Annex A

Habitats Directive: Form for recording likely significant effect (Stage 2)

Environment Agency

For ~~information /~~ consultation

Environment Agency Record of Assessment of Likely Significant Effect On A European Site (Stage 2). The new application for an Environmental Permit detailed below is within the Stage 1 criteria of Severn Estuary / Môr Hafren SAC, SPA and RAMSAR, and in order to progress the application a Stage 2 assessment and consultation with Natural England and Countryside Council for Wales is required.

Part A
Permitting officer to complete this section in consultation with Conservation/Ecology section and Natural England/Countryside Council for Wales (CCW)

Type of permission/activity:	Environmental permit (Water Discharge Activity)
Environment Agency reference no:	EPR/HP3228XT/A001
National grid reference:	ST 19200 47500
Site description:	Hinkley Point C new nuclear power station, Nr. Bridgwater, Somerset
Brief description of proposal:	This proposal relates to discharges during operation of Hinkley Point C (HPC) power station, which will consist of two UK-EPR reactors of the pressurised water design. The operation of HPC requires the continuous abstraction of seawater from the Severn Estuary, to provide cooling, before being discharged back to source. The abstraction will be via two tunnels with the intake heads located approximately 3km offshore. The resultant discharge of cooling water will be made approximately 1.8km offshore, via a single outfall tunnel. The non-radioactive, aqueous discharges considered in this proposal are as follows: (i) cooling water (ii) process effluent from the nuclear island*, including steam generator blowdown, and from the turbine hall drains (iii) oily water from areas where oils are used, e.g. workshops, diesel generators, transformers (iv) effluent from the production of demineralised water and (v) domestic sewage from staff welfare facilities. * The area of the power station referred to as the 'nuclear island' contains the reinforced concrete containment building, within which the primary circuit and nuclear steam supply system is located - this is the central part of the pressurised water reactor (PWR). The reactor core is housed within the reactor pressure vessel, which is connected to one of two, three or four heat transfer loops, each with its own separate steam generator and coolant pump. The UK EPR has four heat transfer loops. The main component of the discharge will be cooling water. HPC will use a direct cooling system, whereby water is abstracted from the sea,* passed once through the condensers, and discharged back to source at an elevated temperature (12.5°C above ambient under normal operating conditions). The cooling water may be

Brief description of proposal (continued)	dosed with sodium hypochlorite to control biofouling and consequently could contain total residual oxidant (TRO) and chlorinated by-products (CBPs). The maximum discharge rate of cooling water for HPC will be 134m3/s, equivalent to a maximum daily volume of 11.6 million cubic metres. Process effluents (ii) to (v) will all be diluted within the main cooling water flow prior to discharge. Their combined volume is relatively small and represents <0.1% of the total cooling water flow. Potential contaminants include substances used to control reactivity, e.g. boric acid, and to condition the various circuits by optimising pH and minimising corrosion, e.g. lithium hydroxide, ammonia, and hydrazine. Corrosion products, i.e. metals, although minimised by appropriate circuit conditioning will nonetheless be present in the discharge. A range of treatment techniques will be employed within the plant to reduce the concentration of potentially harmful substances. These techniques include filtration, demineralisation using ion exchange, degassing, evaporation and oil / water separation. The type of treatment is specific to both the origin and nature of the effluent and the required treatment objectives. Although some substances proposed for discharge under this permit application arise within the primary reactor circuit, on the 'nuclear island', radioactivity itself will be dealt with under a separate Radioactive Substances Activity permit application under EPR 2010. Discharges via the main outfall arising during commissioning (hot functional testing) and during power changes, shutdowns, outages, etc, are also considered within the application. Outages, for example, to facilitate refuelling tend to occur every 18-22 months.
European site name(s) and status:	**Severn Estuary/ Môr Hafren SAC** **Severn Estuary/ Môr Hafren SPA (or proposed SPA)** **Severn Estuary/ Môr Hafren Ramsar** **River Usk/ Afon Wysg SAC*** **River Wye/ Afon Gwy SAC*** **River Towy/ Afon Tywi SAC*** * The River Usk/ Afon Wysg SAC, River Wye/ Afon Gwy SAC and River Towy/ Afon Tywi SAC are intrinsically linked to the Severn Estuary/ Môr Hafren SAC in relation to migratory fish. It has been agreed[1] by both Natural England (NE) and the Countryside Council for Wales (CCW) that potential effects to the Rivers Usk, Wye and Towy SACs will not be directly considered as part of the assessment, but will be considered if effects arise in relation to the Severn Estuary/ Môr Hafren migratory fish feature, specifically in relation to Atlantic salmon, shad and sea lamprey.

[1] Meeting of 24 October 2011 between EA / NE/ CCW

List of interest features (relevant to this type of permission):	**Severn Estuary/ Môr Hafren Ramsar** 1.12 Estuarine & intertidal habitats (Atlantic salt meadows, estuaries, rocky shore, mudflats and sandflats not covered by seawater at low tide. 1.13 Submerged marine habitats (Sandbanks that are slightly covered by sea water all the time. 2.5 Migratory fish (river lamprey, sea lamprey, twaite shad, allis shad, eel, Atlantic salmon and sea trout). 3.6 Birds of lowland freshwaters and their margins (Gadwall (3.6), Lesser black-backed gull (3.6), Pintail (3.6), Ringed plover (3.6), Teal (3.6), Waterfowl(>20, 000) (3.6), White-fronted goose (3.6) 3.8 Birds of coastal habitats (Bewick's Swan (3.8), Waterfowl(>20, 000) (3.8) 3.9 Birds of estuarine habitats (Dunlin (3.9), Lesser black-backed gull (3.6), Redshank (3.9), Shelduck (3.9), Waterfowl(>20, 000) (3.9)) **Severn Estuary/ Môr Hafren SPA** 3.6 Birds of lowland freshwaters and their margins (Bewick's swan (3.6), Gadwall (3.6), Pochard (3.6), Shelduck (3.6), Teal (3.6), Tufted duck (3.6), Wigeon (3.6) 3.8 Birds of coastal habitats (Bewick's Swan (3.8), Curlew (3.8), Dunlin (3.8), Grey plover (3.8), Pintail (3.8), Pochard (3.8), Redshank (3.8), Ringed plover (3.8), Shelduck (3.8), Teal (3.8), Waterfowl(>20, 000) (3.8), White-fronted goose (3.8), Wigeon (3.8) 3.9 Birds of estuarine habitats (Curlew (3.9), Dunlin (3.9), Grey plover (3.9), Pintail (3.9), Pochard (3.9), Redshank (3.9), Ringed plover (3.9), Shelduck (3.9), Teal (3.9), Waterfowl(>20, 000) (3.9), Whimbrel (3.9), White-fronted goose (3.9), Wigeon (3.9)) **Severn Estuary/ Môr Hafren SAC** 1.12 Estuarine & inter-tidal habitats (Atlantic salt meadows, estuaries, rocky shore, mudflats and sandflats not covered by seawater at low tide). 1.13 Submerged marine habitats (reefs, sandbanks that are slightly covered by sea water all the time. 2.5 Migratory fish (river lamprey, sea lamprey, twaite shad)
Is this application necessary to manage the site for nature conservation?	No

What potential hazards are likely to affect the interest features (relevant to this type of permission?)

The permit application contains design and operational information and an impact assessment relating to the abstraction of sea water for direct cooling. We consider the seawater abstraction to be an inherent part of the cooling water system and therefore we have included potential hazards associated with the abstraction in the assessment below.

Sensitive interest feature:	Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary Ramsar		
1.12 Estuarine & inter-tidal habitats (Atlantic salt meadows, estuaries, mudflats, rocky shore and sandflats not covered by seawater at low tide)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
	Physical damage	**Potential exposure** due to entrainment of planktonic organisms through the cooling water system
	Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
	Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
	Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
	Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.
1.13 Submerged marine habitats (Sandbanks that are slightly covered by sea water all the time.)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
	Physical damage	**Potential exposure** due to volume and rate of water discharge
	Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
	Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
	Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
	Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:	Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary Ramsar		
2.5 Migratory fish (River lamprey, Sea lamprey, Twaite shad, Allis shad, Eel, Atlantic salmon, Sea trout and assemblage of fish)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
	Physical damage (Entrainment and impingement)	**Potential exposure** due to abstraction of water for direct cooling
	Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
	Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
	Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
	Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
	pH	**No potential exposure** as the discharge will be pH neutral
	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:		Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary Ramsar			
3.6 Birds of lowland habitats, 3.8 Birds of coastal habitats and 3.9 Birds of estuarine habitats	Internationally important populations of wintering waterfowl (199 Ramsar Criterion 3c) Bewick's swan, European white-fronted goose, Dunlin, Redshank, Shelduck, Gadwall	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
		Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
		Physical damage	**No potential exposure** as the discharge will be made via a diffuser system located 1.8km offshore
		Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
		Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
		Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
		Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
		pH	**No potential exposure** as the discharge will be pH neutral
		Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:		Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary Ramsar			
	Internationally important assemblage of waterfowl (1995 Ramsar Criterion 2c, 3a and 3c) Regularly supporting in winter over 20,000 waterfowl The above species plus Ringed plover, Whimbrel, Teal, Pintail, Wigeon, Pochard, Tufted duck, Grey plover, Curlew, Spotted redshank	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
		Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
		Physical damage	**No potential exposure** as the discharge will be made via a diffuser system located 1.8km offshore
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		Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
		pH	**No potential exposure** as the discharge will be pH neutral
		Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:		Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary SPA			
3.6 Birds of lowland habitats, 3.8 Birds of coastal habitats and 3.9 Birds of estuarine habitats	4.1 Internationally important populations of regularly occurring Annex 1 species (under Article 4.1 of the EU Birds Directive) Bewick's Swan	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
		Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
		Physical damage	**No potential exposure** as the discharge will be made via a diffuser system located 1.8km offshore
		Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
		Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
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		Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
		pH	**No potential exposure** as the discharge will be pH neutral
		Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:		Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary SPA			
	4.2 Internationally important populations of regularly occurring migratory species European white-fronted goose, Dunlin, Redshank, Shelduck, Gadwall, Ringed Plover* Curlew* Pintail* Internationally important assemblage of waterfowl (>20,000) (under Article 4.2 of EU Birds Directive). The above species plus Wigeon, Lapwing*, Teal, Mallard*, Shoveler*, Pochard, Tufted Duck, Grey Plover, Whimbrel, spotted redshank*, (*recommended additions under the SPA review)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
		Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
		Physical damage	**No potential exposure** as the discharge will be made via a diffuser system located 1.8km offshore
		Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
		Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
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		pH	**No potential exposure** as the discharge will be pH neutral
		Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works

Sensitive interest feature:	Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary/ Môr Hafren SAC		
1.12 Estuarine & inter-tidal habitats (Atlantic salt meadows, estuaries, mudflats, rocky shore and sandflats not covered by seawater at low tide)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
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	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:	Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary/ Môr Hafren SAC		
1.13 Submerged marine habitats (reefs, sandbanks that are slightly covered by sea water all the time.)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
	Physical damage	**Potential exposure** due to volume and rate of water discharge
	Salinity	**No potential exposure** as no changes to salinity of water discharges compared with ambient.
	Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
	Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
	Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Sensitive interest feature:	Potential hazard:	Potential exposure to hazard and mechanism of effect/impact if known:
Severn Estuary/ Môr Hafren SAC		
2.5 Migratory fish (River lamprey, Sea lamprey, Twaite shad)	Changes in thermal regime	**Potential exposure** due to discharge of cooling water at up to +12^{o}C above ambient
	Nutrient enrichment	**Potential exposure** due to releases of nitrates and phosphates from 'nuclear island processes and from the on-site sewage treatment works
	Physical damage (Entrainment and impingement)	**Potential exposure** due to abstraction of water for direct cooling
	Salinity	**No potential exposure** as no change to salinity of water discharges compared with ambient.
	Siltation	**No potential exposure** as no net change to sediment concentrations in discharge compared with ambient.
	Toxic contamination	**Potential exposure** due to presence of biocide and other contaminants, e.g. hydrazine, metals, within discharged water
	Turbidity	**No potential exposure** no net change to turbidity of discharge compared with ambient.
	pH	**No potential exposure** as the discharge will be pH neutral
	Organic loading	**Potential exposure** due to releases from 'nuclear island' processes and the on-site sewage treatment works.

Is the potential scale or magnitude of any effect likely to be significant?		
Alone?	Yes – particularly with respect to impacts resulting from (a) the thermal and chemical changes in the receiving water due to proposed discharges and (b) the impacts on fish assemblage due to the abstraction of water for direct cooling.	
In combination with other Environment Agency permissions, plans or projects?	Yes – as above	
In combination with permissions, plans or projects with competent authorities? **! Important** Use 202_04 Habitats Directive: Standard letter for consulting about new PPP for consulting about new PPP.	Yes – as above As a result of this risk assessment, the Environment Agency can conclude that this permit application could act either alone or in combination with permissions and/or plans/projects of other competent authorities to produce a Likely Significant Effect on the Severn Estuary Ramsar, SAC and SPA. Consultation is being undertaken and an appropriate assessment will be made in Stage 3.	
Conclusion: **Is there likely to be a significant effect 'alone and/or in combination' on a European site?**	As a result of this risk assessment, the Environment Agency can conclude that this permit application could act either alone or in combination with permissions and/or plans/projects of other competent authorities to produce a Likely Significant Effect on the Severn Estuary Ramsar, SAC and SPA. Consultation is being undertaken and an appropriate assessment will be made in Stage 3.	
EA Officer:	[redacted] Senior Permitting Officer Nuclear New Build	Date: 23 January 2012
Natural England/CCW comment on assessment:	Based on the information provided within the assessment, Natural England agrees with the EA's conclusion that there is likely to be a significant effect from the proposal either alone or in combination with permissions and/or plans/projects of other competent authorities. An appropriate assessment is necessary.	
Natural England/CCW Officer:	[redacted] Senior Land Use Adviser	Date: 20th February 2012
If there is a likely significant effect, an appropriate assessment will be required (see part B for suggested scope).		

Part B Suggested scope of the EA appropriate assessment:		
Add details to following framework • Other competent authorities involved • Characterise the site in relation to the qualifying features and their conservation objectives; - existing information - additional surveys - management/unauthorised impacts • Detailed description of plan/project • Assess each likely impact on the interest features; - compare with historical data - predict impacts - compare with impact from management/unauthorised activities • Determine the extent to which each possible impact can be avoided.		
Natural England comment on scope of EA appropriate assessment: Natural England is currently involved in detailed discussions with the EA with regards to the scope of its appropriate assessment.		
Natural England Officer:	Glen Gillespie Senior Land Use Adviser	Date: 20th February 2012

Annex B

Annex B Predicted impacts of abstraction for HPB and HPC on migratory fish.

Species	HPC estimated annual impact with EAV, AFD/low velocity intake and FRR		HPB estimated annual impact numbers (EAV)	HPB plus HPC annual impact		Change over HPB (HPB plus HPC at 100%)	Change over HPB (HPC alone)	Comparable data on population estimates in the Severn Estuary / Bristol Channel (Spawning Stock Biomass (SSB) & local fishery (lf))		Percentage of population estimate HPB plus HPC		
	No. of fish	(t)	No. of fish	No. of fish	(t)	(%)	(%)	Local fishery (t)	SSB (t) or fish numbers	% tage of Local fishery (%)(t)	%tage of SSB (%)(t)	%tage of Populat i-on (%)
Sprat	405,702	3.16	936,386	1,342,088	7.3	43.3	-57.0	0.19	N/A	**2632**	**N/A**	
Whiting	64,818	11.50	79,253	144,071	14	81.8	-18.0	33.5	1,724	**41.8**	**0.8**	
Dover sole	5,448	1.24	8,559	14,007	1.95	63.7	-36.0	263	3,240	**0.74**	**0.06**	
Cod	527	2.30	638	1,165	5.1	82.6	-17.0	25.2	975	**20.2**	**0.52**	
Herring	2,240	0.28	12,570	14,810	1.57	17.8	-82.0	119.4		**1.3**	**N/A**	
Plaice	83	0.04	129	212	0.06	64.3	-36.0	84	952	**0.07**	**0.01**	
Blue whiting	36	0.01	46	82	0.01	78.3	-22.0	37,900	5,360,000	**0.00**	**0.00**	
Eel	261	0.08	351	612	0.1	74.4	-26.0	26	133.4	**0.39**	**0.08**	
Twaite shad	273	Not available	646	919		42.3	-58.0		100,000			**0.92**
Allis shad	8	Not available	22	30		36.4	-63.0		100,000			**0.03**
Sea lamprey	41	Not available	42	83		97.6	-3.0		15,269			**0.54**
River lamprey	16	Not available	18	34		88.9	-9.0		116,109			**0.03**
Salmon	0	Not available	0	0		0.0	0.0		0			**0.00**
Sea trout	0	Not available	0	0		0.0	0.0		0			**0.00**

Annex C

Table A1

Waste Stream A (Post Schedule 5) Return of Abstracted Cooling Water

Flow m3/s	**Max Daily Flow (m3/s)**	**Average Daily Flow (m3/s)**	**Min Daily Flow (m3/s)**	**Min Flow used for dilution of other waste streams (taken to be as if one EPR running) (m3/s)**		**Max Volume (m3/day)**	**Maximum Annual Volume (m3/year)**
	134	125	116	60.4		11,700,000	4,270,500,000
Contaminants	**∆T deg C based on Max Flow**	**∆T deg C based on Mean Flow**	**∆T deg C based on Min Flow**				
Temperature Differential (∆T deg C)	10.7	11.6	12.5				
	Annual Load kg/yr	**Max Conc in Effluent µg/l**					
TRO (from chlorination if used)		200					

Table A2

Combined Streams B and C (Post Schedule 5) **Effluent from Primary Circuit and blowdown from the Secondary Circuit**

Flow m3/s	Average Daily Flow (m3/s)	Max Volume (m3//day)
	0.035	1500

Note: Max Volume is based on the discharge from 2 tanks, each of 750 m3

Note: Average Daily Flow is based on one tank of 750 m3/s being discharged over 6 hours

Contaminants	Annual Load (kg/yr)	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)	Max Daily Load (kg/day)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)
Boric Acid	14000.00	25570.78	3.83	7.65	5625.00	3750000.00	1077.88	2155.77
Boron	2448.00	4471.23	0.67	1.34	984.00	656000.00	188.56	377.12
Lithium hydroxide	8.73	15.95	0.00	0.00	4.40	2933.33	0.84	1.69
Hydrazine	3.00	5.48	0.00	0.00	1.00	666.67	0.19	0.38
Morpholine	210.00	383.56	0.06	0.11	75.00	50000.00	14.37	28.74
Ethanolamine	65.00	118.72	0.02	0.04	15.00	10000.00	2.87	5.75
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	10.00	18.26	0.00	0.01	8.00	5333.33	1.53	3.07
Total Ammonia as N (assuming all nitrogen as N is ammonia)	10.00	18.26	0.00	0.01	8.00	5333.33	1.53	3.07
Nitrogen as N (total) based on total of N in all compounds containing N	61.34	112.03	0.02	0.03	24.39	16257.73	4.67	9.35
Phosphates (as P)	196.48	358.86	0.05	0.11	48.92	32610.00	9.37	18.75
Detergents	3200.00	5844.75	0.87	1.75	270.00	180000.00	51.74	103.48
Suspended Solids	134.96	246.50	0.04	0.07	20.24	13493.33	3.88	7.76
COD	600.95	1097.63	0.16	0.33	39.27	26180.00	7.53	15.05
Aluminium	0.41	0.75	0.00	0.00	0.09	60.00	0.02	0.03
Copper	0.03	0.05	0.00	0.00	0.01	6.67	0.00	0.00
Chromium	0.65	1.19	0.00	0.00	0.14	93.33	0.03	0.05
Iron	2.70	4.93	0.00	0.00	0.60	400.00	0.11	0.23
Manganese	0.26	0.47	0.00	0.00	0.06	40.00	0.01	0.02
Nickel	0.03	0.05	0.00	0.00	0.01	6.67	0.00	0.00
Lead	0.02	0.04	0.00	0.00	0.01	6.67	0.00	0.00
Zinc	0.46	0.84	0.00	0.00	0.10	66.67	0.02	0.04

Table A3

Waste Stream D (Post Schedule 5) **Effluent from the Turbine Hall and uncontrolled floor drains (but not blowdown from the secondary circuit)**

Flow m3/s	**Average Daily Flow (m3/s)**	**Max Volume (m3//day)**
	0.035	1500

Note: Max Volume is based on the discharge fron 2 tanks, each of 750 m3

Note: Average Daily Flow is based on one tank of 750 m3/s being discharged over 6 hours

Contaminants	**Annual Load (kg/yr)**	**Average Conc in Effluent (µg/l)**	**Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge continuous over 24 hrs (µg/l)**	**Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)**	**Max Daily Load (kg/day)**	**Max Conc in Effluent (µg/l)**	**Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)**	**Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)**
Boric Acid	0.00				0.00			
Boron	0.00				0.00			
Lithium hydroxide	0.00				0.00			
Hydrazine	24.30	88.77	0.01	0.01	3.00	2000.00	0.57	1.15
Morpholine	1464.00	5347.95	0.40	0.80	17.25	11500.00	3.31	6.61
Ethanolamine	854.00	3119.63	0.23	0.47	9.75	6500.00	1.87	3.74
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	10120.00	36968.04	2.77	5.53	320.00	213333.33	61.32	122.64
Total Ammonia as N	10120.00	36968.04	2.77	5.53	55.46	36973.33	10.63	21.25
Nitrogen as N (total) based on total of N in all compounds containing N	10572.90	38622.47	2.89	5.78	327.64	218426.28	62.78	125.57
Phosphates (as P)	66.00	241.10	0.02	0.04	66.00	44000.00	12.65	25.29
Detergents	0.00				0.00			
Suspended Solids	2665.00	9735.16	0.73	1.46	399.80	266533.33	76.61	153.22
COD	4449.00	16252.05	1.22	2.43	290.70	193800.00	55.71	111.41
Aluminium	4.85	17.72	0.00	0.00	1.01	673.33	0.19	0.39
Copper	0.39	1.42	0.00	0.00	0.07	49.33	0.01	0.03
Chromium	7.72	28.20	0.00	0.00	1.56	1040.00	0.30	0.60
Iron	32.27	117.88	0.01	0.02	6.55	4366.67	1.26	2.51
Manganese	3.07	11.21	0.00	0.00	0.61	406.67	0.12	0.23
Nickel	0.41	1.50	0.00	0.00	0.08	55.33	0.02	0.03
Lead	0.28	1.02	0.00	0.00	0.06	36.67	0.01	0.02
Zinc	5.54	20.24	0.00	0.00	1.10	733.33	0.21	0.42

Table A4

Combined Waste Streams B & C & D **Effluent from Primary Circuit and blowdown from the Secondary Circuit and the Turbine Hall**

Flow m3/s	Average Daily Flow (m3/s)	Max Volume (m3//day)
	0.035	1500

Note: Max Volume is based on the discharge fron 2 tanks, each of 750 m3

Note: Average Daily Flow is based on one tank of 750 m3/s being discharged over 6 hours

Contaminants	Annual Load (kg/yr)	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)	Max Daily Load (kg/day)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)
Boric Acid	14000.00	51141.55	3.83	7.65	5625.00	3750000.00	1077.88	2155.77
Boron	2448.00	8942.47	0.67	1.34	984.00	656000.00	188.56	377.12
Lithium hydroxide	8.73	31.89	0.00	0.00	4.40	2933.33	0.84	1.69
Hydrazine	27.30	99.73	0.01	0.01	4.00	2666.67	0.77	1.53
Morpholine	1674.00	6115.07	0.46	0.92	92.25	61500.00	17.68	35.35
Ethanolamine	919.00	3357.08	0.25	0.50	24.75	16500.00	4.74	9.49
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	10130.00	37004.57	2.77	5.54	328.00	218666.67	62.85	125.71
Total Ammonia as N	10130.00	37004.57	2.77	5.54	63.46	42306.67	12.16	24.32
Nitrogen as N (total) based on total of N in all compounds containing N	10634.24	38846.54	2.91	5.81	352.03	234684.02	67.46	134.91
Phosphates (as P)	262.48	958.83	0.07	0.14	114.92	76610.00	22.02	44.04
Detergents	3200.00	11689.50	0.87	1.75	270.00	180000.00	51.74	103.48
Suspended Solids	2799.96	10228.16	0.77	1.53	420.04	280026.67	80.49	160.98
COD	5049.95	18447.31	1.38	2.76	329.97	219980.00	63.23	126.46
Aluminium	5.26	19.21	0.001	0.003	1.10	733.33	0.211	0.422
Copper	0.42	1.53	0.000	0.000	0.08	56.00	0.016	0.032
Chromium	8.37	30.58	0.002	0.005	1.70	1133.33	0.326	0.652
Iron	34.97	127.74	0.010	0.019	7.15	4766.67	1.370	2.740
Manganese	3.33	12.16	0.001	0.002	0.67	446.67	0.128	0.257
Nickel	0.44	1.61	0.000	0.000	0.09	62.00	0.018	0.036
Lead	0.30	1.10	0.000	0.000	0.07	46.67	0.013	0.027
Zinc	6.00	21.92	0.002	0.003	1.20	800.00	0.230	0.460
Cadmium	0.37	1.35	0.0001	0.0002	0.005	3.33	0.0010	0.0019
Mercury	0.099	0.36	0.0000	0.0001	0.0011	0.73	0.0002	0.0004

Table A5

Waste Stream E Effluent from areas potentially containing oils and hydrocarbons

Flow m3/s	Max Daily Flow (m3/s)	Max Volume (m3//day)
	0.0028	240

Note: Max Daily Flow is based on max volume being discharged over 24 hours

Contaminants	Annual Load kg/yr	Average Conc in Effluent µg/l		Max Daily Load kg/day	Max Conc in Effluent µg/l	Max Conc in Effluent following dilution of max conc in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)
Oils					5000	0.083

Table A6

Waste Stream F **Effluent from the production of demineralised water**

Flow m3/s	Max Daily Flow (m3/s)	Max Volume (m3//day)
	0.046	4000

Note: Max Daily Flow is based on max volume being discharged over 24 hours

Contaminants	Annual Load (kg/yr)	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Max Daily Load (kg/day)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)
Detergents	624.00	854.79	0.17	nd	nd	
Sulphates	98400.00	134794.52	26.90	2000.00	500000.00	383.25
Sodium	52400.00	71780.82	14.32	855.00	213750.00	163.84
Amino tri-methylene phosphonic acid (ATMP)	9100.00	12465.75	2.49	45.00	11250.00	8.62
Hydroxy Ethylidene Diphosphonic Acid (HEDP)	890.00	1219.18	0.24	4.50	1125.00	0.86
Acetic Acid	14.00	19.18	0.00	0.10	25.00	0.02
Phosphoric Acid	12.00	16.44	0.00	0.10	25.00	0.02
Sodium Polyacrylate	8030.00	11000.00	2.20	40.00	10000.00	7.66
Acrylic acid	165.00	226.03	0.05	1.00	250.00	0.19
Iron	46000.00	63013.70	12.57	250.00	62500.00	47.91
Suspended solids	88000.00	120547.95	24.06	450.00	112500.00	86.23
Chloride	87100.00	119315.07	23.81	450.00	112500.00	86.23
Total P (as P) As a sum of all inputs, based on the proportion of P in the P-containing compounds	3559.84	4876.49	0.97	17.65	4411.49	3.38

Table A7

Waste Stream G **Effluent from Site STW**

Flow m3/s	Max Daily Flow (m3/s)	Max Volume (m3//day)
	0.002	175

Note: Max Daily Flow is based on max volume being discharged over 24 hours

Contaminants	Annual Load (kg/yr)	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution in CW flow of 116 m3/s (µg/l)	Max Daily Load (kg/day)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution in CW flow of 60.4 m3/s (µg/l)
Total Ammonia (as N)	1278.00	20007.83	0.35	3.50	20000.00	0.67
Suspended Solids	1916.00	29996.09	0.52	5.30	30267.03	1.01
BOD	1278.00	20007.83	0.35	3.50	20000.00	0.67
Nitrogen (as N) from permit application	1278.00	20007.83	0.35	4.00	22833.75	0.77
Assumed Total Inorganic Nitrogen (as N) based on a concentration in the discharge of 30 mg/l	1916.25	30000.00	0.52	5.25	30000.00	1.01
Phosphate (as P) based on per capita daily load of 0.6522 g	416.60	6522.11	0.11	1.14	6522.11	0.22

Table B1 Target Values for Potential Contaminants

Discharge	Potential contaminants					Other Targets					
		EQS	EQS	PNEC	PNEC	WFD Good standard			Habitats Directive WQ TAG Guidelines		Operational Target
		AA µg/l	MAC µg/l	Chronic µg/l	Acute µg/l	AA µg/l	95%ile µg/l	5%ile mg/l	If different to other standards/targets		MAC µg/l
Waste Stream A	Excess Temperature					3 ºC uplift over background	23 ºC as 98%ile		2 ºC uplift over background	21.5 ºC as 98%ile for SAC, 28 ºC as 98%ile for SPA	
	Total Residual Oxidant						10				
	Chlorination by-products										
	Chloroform	2.5 T	N/A								
	Bromoform			9.6 T	70 T						
	Dibromoacetonitrile										
Waste Streams B, C, & D	Boron	7000 T		180	4000						
	Lithium										
	Phosphate										
	Detergents										
	COD							5.0 - (0.028*salinity) as DO conc	6.0 - (0.028*salinity) as DO conc		
	Hydrazine			0.0004	0.004						
	Morpholine			17	28						
	Ethanolamine			16	16						
	Copper					5 D					
	Chromium	15 D				0.6 D	32 D				
	Nickel	20 D	N/A								
	Iron					1000 D					
	Manganese										
	Aluminium								1000 T		1000 T
	Lead	7.2 D	N/A								
	Zinc					40 D					
	Ammonia					21 UIA			1100 Total as AA	8000 Total as MAC	
	Nitrate					Varies with turbidity for both coastal and transitional waters - see Annex 1 below					
	Phosphate										
	Acetates										
	Formates										
	Glycolates										
	Oxalates										
	Suspended Sediments										

Target Values for Potential Contaminants cont

Discharge	Potential contaminants					Other Targets					
		EQS	EQS	PNEC	PNEC	WFD Good standard			Habitats Directive WQ TAG Guidelines		Operational Target
		AA µg/l	MAC µg/l	Chronic µg/l	Acute µg/l	AA µg/l	95%ile µg/l	5%ile mg/l	If different to other standards/targets		MAC µg/l
Waste Stream E	Oils/hydrocarbons										
Waste Stream F	Cadmium	0.2 D	0.9 D								
	Mercury	0.05 D	0.07 D								
	Detergents										
	Sulphate	N/A	N/A								
	Sodium	N/A	N/A								
	Amino tri-methylene phosphonic acid (ATMP)										
	Hydroxy Ethylidene Diphosphonic Acid (HEDP)										
	Acetic Acid										
	Phosphoric Acid										
	Sodium Polyacrylate										
	Acrylic acid										
	Iron					1000 D					
	Suspended Solids										
	Chloride	N/A	N/A								
	Phosphate										
Waste Stream G	BOD							5.0 - (0.028*salinity) as DO conc	6.0 - (0.028*salinity) as DO conc		
	SS										
	Ammonia					21 UIA					
	Nitrate					Varies with turbidity for both coastal and transitional waters - see Annex1 below					
	Phosphate										

Annex `1

Dissolved Inorganic Nitrogen Concentrations (in µg/l) at a mean salinity of 32 for coastal waters and 25 for transitional waters for the period 1st Nov to 28th Feb.	Coastal waters	Mean	99%ile	Transitional waters	Mean	99%ile
	Clear	252		Clear	420	
	Intermediate turbidity		980	Intermediate turbidity		980
	Medium turbidity		2520	Medium turbidity		2520
	Very turbid		3780	Very turbid		3780

Note Turbidity types are related to the annual mean concentrations of suspended particulate matter in mg/l

Very turbid	> 300
Medium turbidity	100 to 300
Intermediate turbidity	10 to <100
Clear	< 10

Table C1

Waste Stream A (Post Schedule 5) Return of Abstracted Cooling Water

Contaminants	ΔT deg C based on Max Flow	ΔT deg C based on Mean Flow	ΔT deg C based on Min Flow		SAC Deviation from ambient	SAC Maximum temperature	SPA Deviation from ambient	SPA Maximum temperature	Habitats Directive WQ TAG Guidelines: Mean Background Concentrations in µg/l or Values	Habitats Directive WQ TAG Guidelines: Max Background Concentrations in µg/l or Values
Temperature Differential (ΔT deg C) over ambient temperature	10.7	11.6	12.5		2°C as a Maximum Allowable Concentration (MAC) at the edge of the mixing zone	21.5°C as a 98 percentile at the edge of the mixing zone	2°C as a MAC at the edge of the mixing zone	28°C as a 98 percentile at the edge of the mixing zone	12.6 deg C as mean of annual means (whole years data only)	20.4 deg C as 98%ile of monthly means from CEFAS Data (whole years only)
	Annual Load kg/yr	**Max Conc in Effluent µg/l**			**EQS or Target (µg/l)**					
TRO (from chlorination if used)		200			10 T as a 95%ile				No Data	No Data
Chlorination by-products										
Chloroform					2.5 T as AA				< 1	< 1
Bromoform					9.6 T as Chronic PNEC				< 1	< 1
Dibromoacetonitrile					??				< 1	< 1

Notes:
D is Dissolved
T is Total
AA is Annual Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration

Table C2

Combined Streams B and C (Post Schedule 5) **Effluent from Primary Circuit and blowdown from the Secondary Circuit**

Contaminants	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)	EQS or Target (µg/l)		Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Boric Acid	25570.78	7.65	3750000.00	2155.77				
Boron	4471.23	1.34	656000.00	377.12	7000 T		4059	7173
Lithium hydroxide	15.95	0.00	2933.33	1.69			114 D	184 D
Hydrazine	5.48	0.00	666.67	0.38	0.0004 as chronic PNEC	0.004 as acute PNEC	< 100	< 100
Morpholine	383.56	0.11	50000.00	28.74	17 as chronic PNEC	28 as acute PNEC	< 10	< 10
Ethanolamine	118.72	0.04	10000.00	5.75	16 as chronic PNEC	16 as acute PNEC	< 10	< 10
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	18.26	0.01	5333.33	3.07			849	1556
Total Ammonia as N (assuming all nitrogen as N is ammonia)	18.26	0.01	5333.33	3.07	1100 T as AA	8000 T as MAC	160 T[a]	580 T[a]
Nitrogen as N (total) based on total of N in all compounds containing N	112.03	0.03	16257.73	9.35			849	1556
Phosphates (as P)	358.75	0.11	32610.00	18.75			30	140
Detergents	5844.75	1.75	180000.00	103.48			< 100	< 100
Suspended Solids	246.50	0.07	13493.33	7.76			264000	1795000
COD	1097.63	0.33	26180.00	15.05			14100	169000
Aluminium	0.75	0.00	60.00	0.03	1000 T as MAC		22.8 D	240 D
Copper	0.05	0.00	6.67	0.00	5 D as AA		3.95 D	14.1 D
Chromium	1.19	0.00	93.33	0.05	15 D as AA		0.02 D	1.20 D
Iron	4.93	0.00	400.00	0.23	1000 D as AA		13.5 D	80.0 D
Manganese	0.47	0.00	40.00	0.02			3.51 D	19.3 D
Nickel	0.05	0.00	6.67	0.00	20 D as AA		0.19 D	3.94 D
Lead	0.04	0.00	6.67	0.00	7.2 D as AA		0.02 D	1.46 D
Zinc	0.84	0.00	66.67	0.04	40 D as AA		39.3 T	54.0 T

Notes:
D is Dissolved
T is Total
AA is Annual Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration
T[a] is Total Ammonia as NH3

Table C3

Waste Stream D (Post Schedule 5) **Effluent from the Turbine Hall and uncontrolled floor drains (but not blowdown from the secondary circuit)**

Contaminants	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)	EQS or Target (µg/l)		Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Boric Acid								
Boron					7000 T		4059	7173
Lithium hydroxide							114 D	184 D
Hydrazine	88.77	0.01	2000.00	1.15	0.0004 as chronic PNEC	0.004 as acute PNEC	< 100	< 100
Morpholine	5347.95	0.80	11500.00	6.61	17 as chronic PNEC	28 as acute PNEC	< 10	< 10
Ethanolamine	3119.63	0.47	6500.00	3.74	16 as chronic PNEC	16 as acute PNEC	< 10	< 10
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	36968.04	5.53	213333.33	122.64			849	1556
Total Ammonia as N	36968.04	5.53	36973.33	21.25	1100 T as AA	8000 T as MAC	160 T[a]	580 T[a]
Nitrogen as N (total) based on total of N in all compounds containing N	38622.47	5.78	218426.28	125.57			849	1556
Phosphates (as P)	241.10	0.04	44000.00	25.29			30	140
Detergents							< 100	< 100
Suspended Solids	9735.16	1.46	266533.33	153.22			264000	1795000
COD	16252.05	2.43	193800.00	111.41			14100	169000
Aluminium	17.72	0.00	673.33	0.39	1000 T as MAC		22.8 D	240 D
Copper	1.42	0.00	49.33	0.03	5 D as AA		3.95 D	14.1 D
Chromium	28.20	0.00	1040.00	0.60	15 D as AA		0.02 D	1.20 D
Iron	117.88	0.02	4366.67	2.51	1000 D as AA		13.5 D	80.0 D
Manganese	11.21	0.00	406.67	0.23			3.51 D	19.3 D
Nickel	1.50	0.00	55.33	0.03	20 D as AA		0.19 D	3.94 D
Lead	1.02	0.00	36.67	0.02	7.2 D as AA		0.02 D	1.46 D
Zinc	20.24	0.00	733.33	0.42	40 D as AA		39.3 T	54.0 T

Notes:
D is Dissolved
T is Total
AA is Annual Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration
T[a] is Total Ammonia as NH3

Table C4

Combined Waste Streams B & C & D (Post Schedule 5) **Effluent from Primary Circuit and blowdown from the Secondary Circuit and the Turbine Hall**

Contaminants	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge over 12 hrs per day (µg/l)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge over 12 hrs per day (µg/l)	EQS or Target (µg/l)		Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Boric Acid	51141.55	7.65	3750000.00	2155.77				
Boron	8942.47	1.34	656000.00	377.12	7000 T		4059	7173
Lithium hydroxide	31.89	0.00	2933.33	1.69			114 D	184 D
Hydrazine	99.73	0.01	2666.67	1.53	0.0004 as chronic PNEC	0.004 as acute PNEC	< 100	< 100
Morpholine	6115.07	0.92	61500.00	35.35	17 as chronic PNEC	28 as acute PNEC	< 10	< 10
Ethanolamine	3357.08	0.50	16500.00	9.49	16 as chronic PNEC	16 as acute PNEC	< 10	< 10
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)	37004.57	5.54	218666.67	125.71			849	1556
Total Ammonia as N	37004.57	5.54	42306.67	24.32	1100 T as AA	8000 T as MAC	160 T[a]	580 T[a]
Nitrogen as N (total) based on total of N in all compounds containing N	38846.54	5.81	234684.02	134.91			849	1556
Phosphates (as P)	958.83	0.14	76610.00	44.04			30	140
Detergents	11689.50	1.75	180000.00	103.48			< 100	< 100
Suspended Solids	10228.16	1.53	280026.67	160.98			264000	1795000
COD	18447.31	2.76	219980.00	126.46			14100	169000
Aluminium	19.21	0.003	733.33	0.422	1000 T as MAC		22.8 D	240 D
Copper	1.53	0.000	56.00	0.032	5 D as AA		3.95 D	14.1 D
Chromium	30.58	0.005	1133.33	0.652	15 D as AA		0.02 D	1.20 D
Iron	127.74	0.019	4766.67	2.740	1000 D as AA		13.5 D	80.0 D
Manganese	12.16	0.002	446.67	0.257			3.51 D	19.3 D
Nickel	1.61	0.000	62.00	0.036	20 D as AA		0.19 D	3.94 D
Lead	1.10	0.000	46.67	0.027	7.2 D as AA		0.02 D	1.46 D
Zinc	21.92	0.003	800.00	0.460	40 D as AA		39.3 T	54.0 T
Cadmium	1.35	0.0002	3.33	0.0019	0.2 D as AA	0.9 D as MAC	< 1	< 1
Mercury	0.36	0.0001	0.73	0.0004	0.05 D as AA	0.07 D as MAC	0.02	1.94

Notes:
D is Dissolved
T is Total
AA is Annual Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration
T[a] is Total Ammonia as NH3

Table C5

Waste Stream E **Effluent from areas potentially containing oils and hydrocarbons**

Contaminants	Average Conc in Effluent (µg/l)		Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max conc in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	EQS or Target (µg/l)	Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Oils			5000	0.083		< 10	< 10

Table C6

Waste Stream F **Effluent from the production of demineralised water**

Contaminants	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution of annual load in CW flow of 116 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution of max daily load in CW flow of 60.4 m3/s. Effluent discharge continuous over 24 hrs (µg/l)	EQS or Target (µg/l)	Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Detergents	854.79	0.17	nd			< 100	< 100
Sulphates	134794.52	26.90	500000.00	383.25		1924000.00	2960000.00
Sodium	71780.82	14.32	213750.00	163.84		8545000.00	16070000.00
Amino tri-methylene phosphonic acid (ATMP)	12465.75	2.49	11250.00	8.62			
Hydroxy Ethylidene Diphosphonic Acid (HEDP)	1219.18	0.24	1125.00	0.86			
Acetic Acid	19.18	0.00	25.00	0.02			
Phosphoric Acid	16.44	0.00	25.00	0.02			
Sodium Polyacrylate	11000.00	2.20	10000.00	7.66			
Acrylic acid	226.03	0.05	250.00	0.19			
Iron	63013.70	12.57	62500.00	47.91	1000 D as AA	13.5 D	80.0 D
Suspended solids	120547.95	24.05	112500.00	86.23		264000.00	1795000.00
Chloride	119315.07	23.81	112500.00	86.23		14275000.00	20251000.00
Total P (as P) As a sum of all inputs, based on the proportion of P in the P-containing compounds	4876.49	0.97	4411.49	3.38		30.00	140.00

Notes:
D is Dissolved
T is Total
AA is Annual Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration

Table C7

Waste Stream G **Effluent from Site STW**

Contaminants	Average Conc in Effluent (µg/l)	Average Conc in Effluent following dilution in CW flow of 116 m3/s (µg/l)	Max Conc in Effluent (µg/l)	Max Conc in Effluent following dilution in CW flow of 60.4 m3/s (µg/l)	EQS or Target (µg/l)		Mean Background Concentrations (µg/l)	Max Background Concentrations (µg/l)
Total Ammonia (as N)	20007.83	0.35	20000.00	0.67	1100 T as AA	8000 T as MAC	160 T[a]	580 T[a]
Suspended Solids	29996.09	0.52	30267.03	1.01			264000	1795000
BOD	20007.83	0.35	20000.00	0.67			1200	14400
Nitrogen (as N) from permit application	20007.83	0.35	22833.75	0.77			849	1556
Assumed Total Inorganic Nitrogen (as N) based on a concentration in the discharge of 30 mg/l	30000.00	0.52	30000.00	1.01			849	1556
Phosphate (as P) based on per capita daily load of 0.6522 g	6522.11	0.11	6522.11	0.22			30	140

Notes:
D is Dissolved
T is Total
AA is Annual
Average
MAC is Maximum Allowable Concentration
PNEC is Probable No Effects Concentration
T[a] is Total Ammonia as NH3

Table D1

Combined Streams B and C (Post Schedule 5) **Effluent from Primary Circuit and blowdown from the Secondary Circuit**

Contaminants	Average Conc in Effluent relative to EQS or Target as %age	Max Conc in Effluent relative to EQS or Target as %age	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to EQS or Target as %age	Max Conc in Effluent after dilution relative to EQS or Target as %age	Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Boric Acid									
Boron	127.75	9371.43	220.31	9145.41		0.02	5.39	0.03	5.26
Lithium hydroxide			27.97	1594.20				0.00	0.92
Hydrazine	2739726.03	16666666.67	10.96	666.67		410.04	9581.19	0.00	0.38
Morpholine	4512.49	178571.43	7671.23	500000.00		0.68	102.66	1.15	287.44
Ethanolamine	1484.02	62500.00	2374.43	100000.00		0.22	35.93	0.36	57.49
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)			4.30	342.76				0.00	0.20
Total Ammonia as N (assuming all nitrogen as N is ammonia)	20.37	203.22	140.04	2803.06		0.00	0.12	0.02	0.53
Nitrogen as N (total) based on total of N in all compounds containing N			4.30	342.76				0.00	0.60
Phosphates (as P)			2392.39	23292.86				0.36	13.39
Detergents			11689.50	180000.00				1.75	103.48
Suspended Solids			0.19	0.75				0.00	0.00
COD			15.57	15.49				0.00	0.01
Aluminium	0.15	6.00	6.57	25.00		0.00	0.00	0.00	0.01
Copper	2.19	133.33	2.77	47.28		0.00	0.08	0.00	0.03
Chromium	15.83	622.22	11872.15	7777.78		0.00	0.36	1.78	4.47
Iron	0.99	40.00	73.06	500.00		0.00	0.02	0.01	0.29
Manganese			27.06	207.25				0.00	0.12
Nickel	0.55	33.33	57.68	169.20		0.00	0.02	0.01	0.10
Lead	1.01	92.59	365.30	456.62		0.00	0.05	0.05	0.26
Zinc	4.20	166.67	4.28	123.46		0.00	0.10	0.00	0.07

Table D2

Waste Stream D (Post Schedule 5) **Effluent from the Turbine Hall and uncontrolled floor drains (but not blowdown from the secondary circuit)**

Contaminants	Average Conc in Effluent relative to EQS or Target as %age	Max Conc in Effluent relative to EQS or Target as %age	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to EQS or Target as %age	Max Conc in Effluent after dilution relative to EQS or Target as %age	Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Boric Acid									
Boron									
Lithium hydroxide									
Hydrazine	22191780.82	50000000.00	88.77	2000.00		3321.33	28743.56	0.01	1.15
Morpholine	31458.50	41071.43	53479.45	115000.00		4.71	23.61	8.00	66.11
Ethanolamine	19497.72	40625.00	31196.35	65000.00		2.92	23.35	4.67	37.37
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)			4354.30	13710.37				0.65	7.88
Total Ammonia as N	3511.13	2730.33	24139.04	37659.70		0.53	1.57	3.46	3.66
Nitrogen as N (total) based on total of N in all compounds containing N			4354.30	2376.18				0.68	8.07
Phosphates (as P)			803.65	31428.57				0.12	18.07
Detergents									
Suspended Solids			3.69	14.85				0.00	0.01
COD			115.26	114.67				0.02	0.07
Aluminium	1.77	67.33	77.71	280.56		0.00	0.04	0.01	0.16
Copper	28.49	986.67	36.07	349.88		0.00	0.57	0.01	0.20
Chromium	188.01	6933.33	141004.57	86666.67		0.03	3.99	21.10	49.82
Iron	11.79	436.67	873.19	5458.33		0.00	0.25	0.13	3.14
Manganese			319.50	2107.08				0.05	1.21
Nickel	7.49	276.67	788.27	1404.40		0.00	0.16	0.12	0.81
Lead	14.21	509.26	5114.16	2511.42		0.00	0.29	0.77	1.44
Zinc	50.59	1833.33	51.49	1358.02		0.01	1.05	0.01	0.78

Key	
	>100%
	50 to 100%
	10 to 50%
	5 to 10%
	< 5%

Table D3

Combined Waste Streams B & C & D **Effluent from Primary Circuit and blowdown from the Secondary Circuit and the Turbine Hall**

Contaminants	Average Conc in Effluent relative to EQS or Target as %age	Max Conc in Effluent relative to EQS or Target as %age	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to EQS or Target as %age	Max Conc in Effluent after dilution relative to EQS or Target as %age	Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Boric Acid									
Boron	127.75	9371.43	220.31	9145.41		0.02	5.39	0.03	5.26
Lithium hydroxide			27.97	1594.20				0.00	0.92
Hydrazine	24931506.85	66666666.67	99.73	2666.67		3731.37	38324.75	0.01	1.53
Morpholine	35970.99	219642.86	61150.68	615000.00		5.38	126.27	9.15	353.55
Ethanolamine	20981.74	103125.00	33570.78	165000.00		3.14	59.28	5.02	94.85
Nitrogen as N (excluding hydrazine, morpholine, and ethanolamine)(appears to consist of ammonium, nitrite, and nitrate, ie. inorganic N species)			4358.61	14053.13				0.65	8.08
Total Ammonia as N	3531.50	2933.55	24279.09	40462.76		0.53	1.69	3.46	4.19
Nitrogen as N (total) based on total of N in all compounds containing N			4358.61	2718.94				0.68	8.67
Phosphates (as P)			3196.10	54721.43				0.48	31.46
Detergents			11689.50	180000.00				1.75	103.48
Suspended Solids			3.87	15.60				0.00	0.01
COD			130.83	130.17				0.02	0.07
Aluminium	1.92	73.33	84.27	305.56		0.00	0.04	0.01	0.18
Copper	30.68	1120.00	38.84	397.16		0.00	0.64	0.01	0.23
Chromium	203.84	7555.56	152876.71	94444.44		0.03	4.34	22.88	54.29
Iron	12.77	476.67	946.25	5958.33		0.00	0.27	0.14	3.43
Manganese			346.56	2314.34				0.05	1.33
Nickel	8.04	310.00	845.95	1573.60		0.00	0.18	0.13	0.90
Lead	15.22	648.15	5479.45	3196.35		0.00	0.37	0.82	1.84
Zinc	54.79	2000.00	55.77	1481.48		0.01	1.15	0.01	0.85
Cadmium	675.80	370.37	135.16	333.33		0.10	0.21	0.02	0.19
Mercury	723.29	1047.62	1808.22	37.80		0.11	0.60	0.27	0.02

Key	
	>100%
	50 to 100%
	10 to 50%
	5 to 10%
	< 5%

Table D4

Waste Stream E **Effluent from areas potentially containing oils and hydrocarbons**

Contaminants	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Oils	50000.00	50000.00		0.83	0.83

Key	
	>100%
	50 to 100%
	10 to 50%
	5 to 10%
	< 5%

Table D5

Waste Stream F **Effluent from the production of demineralised water**

Contaminants	Average Conc in Effluent relative to EQS or Target as %age	Max Conc in Effluent relative to EQS or Target as %age	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to EQS or Target as %age	Max Conc in Effluent after dilution relative to EQS or Target as %age	Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Detergents			854.79	854.79				0.17	0.17
Sulphates			7.01	16.89				0.00	0.01
Sodium			0.84	1.33				0.00	0.00
Amino tri-methylene phosphonic acid (ATMP)									
Hydroxy Ethylidene Diphosphonic Acid (HEDP)									
Acetic Acid									
Phosphoric Acid									
Sodium Polyacrylate									
Acrylic acid									
Iron	6301.37	6250.00	466768.14	78125.00		1.26	4.79	93.15	59.88
Suspended solids			45.66	6.27				0.01	0.00
Chloride			0.84	0.56				0.00	0.00
Total P (as P) As a sum of all inputs, based on the proportion of P in the P-containing compounds			16254.98	3151.06				3.24	2.42

Key	
	>100%
	50 to 100%
	10 to 50%
	5 to 10%
	< 5%

Table D6

Waste Stream G **Effluent from Site STW**

Contaminants	Average Conc in Effluent relative to EQS or Target as %age	Max Conc in Effluent relative to EQS or Target as %age	Average Conc in Effluent relative to Average Background as %age	Max Conc in Effluent relative to Max Background as %age		Average Conc in Effluent after dilution relative to EQS or Target as %age	Max Conc in Effluent after dilution relative to EQS or Target as %age	Average Conc in Effluent after dilution relative to Average Background as %age	Max Conc in Effluent after dilution relative to Max Background as %age
Total Ammonia (as N)	1818.89	250.00	12504.89	3448.28		0.03	0.01	0.22	0.12
Suspended Solids			11.36	1.69				0.00	0.00
BOD			1667.32	138.89				0.03	0.00
Nitrogen (as N) from permit application			2356.63	1467.46				0.04	0.05
Assumed Total Inorganic Nitrogen (as N) based on a concentration in the discharge of 30 mg/l			3533.57	1928.02				0.06	0.06
Phosphate (as P) based on per capita daily load of 0.6522 g			21740.38	4658.65				0.38	0.16

Key	
	>100%
	50 to 100%
	10 to 50%
	5 to 10%
	< 5%

Annex D

Natural England Comments	Environment Agency response
The EA'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 EA please clarify this.	The assessment for shad within the HRA was reviewed and further discussed with Natural England. Natural England have agreed that the approach used in the HRA is conservative and the differences in impact data made results in the conclusions of the HRA being based on '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 2 years at 100% capacity in parallel with HPC (c.2020-2023). Mortality after mitigation results in an annual loss of 0.27% (80% survival with FRR) for HPC alone, but total mortality is identified as 0.28% for B & C together. Are these % 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%. 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 % figures are predicted annual loss.
NE recommend acknowledging CCW issues regarding in combination within our HRA – i.e. 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.

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 prior to discharge Monitoring of Habitat features: ➢ Population of phytoplankton to ensure 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 ensure 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 ensure 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 ensure 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 ensure levels are maintained within the WFD threshold	Our draft permit requires NNB GenCo to monitor and report sample data to the Environment Agency Pre-operational condition PO11 within the draft Permit requires that a monitoring strategy is put in place with the agreement of the Environment Agency to monitor and mitigate any changes to the biology, chemistry and physical characteristics of the areas impacted by the water discharge and abstraction system. 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 it is as a result of the water discharge, abstraction or other aspects of the development.

CCW Comment	Environment Agency response
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)	Tables to be updated to reflect potential indirect impact on birds of changes to water chemistry.
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	Agreed with CCW within meeting of 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.
Recommendation that 'competition from non-native 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 also depending on the type of detergent can 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 within meeting of 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.

CCW Comment	Environment Agency response
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.
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.