior to the operation of HPC. We are therefore satisfied that the AFD and FRR systems will be effective in minimising impacts upon fish and that consequently there will not be a significant impact on fisheries interests. In addition through our HRA document, we have advised the competent authorities (the Secretary of State through the Planning Inspectorate (NID) inquiry, and the Marine Management Organisation) to ensure that a comprehensive ecological monitoring and contingency plan is developed. This should be done before any water is abstracted (including water required for any trials). The plan will set out the measures necessary to ensure that during the operation of HPC, the AFD and FRR systems work to optimal levels thereby maintaining their effectiveness. This plan shall provide a mechanism for ensuring that any adaptive measures identified by monitoring, to improve performance, are appropriately considered and implemented. The plan shall also set out the monitoring methodology and the frequency and format for reporting of monitoring data, including that relating to fish mortality.

	In considering whether NNB GenCo's proposals would have an impact upon recreational angling we have thought about the rights of anglers to enjoy the amenity of the Severn Estuary. We have closely associated 'amenity' with the condition of the fishery itself as wider amenity issues are planning considerations. Our view is that amenity, in this context, has been inherently addressed by virtue of assessing the impact on the fish species present in the fishery. Therefore taking into account our findings of no adverse affect on fish (subject to the regulatory controls described in this decision document) we consider that amenity will not be affected by the activities covered by this permit.

Responses from individual members of the public

No responses received relevant to the Water Discharge Activity.

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