Environment Agency

Generic design assessment

AP1000® nuclear power plant design by Westinghouse Electric Company LLC

Final assessment report

Other environmental regulations

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Protective status	This document contains no sensitive nuclear information or commercially confidential information.
Process and Information Document[1]	The following sections of Table 1 in our Process and Information document are relevant to this assessment: 3.1 – water abstraction 3.2 – water discharge of non-radioactive substances 3.3 – standby generation 3.4 – Control of Major Accident Hazards Regulations
Radioactive Substances Regulation Environmental Principles[2]	Not directly relevant to this report
Report author	Green, R.

1. Process and Information Document for Generic Assessment of Candidate Nuclear Power Plant Designs, Environment Agency, Jan 2007.

   http://publications.environment-agency.gov.uk/pdf/GEHO0107BLTN-e-e.pdf

2. Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation - Environmental Principles (REPs), 2010.

   http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSB-e-e.pdf

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1 Summary

1 In GDA we focused our main assessment effort on radioactive waste matters but we also considered other environmental matters where the Environment Agency has a regulatory role:

a) Abstraction of water – use of water taken from the open sea for cooling is unlikely to require an abstraction licence from us but the design of the seawater intake to minimise damage to marine life will be a site-specific issue.

b) The discharge of aqueous effluents will require a permit from us. The indications from GDA are that it should be possible for us to issue a permit for the discharge from an AP1000® reactor, dependent on site specific dispersion modelling.

c) An AP1000 will not make direct or indirect discharges to groundwater in normal operation and will not require a groundwater permit from us. Pollution prevention techniques used in the AP1000 design should prevent any leaks or spills entering groundwater.

d) The emergency diesel generators on an AP1000 reactor will not require a combustion activities permit from us.

e) The strategy proposed by Westinghouse for managing wastes is consistent with the waste hierarchy and the Waste Framework Directive objective that waste management is carried out without endangering human health and without harming the environment.

f) Future operators will need to produce a site waste management plan for each of their construction projects with an estimated cost greater than £300,000 under the Site Waste Management Plans Regulations 2008.

g) The AP1000 reactor will be a lower tier installation under the Control of Major Accident Hazards Regulations (COMAH). This will be on the basis of storage of more than 0.5 tonne of hydrazine hydrate – a named carcinogen under COMAH. However the risk of a Major Accident to the Environment (MATTE) from an accident involving hydrazine is highly unlikely.

h) An AP1000 reactor will need a greenhouse gas emissions permit from us, under the EU Emissions Trading Scheme, for its total 25.8 MW of combustion plant (emergency diesel generators).

2 Our findings on the wider environmental impacts and waste management arrangements for the AP1000 reactor may be found in our Decision Document (Environment Agency, 2011a).

2 Introduction

3 We originally published this report in June 2010 to support our GDA consultation on the AP1000 design. The consultation was on our preliminary conclusions. It began on 28 June 2010 and closed on 18 October 2010. (Consultation Document: Environment Agency, 2010a)

4 We received additional information from Westinghouse after June 2010 and also undertook additional assessment in response to consultation responses. This report is an update of our original report covering assessment undertaken between June 2010 and the end of March 2011 when Westinghouse published an update of their submission. Where any paragraph has been added or substantially revised it is in a blue font.

5 We do not specifically deal with consultation responses in this report, they are covered in detail in the Decision Document (Environment Agency, 2011a). However, where a response prompted additional assessment by us this is referenced, the key to GDA reference numbers is in Annex 7 of the Decision Document. The conclusions in this report have been made after consideration of all relevant responses to our consultation.

2.1 Assessment Methodology

6 The basis of our assessment was to:

a) read appropriate sections of the AP1000 Environment Report (ER) and its supporting documents;

b) hold technical meetings with Westinghouse to clarify our understanding of the information presented and explain any concerns we had with that information;

c) raise Regulatory Observations and Technical Queries where we believed information provided by Westinghouse was insufficient;

d) assess the information provided by Westinghouse using our relevant internal guidance and regulatory experience and form conclusions.

e) decide on any GDA Issues or assessment findings to carry forward from GDA in our Statement of Design Acceptability, if issued.

2.2 Westinghouse submission

7 Guidance on our generic design process (GDA) was published in January 2007 (process and information document (P&ID) (Environment Agency, 2007)). Table 1, references 3.1 to 3.4 of the P&ID sets out the information we require on environmental matters other than radioactivity.

8 Westinghouse provided its submission to GDA in August 2007. We carried out our initial assessment and concluded that we needed additional information. We raised a Regulatory Issue on Westinghouse in February 2008 setting out the further information that we needed. In particular we believed P&ID reference 1.5 had not been addressed by the submission and required "*a formal BAT assessment for each significant waste stream*".

9 Westinghouse completely revised its submission during 2008 and provided an Environment Report (Revision 2) with supporting documents.

10 We assessed information contained in the Environment Report but found that while much improved from the original submission it still lacked the detail we require to demonstrate BAT is used. We raised a Regulatory Observation RO-AP1000-034 on Westinghouse in June 2009 that had actions relevant to this report to provide:

a) a comprehensive Integrated Waste Strategy; and

b) a demonstration that BAT will be used to prevent or minimise the creation and disposal of wastes.

11 We raised 43 Technical Queries (TQs) and 14 Regulatory Observations on Westinghouse during our assessment. Relevant to this report were:

a) RO-AP1000-39 – Non-radioactive liquid waste management.

b) TQ-AP1000-168 – Prevention of contamination

c) TQ-AP1000-212 – Monitoring of liquid effluents

12 Westinghouse responded to all the ROs and TQs. They reviewed and updated the Environment Report in March-April 2010 to include all the relevant information provided by the ROs and TQs. This version of the ER was referenced by our Consultation Document and publicly available on the AP1000 website.

13 Additional information on some topics was submitted by Westinghouse after March 2010. Westinghouse reviewed and updated the ER to include all submitted information in March 2011. This report only uses and refers to the information contained in the updated Environment Report (UKP-GW-GL-790 (Rev 4))(ER) and its supporting documents in particular the AP1000 BAT Assessment (UKP-GW-GL-026 (Rev 2))(AP1000 BAT), publicly available on the AP1000 website (www.ukap1000application.com).

3 Water Resources Act 1991 (as amended): Water abstraction

14 The supply of water is limited, so we make sure that it's managed and used effectively to meet the needs of people and the natural environment. We do this through a licensing system. You can find out more on our website: Environment Agency - Water abstraction

3.1 Assessment Objectives

15 Our assessment was aimed at:

a) Understanding the requirements for water use in the AP1000.

b) Identifying the sources of water to be used.

c) Deciding whether any licences or permits might be required for water abstraction.

d) Deciding whether the choice of cooling option(s) proposed for the generic site was appropriate.

e) Identifying any issues connected with water use.

3.2 Westinghouse documentation

16 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4

17 We use short references in this report, for example: ER section 2.7 = ERs2.7.

3.3 Assessment

18 The AP1000 is a pressurised water reactor (PWR), based around a primary circuit, a secondary circuit and a cooling circuit. Water requirements of the plant are set out in the following paragraphs.

3.3.1 Freshwater

19 Westinghouse states that the AP1000 will need supplies of freshwater for several purposes and assume for GDA that this will be from a mains supply (ERs2.7):

a) for the demineralised water treatment plant that provides treated water for the primary and secondary circuits (ERs2.7.3);

b) to provide potable water for drinking and sanitation needs (showers and lavatories) (ERs2.7.4);

c) to supply the fire protection system (ERs2.7.5).

Westinghouse provides normal and maximum flows for each use in ER Figure 2.7-1. The figure shows normal and maximum flowrates in gallons per minute, we have estimated from those flowrates that an AP1000 should use up to a total of 100 $m^3 h^{-1}$ in normal operation.

20 Providing freshwater will be a site-specific matter, and we have not considered this at GDA. If a site needs abstracted surface water or groundwater, then the Operator will need to obtain an abstraction licence (under the Water Resources Act 1991) from us before any abstraction takes place (if the daily abstraction volume exceeds $20m^3$). If the site needs a temporary or permanent reservoir for water then an impoundment licence may be needed from us.

3.3.2 Seawater

21 Westinghouse only consider a coastal site at GDA and assume cooling water requirements will be met by abstraction of seawater.

22 Westinghouse has only considered direct (also known as open, or once-through) seawater cooling of the main condensers and plant auxiliary systems. Although not explicit in our P&I Document we have considered whether the choice of cooling regime is broadly consistent with current best practice.

23 We commissioned a report entitled *Cooling Water Options for the New Generation of Nuclear Power Stations in the UK* (Environment Agency, 2010b). The purpose of the document was to "*investigate the potential cooling water options for new reactors and evaluate the environmental impact of these in terms of thermal, chemical and radionuclide pollution, and impact on biota*" to assist the UK regulatory authorities (the Environment Agency and the Office for Nuclear Regulation[1] (ONR)) in the GDA process. With regard to cooling, the report concludes that direct cooling "*can be the most appropriate environmental option for large power stations sited on the coast or estuaries, subject to current best planning, design and operational practice and best available mitigations being put in place, and meeting conservation objectives of the site in question.*" Based on this conclusion we have accepted that the selection of direct cooling for the AP1000 is not inconsistent with current best practice.

24 We note the National Policy Statement for Nuclear Power Generation (EN-6) (DECC, 2011) states at section 3.7.7: '*Applicants will be expected to demonstrate Best Available Techniques to minimise the impacts of cooling water discharges*'.

25 The AP1000 has two cooling systems:

a) the circulating water system (CWS)(ERs2.7.1) supplies seawater to remove heat from the:
   i) main condensers;
   ii) the turbine building closed cooling water system (TCS) heat exchangers;
   iii) the condenser vacuum pump seal water heat exchangers.

b) the service water system (SWS)(ERs2.7.2) supplies seawater to remove heat from the component cooling water system (CCS) heat exchangers in the turbine building.

26 Westinghouse predicts the following flows and return temperatures (ERs4.2.3.3):

a) CWS: 38 $m^3 s^{-1}$ at 14 °C warmer than intake;

b) SWS: 1.3 $m^3 s^{-1}$ at 18.3 °C warmer than intake.

The returning flows are combined at the seawater return sump where the temperature will be 14.15 °C warmer than intake.

27 The SWS is a seawater system for the GDA generic site (a coastal site). The European DCD and the PCSR describe a cooling tower system for use where seawater cooling is not practical. A cooling tower system would need additional fresh water supplies at up to 182 $m^3 h^{-1}$. (ERs7.2)

28 Using a combined flow rate of 39.3 $m^3 s^{-1}$ means that the total annual volume of seawater required for cooling will be around 1.24 billion cubic metres.

29 We will have to decide at the site specific stage whether an abstraction licence is required for the seawater cooling supply. The abstraction of water from the open sea

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1 The Office for Nuclear Regulation (ONR) was created on 1st April 2011 as an Agency of the Health and Safety Executive (HSE). It was formed from HSE's Nuclear Directorate and has the same role. In this report we therefore generally use the term "ONR", except where we refer back to documents or actions that originated when it was still HSE's Nuclear Directorate.

would not normally require an abstraction licence from us, unless the particular location of the abstraction or method of abstraction means that it falls within the definition inland waters under the Water Resources Act 1991.

30 Historically, under the Water Resources Act 1963 [WRA63] the seaward boundaries for water abstraction licensing were generally taken as the low water mark (of ordinary spring tides) on the coast of the area, or at such point(s) where Local Orders made provision for more useful seaward boundaries to be defined. The subsequent Water Acts of 1973 and 1989 respectively, repealed these provisions.

31 Today, the main legislation for abstraction licensing is the Water Resources Act 1991 (as amended by the Environment Act 1995) and the Water Act 2003. Currently there is no specifically defined seaward boundary of jurisdiction for water resources and generally, the requirement for an abstraction licence is based on whether the water being abstracted is located within what is termed a "*Source of Supply*". By definition, Source of Supply includes any channel, creek, bay, estuary or arm of the sea, and is synonymous with inland waters, as opposed to the open sea.

32 We have assumed for GDA that the cooling water intake will be located in the open sea and that the abstraction will not be licensable. However, we would need to examine carefully the location of the abstraction for each specific site to decide whether an abstraction license is required. Potential operators would need to contact us for advice giving full details of their proposals.

33 The abstracted seawater will need to be filtered to remove debris, including seaweed before it is used. Westinghouse has not provided information on this topic at GDA. Handling the removed material will need to be considered for each site, it will be a waste for disposal. In some cases, it can be macerated and returned to the sea. The Operator for each specific site will need to discuss with us the need for waste or water discharge permits for the option chosen for the site. We have not assessed this matter at GDA.

3.3.3 Environmental impact of abstractions

34 The primary concern with water abstractions is the potential impact upon marine organisms (ranging from planktonic bacteria and algae to macroinvertebrates and fish) of the seawater cooling intake. The design of this structure is critical to ensure that possible damage through entrapment, impingement and entrainment on filter screens, is minimised. Our Science report entitled "*Cooling Water Options for the New Generation of Nuclear Power Stations in the UK*" (Environment Agency, 2010b) explains the matters surrounding intake design and reviews mitigation measures. We would expect operators to contact us at the early stages of site specific designs so that we can advise on techniques to minimise the impact of cooling water intakes on marine ecology *per se*.

35 We would assess and comment on the proposed intake design in our role as statutory consultee in the planning process. If the abstraction were licensable (under the Water Resources Act 1991) then we would also seek to influence the design through agreed conditions on the abstraction licence, for example, requiring the operator to install mitigation measures and / or undertake monitoring programmes.

36 Westinghouse has undertaken a generic impact assessment of direct (or once-through) cooling, in terms of water quality and ecology. It is useful insofar as it demonstrates an awareness of the relevant matters, highlights potential impacts and identifies mitigation measures. However as the assessment is based on a generic UK site the conclusions can only be qualified through further site specific work. Westinghouse has identified the need for such work to properly assess potential impacts, particularly those relating to habitats and species. This is consistent with our understanding of the requirements of the Environmental Impact Assessment (EIA) process.

3.4 Conclusion

37 We concluded for water abstraction that:

a) Westinghouse propose abstraction of cooling water from the open sea only, at a rate of 39.3 $m^3 s^{-1}$, as direct seawater cooling is the preferred means for cooling the main condensers and plant auxiliary systems. Abstraction from the open sea would not require an abstraction licence from us.

b) There are a number of site specific matters that are outside the scope of GDA and which will need to be addressed by future operators at site specific permitting, namely:

   i) the design of the sea water intake such that it will minimise damage to marine life;

   ii) the provision of freshwater for plant process and sanitation needs, etc;

   iii) the ecological impact assessment of freshwater and seawater abstractions; and

   iv) the management of marine debris from the seawater intake filters.

4 Environmental Permitting Regulations 2010 (EPR 10): Discharges to surface water

38 The Environmental Permitting Regulations (England and Wales) 2010 (EPR 10), cover water discharges and groundwater activities, radioactive substances, waste, mining waste and specified installations.

39 You can find more information on EPR 10 on our website: Environment Agency - Environmental permitting. Also guidance is available on discharges to water: Environment Agency - Environmental permitting guidance - point source discharges to surface water or groundwater.

4.1 Assessment Objectives

40 We started our assessment with some key questions to answer:

a) what is the role of BAT within this assessment and with respect to our established Water Quality permitting process?

b) what do we see as being the potential constraints involved with assessing discharges to controlled waters at a generic level;

c) what subject areas can only be assessed properly when you are dealing with a specific location?

d) has Westinghouse provided enough information for us to fully characterise the AP1000's liquid process streams?

e) based on the information available at GDA could we make an in principal decision on the likelihood of granting a discharge permit for the AP1000 design at the site specific stage; and

f) dependent upon the constraints identified, how do we ensure that we produce a meaningful assessment at GDA, while being reasoned and pragmatic about the potential future site specific work?

4.2 Consideration of BAT

41 Best available techniques (BAT), is defined under the OSPAR Convention[2] and European Directive 1996/61/EC on Integrated Pollution Prevention and Control (IPPC) (EC, 1996) as "the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste." We have considered in GDA whether the AP1000 design uses BAT to prevent and, where prevention is not practicable, minimise:

a) the production and discharges of non-radioactive substances (including heat);

b) land contamination and groundwater pollution by non-radioactive substances;

both during routine operations and from abnormal events.

42 When we review permits for existing discharges or issue permits for new ones our aim is to issue permits that prevent or minimise any deterioration in the quality of water bodies that could otherwise occur as a result of the discharge. We refer to this as 'no deterioration' and our ideal is for no increase in the planned pollutant load discharged to the water body, although in most cases there is some degree of 'acceptable' deterioration. The 'no deterioration' policy does not have BAT as the criteria for acceptability but instead aims to balance deterioration against cost and practicality. If

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2 Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992 ("OSPAR Convention")

the discharge were to threaten a Water Quality standard only then would BAT become a relevant criteria. This would normally lead to controls and limits tighter than those based on considerations of environmental impact only.

43 If we have to consider BAT it is recognised that a point can be reached where the additional costs of securing further reductions in discharge quantity and / or quality, and of the risks associated with those discharges, would far outweigh the increased protection arising from such improvements to the environment and / or the general public. However, where a statutory obligation, for example, an EQS, requires stricter conditions and quality limits than those achievable by the use of BAT then we would seek to ensure that:

a) the Operator investigates whether alternative means exist, for example, a change in process or equipment, or a change in operational regime; and / or

b) additional regulatory measures or controls are applied as necessary;

c) compliance with said discharge quality limits can be achieved.

44 We note the National Policy Statement for Nuclear Power Generation (EN-6) (DECC, 2011) states at section 3.7.7: '*Applicants will be expected to demonstrate Best Available Techniques to minimise the impacts of cooling water discharges*'.

4.3 Westinghouse documentation

45 We referred to the following documents to produce this report:

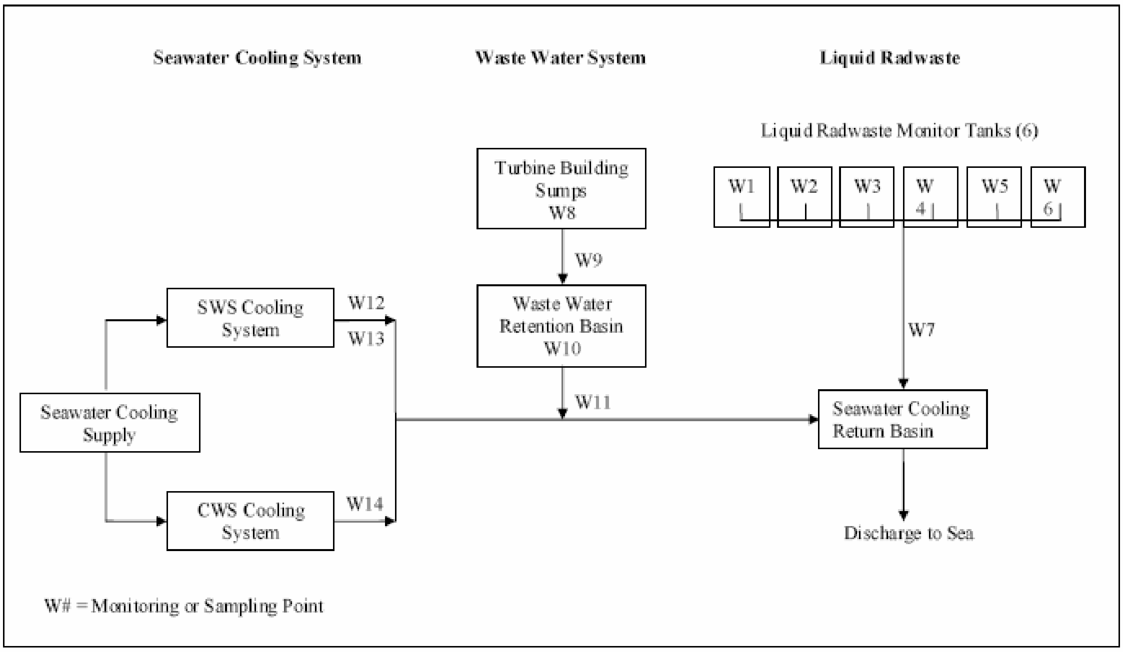
Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4
UKP-GW-GL-034	Generic Assessment of the Impacts of Cooling Options for the Candidate Nuclear Power Plant AP1000	1

46 We use short references in this report, for example: ER section 2.7 = ERs2.7.

4.4 Assessment

4.4.1 Generation of liquid effluents

47 The effluent system of the AP1000 is shown in ER Figure 6.2-2:



48 We would place controls on four effluent release points in a permit:

a) W7 – discharge for liquid radwaste monitor tanks serving the liquid radioactive waste system (WLS);

b) W11 – discharge line of the wastewater system (WWS) from the wastewater retention basin;

c) W14 – discharge line of the circulating water system (CWS);

d) W12 – discharge line of the service water system (SWS).

49 Westinghouse states that the AP1000 will generate the following liquid effluents:

a) effluent from the liquid radwaste system discharged through point W7 (WLS)(ERs3.4.3). The radioactivity of this effluent is dealt with in our report EAGDAR AP1000-05 (Environment Agency 2011b) but the effluent will also contain chemicals and metals, e.g. corrosion products, that will need to be covered in a discharge permit from us and which therefore merit consideration here;

b) effluent from the Wastewater system (WWS) that serves the drains in the non-radioactive building areas of the AP1000. The effluent is collected in sumps and then pumped through an oil separator to the wastewater retention basin for settling of suspended solids and treatment, if required. The basin is discharged, after sampling and appropriate discharge approval, to the seawater return sump through point W11, (ERs4.2.1.1 and ER Figure 6.2-2).

Westinghouse claim that the wastewater retention basin also has sufficient volume to retain any unplanned emissions of effluents or spillages. Effluents that cannot be discharged can then be treated or disposed of off-site (ERs4.2.6.1). Westinghouse state that the design of the wastewater retention basin is a site specific matter and have not provided any detailed information. We have therefore not been able to assess this aspect at GDA. The operator will be required to submit the design details including justification of retention volume to support a site specific permit application.

c) effluent from the Sanitary Drainage System that serves restrooms and locker room facilities in non-radiologically controlled areas. The system design will be site specific and has not been assessed at GDA.

50 The following systems also discharge into the Wastewater system (WWS):

a) the Demineralised Water Treatment system treats raw water using filters, reverse osmosis and electrodeionisation. Chemicals are added in trace quantities to adjust pH and to act as an anti-scalant. The reject flow from reverse osmosis is sent to the WWS (ERs4.2.2.1);

b) the Steam Generator Blowdown System takes a blowdown from each steam generator and treats it to reduce impurities. Blowdown is normally recycled into the secondary system but in event of high impurity levels can be discharged to the WWS (ERs4.2.2.2). If significant radioactivity is detected in the secondary side systems, blowdown is re-directed to the liquid radwaste system.

c) the Condensate System provides feedwater to the secondary system. An ion exchange bed is used to polish the feedwater at start-up, the bed is rinsed before use and the rinse water sent to the WWS (ERs4.2.2.3).

51 Westinghouse states that storm water falling on the site of an AP1000 will be collected into a storm water pond. The storm water system will need to incorporate an oil separator to cope with any oil spillage on roads or loading areas. The detailed design will be site specific and has not been assessed at GDA.

52 Westinghouse states that fire water from internal fire fighting would be initially retained within buildings. Fire water used externally should be collected in the storm water pond. In both cases fire water can be treated or disposed of off-site and should not be discharged in an uncontrolled manner.

4.4.2 Radioactive liquid effluent

53 The main chemicals used in the AP1000 and associated with the liquid radioactive effluent are (ERs2.9.1and s4.2):

a) boric acid used as a neutron absorber and added to:

   i) the coolant (concentration from 612 to 2700 ppm);

   ii) the spent fuel pool and fuel transfer canal;

   iii) the in-containment refuelling water storage tank / refuelling cavity;

   iv) the cask wash-down pit.

   (Concentrations for ii, iii and iv are all 2700 ppm)

b) lithium hydroxide added to the coolant to offset the acidity of the boric acid to prevent equipment corrosion;

c) hydrazine used as an oxygen scavenger in the feedwater at start-up;

d) zinc acetate added to the coolant to be incorporated into oxide films on wetted reactor components to reduce corrosion;

e) trace metals such as iron, nickel, copper and chromium from corrosion and erosion where coolant and other process waters contact equipment. Westinghouse were unable to provide predictions for quantities of these at GDA. However effluents are filtered and, in the case of effluent from treating coolant, passed through ion exchange resins. These techniques will minimise the quantities of metals present in discharges.

54 Westinghouse has not provided detailed information on the trace metal contamination of bulk chemicals.

55 An operator will need to provide more accurate predictions of all metals liable to be contained in the liquid effluents to complete a site specific permit application. This should include details of corrosion products arising from both the primary and secondary circuits and impurities within bulk raw materials.

4.4.3 Non-radioactive liquid effluent

56 The main substances associated with the non-radioactive liquid effluent from the AP1000 include (ER Table 2.9-1):

a) ammonium hydroxide, used for pH control;

b) ammonium chloride, used as an algaecide;

c) sodium hypochlorite, used as a biocide; and

d) polyphosphate, used as an anti-scalant.

57 Suspended solids may come from dirt collected in drain effluents. The waste water retention basin allows for settling of suspended solids before discharge. (ERs4.2.1.1)

58 Westinghouse has not provided information on chemical oxygen demand (COD) in effluents from the AP1000 at GDA. An Operator will need to provide this information to complete a site specific permit application.

59 Seawater cooling circuits need to be protected from biological fouling when the seawater inlet temperature is above 10°C, assumed to be for 6 months of the year. The AP1000 will use sodium hypochlorite as a biocide (30% solution from an 11.4 te tank). The system will leave residual oxidants, chlorine and halogenated by-products such as bromoform in the returning seawater. (ERs4.2.5.1)

60 Westinghouse claim the use of sodium hypochlorite will be minimised by use of BAT in the design of the cooling system. ER Table 4.2-3 provides a list of techniques to be considered. Many of these relate to site specific conditions or operator procedures and therefore we could not readily assess for GDA but they will be important concerns for site specific permitting.

4.4.4 Treatment and discharge of liquid effluents

61 Westinghouse will utilise the cooling water return flow to further dilute liquid effluents prior to discharge to sea. Liquid effluents are collected for monitoring before discharge into the seawater sump where there is immediate and substantial dilution provided by the flow of returning cooling water, approximately 39 m^3/s.

62 Our previously mentioned Science Report on cooling water options (Environment Agency 2010b) acknowledges that it is not uncommon for power stations to "*make use of the cooling system for rapid dilution of low level radioactive waste and sewage treatment plant / 'grey' water*", even though best practice would suggest that wastewater should be kept separate from cooling system. We accept that the typically massive dilutions offered by discharging power station effluents into the cooling water return flow can considerably reduce the concentration of most substances to environmentally acceptable levels without the need for additional treatment, thus making it an attractive option for designers and operators.

63 Liquid effluents are collected for monitoring before discharge into the seawater sump where there is immediate and substantial dilution provided by the flow of returning cooling water, approximately 39 $m^3 s^{-1}$. The two main effluent streams, from the liquid radwaste system and the wastewater system, discharge as follows:

a) radioactive effluents are collected in the 6 monitor tanks of the liquid radwaste system and discharged through point W7, a pumped discharge with a design flow rate of 22.7 $m^3 h^{-1}$;

b) non-radioactive effluents from the waste water system are collected in the wastewater retention basin and are discharged through point W11 at a maximum design flow rate of 408 m^3 h^{-1}.

64 The operator of a specific site will need to define all points of discharge, giving amongst other information flows and the expected composition and concentrations of effluents at each point, in order to characterise all effluent streams.

4.4.5 Effluent monitoring

65 We have assumed that the flow measurement and effluent sampling equipment at points W7 and W11 will be used for both radioactive and non-radioactive discharge measurements. However, the exact location of the sampling points, the number of sampling points and the parameters to be sampled at each point will be a site specific matter to be agreed with the operator.

66 Effluent flow measurement and sampling for a site specific AP1000 will need to be MCERTS compliant. MCERTS is the Environment Agency's monitoring certification scheme established to deliver quality environmental measurements. It is based on international standards and provides for the product certification of instruments, the competency certification of personnel and the accreditation of laboratories. MCERTS provides the framework for operators to meet our quality requirements.

4.4.6 Environmental impact of non-radioactive liquid discharges

67 The key issues for assessing non-radioactive discharges to controlled waters are the discharge of certain Dangerous Substances and the discharge of thermally adjusted cooling waters. Both these matters would be subject to control through an Environmental Permit from the Environment Agency.

4.4.6.1 Chemicals, including Dangerous Substances

68 Dangerous substances (as specified under the Dangerous Substances Directive) and priority substances and priority hazardous substances (as specified under the Priority Substances Directive) are toxic and pose the greatest threat to the environment and human health. The Directives require that we either eliminate or minimise pollution by these substances. We define pollution by dangerous substances / priority substances as exceeding environmental quality standards (EQSs) in the 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.

69 The requirements of the Dangerous Substances Directive are now integrated in the Water Framework Directive, and the Dangerous Substances Directive will be fully repealed in 2013. The Priority Substances Directive now applies to discharges of priority substances and sets EQSs for priority and priority hazardous substances. The Water Framework Directive is designed to improve and integrate the way water bodies are managed throughout Europe. Member states must aim to reach good chemical and ecological status in inland and coastal waters by 2015. This overarching piece of legislation will have wide implications for any new nuclear power station built in Europe, not least because EQS compliance serves as a key indicator of both chemical and ecological status.

70 Westinghouse has provided an impact assessment for some of the substances discharged to sea from the AP1000. Westinghouse has estimated annual discharges of chemicals and calculated discharge concentrations based on dilution in the annual flow of seawater cooling (1.24 x 10^9 m^3), ER Table 4.2-2:

Chemical	Quantity (kg y^{-1})	Annual average concentration (AAC) (µg l^{-1})	Environmental quality standard (EQS) (µg l^{-1})	AAC/EQS (%)
Boric acid (as boron)	≤7884 ≤(1380)	1.1 (as boron)	7000	0.02
Lithium hydroxide	6.4	0.005	-	-
Zinc acetate	<1.2	<3.4 x 10^{-5} (as Zinc)	40	0.00009
Trace metals in chemicals	3.3 (based on 1 ppm)	0.0027	lowest EQS is mercury at 0.3	0.9
Sodium hypochlorite	< 121490	< 200	10 (TRO)	-
Ammonium chloride/hydroxide	< 35,670	< 11 (ammonia as N)	21 (unionised ammonia as N)	-
Hydrazine	370	0.3	-	-

Notes: Westinghouse conclude that the predicted discharge will exceed the EQS for TRO at the point of discharge to the sea, but that there is minimal risk that the EQS would be exceeded at the edge of the mixing zone. As the fate of chlorine in seawater is a highly complex issue further site specific studies will be required in this area.

71 Westinghouse assumed a worst case of 1 ppm metal contamination of bulk chemicals used to predict the discharge concentration of trace metals. The predicted discharge concentration is less than 1% of the lowest EQS (mercury). We do not consider substances with discharge concentrations at less than 1% EQS to be significant and do not require detailed dispersion modelling or further impact assessment. This follows the screening principles set out in our H1 assessment guidance (Environment Agency, 2010d). H1 is used for assessing the risks to the environment and human health from facilities which are applying for a permit under the Environmental Permitting Regulations. Insignificant risks are screened out and more detailed assessment is only needed where the risks justify it.

72 Our procedures for permitting dangerous and priority substances to coastal waters are based on the relationship between the discharge concentration and the EQS. We apply a staged approach which involves more rigorous assessment as each stage is passed. The rigour of each stage is reflected in the need for increasing levels of site specific information and possibly dispersion modelling studies.

73 If the discharge concentration of a substance is less than the EQS then it is considered insignificant. At the other end of the scale, we may have to define what is an acceptable *mixing zone* for a particular substance, taking account of local constraints such as sensitive ecological areas and specify appropriate limits for that substance on a discharge permit.

74 As mentioned above, more detailed information on dangerous and priority substances, particularly metals, would be required in support of a site specific permit application.

4.4.6.2 Thermal discharge

75 The primary environmental effects of power station thermal discharges relate to temperature rise and cooling water system biocide residues.

4.4.6.2.1 Temperature rise

76 Heat is defined as pollution under the Water Framework Directive. Under the Directive draft temperature standards have been published based on the requirements for transitional and coastal waters of Good Ecological Status. In common with other directly cooled power stations (both conventional and nuclear), the AP1000 will produce and discharge large volumes of thermally adjusted cooling waters.

77 Westinghouse claim that the return temperature of seawater used for cooling will be 14.15°C warmer than at intake. Westinghouse has provided no information on impact stating that a site specific definition of mixing zone and impact evaluation will be required. This is consistent with our understanding and therefore we have not assessed potential thermal impact under GDA. Due to the highly localised data requirements of dispersion modelling a detailed study will be required in support of site specific application for a discharge permit.

4.4.6.2.2 Cooling water system biocide (anti-fouling) residues

78 Westinghouse has provided an estimate of the impact of biocide dosing on the receiving environment, quantifying the likely concentration of total residual chlorine against its respective EQS. While Westinghouse concludes that the predicted discharge will exceed the EQS at the point of discharge, it expects the concentration to decrease rapidly upon mixing with seawater. Westinghouse states that there is minimal risk that the EQS would be exceeded at the edge of the mixing zone, but site specific monitoring would be necessary to prove this. It acknowledges that the required dosing regime is highly site-specific and depends on local water quality conditions. This is consequently why we have not assessed this matter at GDA. Future work involving the use of local water quality information and dispersion modelling of each discharge would be necessary to support a site specific application for a discharge permit.

4.4.6.3 Ecological impacts

79 Westinghouse has undertaken an ecological impact assessment based on a representative UK site. This is useful insofar as it demonstrates an awareness of the relevant matters, identifying potential impacts and mitigation measures. However as the assessment is based on a generic site the conclusions can only be qualified through further site specific work. For example (and to highlight this point), at GDA it is not possible to assess the AP1000 discharge under the Habitats Directive.

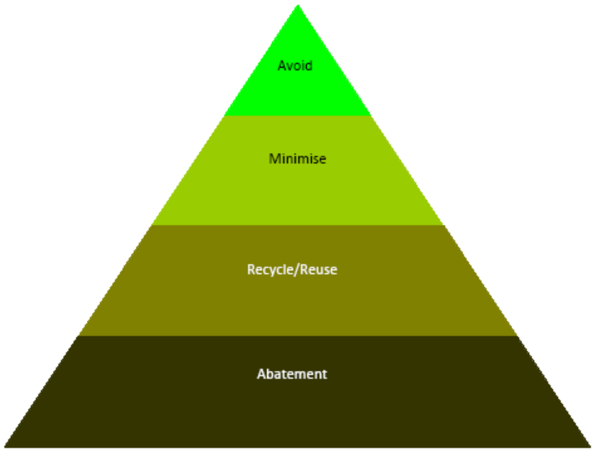
80 The Habitats Directive creates a network of protected areas around the European Union called 'Natura 2000' sites. These sites are found in abundance at various locations around the UK’s coastline and could potentially be affected by new nuclear power station discharges. However, to determine whether a discharge is “relevant” under the legislation we would need to pinpoint it to a particular location. If the discharge were “relevant” we would apply increasingly rigorous assessment stages, ultimately requiring site specific knowledge about how a discharge plume would behave in the receiving water. Detailed dispersion modelling could be required and this is outside the scope of GDA.

81 Westinghouse has identified the need for further site specific work to properly assess potential impacts, particularly those relating to habitats and species. This is consistent with our understanding and is consequently why we have not assessed this matter at GDA.

4.4.7 Consideration of BAT for the production and discharge of non-radioactive liquid effluent

82 Westinghouse set out its approach with respect to BAT in Chapter 3 of the Environment Report. Westinghouse states that its approach to BAT is consistent with:

a) the waste hierarchy of (a) avoid, (b) minimise, (c) reduce / recycle and (d) abatement, shown in ER figure 3.1-1:



b) and with the 4 key BAT management factors for optimisation of releases from nuclear facilities (ERs3.1). These factors, which are set out in the IPPC Directive (EC, 1996) as BAT policy objectives, are as follows:

i) the use of low waste technology;

ii) the efficient use of resources;

iii) the prevention and reduction of the environmental impact of emissions; and

iv) the use of less hazardous substances.

83 Westinghouse state that the BAT policy objectives correlate closely with the waste hierarchy.

84 ER Figure 3.1-2 shows the 15 optimisation factors for nuclear installations that underpin the 4 BAT policy objectives above. In simple terms, the case for BAT can be made based on how compliant a particular process, technique or system is against these optimisation factors.

85 With regard to liquid effluents the Environment Report deals predominantly with BAT for radioactive liquid effluents, but the principles could apply equally to non-radioactive effluents.

86 On the non-radioactive side Westinghouse describe the role of BAT in relation to (a) the choice of cooling water system, and (b) the use of biocide within the cooling water system.

87 Westinghouse state that the use of once through seawater cooling versus cooling towers was considered for the generic coastal site. Westinghouse states that the decision to use once through seawater cooling was consistent with the EU BREF document on BAT for Industrial Cooling Systems. As we mentioned earlier in section 2.3.2, we accept that this approach for coastal sites is not inconsistent with current best practice.

88 Westinghouse has claimed that the use of sodium hypochlorite as a biocide will be minimised by use of BAT in the design of the cooling system. ER Table 4.2-3 provides a list of techniques that may be considered when designing the cooling water system to minimise biocide use. Many of these relate to site specific conditions or operator procedures and therefore we could not readily assess for GDA but they will be

important concerns for site specific permitting. These techniques relate to such matters as:

a) the location of the cooling water intake and outfall points;

b) the design of the intake and cooling system pipework, e.g. materials and coatings;

c) the nature of the dosing regime; and

d) reducing chemical application and using less hazardous chemicals.

89 Westinghouse also note that the re-use of waste heat could be considered BAT to decrease the thermal impact on the receiving water and to optimise overall energy savings. We accept however that this is a site specific matter and may not be viable if dealing with low grade waste heat.

90 We accept that on the whole Westinghouse has considered and demonstrated at a generic level how BAT has been applied to prevent and minimise the production of non-radioactive effluents.

4.5 Conclusion

91 The generic site for the AP1000 reactor in GDA is a coastal site. The key underlying objective of this detailed assessment was to determine whether we could grant a discharge permit for the AP1000 design, subject to any matters that can only be dealt with at the site-specific stage.

92 In order to fully assess the environmental impact of the AP1000 reactor's discharges we require an accurate representation of the behaviour of the receiving waters and of their interaction with the various substances to be discharged. This can only be achieved by computational dispersion modelling, using localised monitoring data – we conclude that this is outside the scope of GDA.

93 Nevertheless, based on our assessment of the information submitted by Westinghouse, we conclude that in principle and without prejudice to our formal determination of an application in due course, we should be able to grant a permit to discharge liquid effluents from the AP1000 reactor to the sea.

94 The predicted discharges of non-radioactive substances from an AP1000 reactor are less than one per cent of any environmental quality standard at the point of disposal to the sea with the exception of biocide used to control fouling, however additional breakdown in the mixing zone around the outlet would be expected to meet the relevant standard, and therefore should be compatible with the Water Framework Directive aim of achieving good ecological and chemical status in the receiving water.

95 There are a number of site specific matters that are outside the scope of GDA and which will need to be addressed by potential Operators at site specific permitting, namely:

a) the impact of the thermal plume (heat) on the receiving environment;

b) the impact of biocide residues on the receiving environment;

c) the consideration of the ecological impacts of the discharge(s), including assessment under the Habitats Directive where applicable;

d) the impact assessment of those substances and metals currently without an EQS;

e) the provision of more accurate predictions of all metals liable to be contained in the liquid effluents to complete a site specific permit application, including details of corrosion products arising from both the primary and secondary circuits and impurities within bulk raw materials.

f) the exact nature of the effluent monitoring regime.

5 Environmental Permitting regulations 2010 (EPR 10): Discharges to groundwater

96 This topic is mainly about preventing any non-radioactive contaminants in liquid streams in the AP1000 reactor from:

a) directly contaminating groundwater; or

b) contaminating land that will then lead indirectly to contamination of groundwater.

Groundwater is vulnerable to contamination and difficult to clean if contamination occurs. It is intimately linked to both surface water and soils, so substances can get into groundwater from either.

97 A permit is required from us for the deliberate discharge of certain substances, to groundwater, with the aim of preventing or limiting pollution of groundwater (Environmental Permitting Regulations 2010 (EPR 10)). You can find more information on EPR 10 on our website: Environment Agency - Environmental permitting. Also guidance is available on groundwater: Environment Agency - Environmental permitting guidance - groundwater

5.1 Assessment Objectives

98 Our assessment was aimed at:

a) Deciding whether an AP1000 reactor might need an EPR 10 permit for discharges to groundwater.

b) Deciding whether pollution prevention techniques used in the AP1000 reactor were adequate to prevent any accidental leaks or spills entering groundwater.

5.2 Westinghouse documentation

99 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4

100 We use short references in this report, for example: ER section 2.7 = ERs2.7.

5.3 Assessment

101 Westinghouse claims that there are no direct or indirect discharges to groundwater from the AP1000 (ERs4.2.1). In that case, an AP1000 should not need to be permitted by us for a discharge to groundwater under EPR 10.

102 Westinghouse lists the following relevant substances (to groundwater under EPR10) as liable to be on an AP1000 reactor site (ER Table 2.9-3/4):

a) hazardous substances: hydrazine, halogenated by-products of chlorination of seawater (for example, bromoform), hydrocarbons (fuel oil) and radioactive substances;

b) non-hazardous pollutants: sodium hypochlorite, metals, phosphates and ammonium hydroxide.

103 Diesel fuel (a hydrocarbon) used by the AP1000 reactor's stand-by generators will present a potential risk to groundwater. We will make sure that storage of fuel complies with the Control of Pollution (Oil Storage)(England) Regulations 2001 and

confirm, by inspection during construction, that any oil handling facilities will prevent any oil leaks or spills reaching groundwater.

104 Westinghouse claims that all AP1000 reactor's chemical storage tanks will be provided with secondary containment (bunds) (ERs2.9.4). Details of the secondary containment are provided in the ER Table 2.9-6. These generally appear adequate but we note that some containment matters are deferred until the site-specific design stage.

105 Westinghouse states that a groundwater monitoring scheme will be developed for each specific site. This would include boreholes and a monitoring programme. This should detect any contaminants that reach groundwater inadvertently. (ERs6.2.2.1) We confirm this is good practice and will work with operators to establish an effective network of boreholes and an appropriate monitoring programme.

5.4 Conclusion

106 We conclude that:

a) the site of an AP1000 reactor should not need to be permitted by us for a discharge to groundwater under the Environmental Permitting Regulations 2010;

b) pollution prevention techniques used in the AP1000 reactor are adequate to prevent any leaks or spills entering groundwater.

6 Environmental permitting regulations 2010 (EPR 10): Combustion plants

107 The Environmental Permitting Regulations (England and Wales) 2010 (EPR 10), cover water discharges and groundwater activities, radioactive substances, waste, mining waste and specified installations.

108 EPR 10 replaced the Pollution Prevention and Control Regulations (PPC) and requires operators of installations containing certain activities to apply for and obtain a permit from us before commencing operations. In relation to the AP1000, combustion activities are relevant:

a) in Part A(1)(a) – where fuel is burned in two or more appliances with an aggregated rated thermal input of 50 MW or more; or

b) in Part B(a) – burning any fuel in a compression ignition engine, with a rated thermal input of 20 or more megawatts (MW), but a rated thermal input of less then 50 MW.

109 You can find more information on EPR 10 on our website: Environment Agency - Environmental permitting. Also guidance is available on combustion activities: Environment Agency - Permitting guidance for combustion activities.

6.1 Assessment Objectives

110 Our assessment was aimed at:

a) Deciding whether an AP1000 might need an EPR 10 permit for combustion activities.

b) If the AP1000 contained an EPR 10 combustion installation, whether we might permit such an installation.

6.2 Westinghouse documentation

111 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4

112 We use short references in this report, for example: ER section 2.7 = ERs2.7.

6.3 Assessment

113 The AP1000 will have two stand-by diesel generators each providing 4 MW of electricity. Westinghouse states that the maximum rated thermal input of each will be 12.9 MW. The aggregate of the two units is therefore 25.8 MW – below the threshold for a Part A EPR activity. Further, the individual units are less than 20 MW and will not fall into Part B. The Operator for a single AP1000 site (the GDA case) will not require an EPR 10 permit for the diesel generators. If more than one AP1000 were to be proposed for one location, the Operator will need to discuss with us the implications for EPR 10 permitting. (ERs4.1.1.2)

114 The diesel generators will require a supply of fuel. The fuel oil storage tanks will need to comply with the Control of Pollution (Oil Storage)(England) Regulations 2001. ER Table 2.9-6 lists:

a) 2 storage tanks of 227 m^3 each in a bund of 250 m^3;

b) 2 day tanks each of 4.9 m^3 in a building with a sump of 2.2 m^3, the Table notes states this will '*be made compliant with UK requirements during site specific design'*, we will require at least 110% of tank volume available as bunding capacity;

c) Tank of 2.45 m^3 in a bund of 9.5 m^3 (this supplies 2 ancillary diesel generators of 80 kW electricity output).

6.4 Conclusion

115 The emergency diesel generators on an AP1000 will not require a combustion activities permit from us.

116 Ingleby Barwick Town council (GDA39) noted that if more than one plant is installed at one site the conclusion may change. We agree but it is a matter for site-specific permitting, also any auxiliary combustion equipment such as boilers would need to be counted to see if EPR 10 applies.

7 Environmental Permitting Regulations 2010 (EPR 10): Waste management

117 Non-radioactive waste management is subject to the requirements of the Environmental Permitting Regulations (England and Wales) 2010 (EPR 10) and / or certain sections of the Environmental Protection Act 1990 (EPA 90) and, where relevant, the Hazardous Waste Regulations 2005. See our website for more information on waste issues and the Duty of Care: Environment Agency - Waste

118 Also regulations came into force in April 2008 which means that any construction project in England costing over £300,000 needs a Site Waste Management Plan: Environment Agency - Site waste management plans

7.1 Assessment Objectives

119 All non-radioactive waste management is subject to the requirements of the Environmental Permitting Regulations and / or certain sections of the Environmental Protection Act 1990 and, where relevant, the Hazardous Waste Regulations 2005. Our assessment was aimed at deciding if Westinghouse's strategy and proposals for non-radioactive waste management are consistent with:

a) the waste hierarchy (EC, 2008);

b) the objective that waste management is carried out without endangering human health and without harming the environment (EC, 2008);

c) the requirement that waste shall not be treated, kept or disposed of in a manner likely to cause environmental pollution or harm to human health (EPA 90);

d) the duty of care in section 34 (EPA 90)

7.2 Westinghouse documentation

120 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4
UKP-GW-GL-054	UK AP1000 Integrated Waste Strategy	1

121 We use short references in this report, for example: ER section 2.7 = ERs2.7.

7.3 Assessment

122 Westinghouse's IWS document outlines its current strategy for managing radioactive and non-radioactive waste produced over the whole lifecycle of the site, including operational and decommissioning activities. The IWS does not include waste from construction activities.

123 Westinghouse states in its IWS that the requirements of the waste management hierarchy are inherent in many aspects of the AP1000 design.

124 Westinghouse's IWS states that the site's integrated management system will address the following:

a) control of activities to prevent and minimise waste arisings;

b) control of waste management activities, which include waste classification and segregation and application of the waste hierarchy;

c) maintain arrangements and equipment required to: minimise waste arising, management of waste, and monitoring and sentencing of waste;

d) check the effectiveness of arrangements and equipment required to: minimise waste arising, management of waste, and monitoring and sentencing of waste;

e) sharing and using good practice across waste streams and projects on the site;

f) sharing and using good practice with other sites;

g) identifying research and technology requirements relating to waste management;

h) identifying competence and skills requirements relating to waste management;

i) managing records and information;

j) managing interfaces with other sites.

125 Westinghouse states in its IWS that the expected volumes of conventional solid waste generated will benefit from good management arrangements together with the features inherent in the AP1000. It states that these features, when combined with best industry practice operating regimes, lead to a reduction in the volumes of conventional waste generated. Westinghouse's strategy for conventional waste arisings is that they are collected and sorted onsite before being transported to appropriate permitted facilities for recovery or disposal.

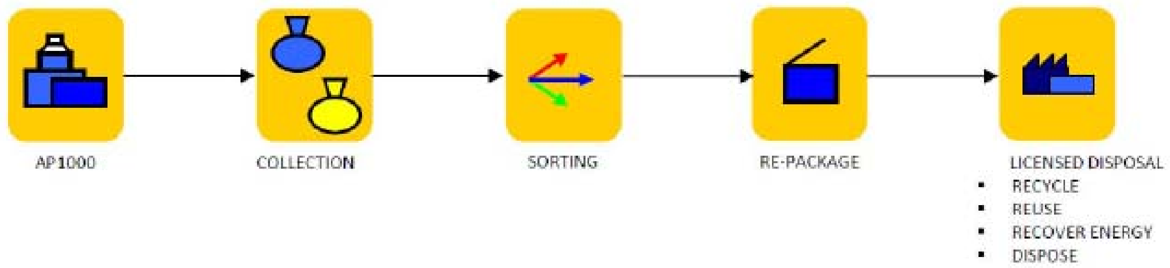
126 The sources of non-radioactive solid waste are summarised in Table 4.3-1 of the ER:

Table 4.3-1

SUMMARY OF MAIN SOLID NON-RADIOACTIVE WASTE PRODUCED BY THE AP1000

Description of Waste Radioactive Waste Classification	Frequency	Normal Volume per Unit Frequency (m^3)	Volume per Life of Plant (m^3)
HVAC filters (fibreglass/metal)	various	various	5209
Battery (lead acid)	Once/20 y	324	630
Lube oil	Once/25 y	79.5	159
Reverse osmosis modules	Once/7 y	15.77	135.2
Electrodeionisation/reverse osmosis filter cartridges	Once/6 months	0.39	45.65
HVAC filters (charcoal)	Once/10y	4.86	29.12
Valve Packing – compressible rigid plastic	Once/5 y	1.14	13.7
Electrodeionisation (resin/membrane module)	Once/12 y	1.34	6.68
Door/hatch gaskets (fibreglass cloth)	Once/60 y	1.16	1.16
Main feedwater pump seals (silicon carbide)	Once/5 y	0.056	0.68
Heat Exchanger gaskets (neoprene)	Once/10 y	0.062	0.37

127 A schematic showing the proposed treatment and disposal of non-radioactive waste is shown in Figure 4.3-1 of the ER:



128 The Health Protection Agency (GDA89) provided the following response: '*The Health Protection Agency notes the EA's proposal to include waste from construction activities in the waste strategy for each site at the site-specific permitting stage. However, in order to do this the EA should ensure that construction does not take place before the permitting process has started. If it is not possible to unilaterally impose this then this aspect may instead need to be addressed through planning controls*.'

129 We have considered this response and therefore, we have removed our assessment finding (from our preliminary conclusion in our consultation document) on this matter. We note that under the provisions of the Site Waste Management Plans Regulation 2008 (SWMPR 08), the future operator shall produce a Waste Management Plan for construction projects with an estimated cost greater than £300,000.

7.4 Conclusion

130 We conclude that Westinghouse's strategy and proposals for the management of non-radioactive waste are consistent with:

a) the waste hierarchy;

b) the Waste Framework Directive objective that waste management is carried out without endangering human health and without harming the environment;

c) the requirement of The Environmental Protection Act 1990 (EPA 90) that waste shall not be treated, kept or disposed of in a manner likely to cause environmental pollution or harm to human health;

d) the duty of care under EPA 90.

131 Future operators will need to produce a site waste management plan for each of their construction projects with an estimated cost greater than £300,000 under SWMPR 08.

8 Control of Major Accident Hazards Regulations 1999 (COMAH)

132 These Regulations aim to prevent and limit the consequences of Major Accidents at over 1,000 installations which use or store significant quantities of dangerous substances, such as oil products, natural gas, chemicals or explosives. A 'Major Accident' could involve an uncontrolled release, fire or explosion, which results in serious danger to human health or the environment. A Major Accident to the Environment (MATTE) would cause severe and / or long-term damage. In England and Wales, responsibility for enforcing COMAH is shared between ourselves and the Health and Safety Executive, working together as a Competent Authority. You can find out more about COMAH and download guidance documents from the website: HSE: Control of major accident hazards (COMAH)

8.1 Assessment Objectives

133 Our assessment was aimed at:

a) Deciding whether an AP1000 would be a COMAH installation.

b) Deciding whether a Major Accident to the Environment (MATTE) would be possible if an AP1000 was a COMAH installation.

8.2 Westinghouse documentation

134 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4
UKP-GW-GL-037	Applicability of COMAH Regulations	1

135 We use short references in this report, for example: ER section 2.7 = ERs2.7.

8.3 Assessment

136 Westinghouse estimated the quantities of chemicals potentially to be stored on the site of an AP1000 and compared to the qualifying quantities of named dangerous substances to which COMAH applies (COMAH (Amendment) Regulations 2005). The most significant chemicals are shown below (from ER Tables 2.9-1/2):

Chemical	Stored quantity (te)	Lower tier threshold (te)	Upper tier threshold (te)
Hydrazine (35% solution)	1.1 (as hydrate)	0.5	2
Hydrogen	0.8	5	50
Petroleum spirits (diesel for back-up generators)	467	2,500	25,000

137 Westinghouse, therefore, states that the site of an AP1000 will become a COMAH lower tier installation because of the expected storage quantity of more than 0.5 tonne of hydrazine hydrate. It should not be an upper tier installation as the inventory is less than 2 tonne. (ERs2.9.2.1)

138 One respondent (GDA39) queried the use of hydrazine when other safer oxygen scavengers are available. We only carried out a basic assessment on information presented in GDA to see if COMAH might be applicable. We expect an operator to present more detailed information, including justification for use of hazardous materials, with their site-specific notification.

139 The Health Protection Agency (GDA89) queried whether all chemicals stored, which fall under the COMAH Regulations had been considered. Westinghouse did provide some information on the hazardous chemicals stored in the AP1000 (ER Tables 2.9-1, 2 and 3). Only hydrazine storage quantities exceeded a COMAH threshold but the risks associated with the others listed will need to be examined with the site-specific notification. The HPA also agreed that a detailed risk assessment will need to be available before operations commence.

140 The operator of a lower tier installation needs to notify the Competent Authority (CA) (ourselves and HSE) and prepare a Major Accident Prevention Policy (MAPP) before starting operations. The operator also needs to be able to demonstrate to the CA that he has taken all measures necessary to prevent Major Accidents and limit their consequences to people and the environment. The notification, MAPP and demonstration will be site-specific matters for the operator, and we have not considered at GDA – our main purpose at GDA was to find out if COMAH would apply.

141 Westinghouse claims that other substances listed in ER Tables 2.9-1/2 are either not hazardous or not stored in sufficient quantity to be considered under COMAH.

142 Hydrazine is used in small quantities as an additive to water in the secondary circuit to consume residual oxygen. Hydrazine is a named carcinogen in the COMAH Regulations – hence the low threshold values – and its main risk is to the workforce.

143 Hydrazine hydrate is a liquid and could have a pathway to the sea in an accident through the site drains. It is classified as dangerous to the environment and is toxic to aquatic organisms. However, its toxicity diminishes with concentration, it is not very bio-cumulable and tends to decompose in the aquatic environment.

144 Westinghouse claims that the following preventative measures will be effective in preventing the accidental pollution of the marine environment with hydrazine (ERs5.4.5):

a) primary containment in steel tank or tote container in turbine hall;

b) secondary containment provided by chemical area containment dyke in turbine hall;

c) spill collection in turbine hall sumps;

d) final barrier is retention in the waste water retention basin;

e) external spills controlled by temporary spill barriers;

f) manual intervention to neutralise spills.

145 Westinghouse claims the above measures make it unlikely that the whole stored quantity of hydrazine (1.1 te) will reach the sea. If hydrazine does enter the sea, then deoxygenation will be the most significant effect. However, Westinghouse believes this would be of a minor, limited spatial extent, for a short duration and local to the release point (ERs5.4.4). We agree with this qualitative risk assessment at this time for GDA. It would appear that a Major Accident to the Environment is highly unlikely from an accident involving hydrazine stored on the AP1000. The operator will need to have a more detailed risk assessment available before site operations commence.

8.4 Conclusion

146 We conclude that:

a) the AP1000 will store hydrazine (a dangerous substance as defined in the COMAH regulations) in quantities exceeding the lower tier COMAH threshold and will, therefore, be a COMAH lower tier installation;

b) the Westinghouse qualitative assessment that a major accident to the environment involving hydrazine is highly unlikely is reasonable. A more detailed risk assessment will need to be provided by the operator before any hydrazine is first stored;

c) the operator should be able to demonstrate that all measures necessary to prevent Major Accidents and limit their consequences to people and the environment have been taken for an AP1000.

147 The above conclusion relates only to the consequences of Major Accidents to the Environment (MATTE) from hydrazine storage. Our partner in the Competent Authority for COMAH regulation, HSE, is responsible for assessing matters relating to impacts on people.

9 EU Emissions Trading Scheme (EU ETS)

148 The scheme is one of the policies introduced across the European Union (EU) to help it meet its greenhouse gas emissions reduction target under the Kyoto Protocol (UN, 1998). The EU has to make an 8 per cent reduction on 1990 levels by the first Kyoto Protocol commitment period (2008 - 2012). The UK Kyoto target is 12.5 per cent. The EU ETS will also contribute to delivering the UK's domestic goal of a 20 per cent reduction in carbon dioxide emissions by 2020.

149 The EU ETS Directive requires all installations carrying out activities listed in its Annex I to hold a greenhouse gas emissions permit. The conditions of the permit will require installations to monitor and report emissions in accordance with the Commission's guidelines for monitoring and reporting. Each year emissions data must be verified, and the equivalent number of allowances surrendered. All transactions and surrendering of allowances take place on a national registry.

150 The Environment Agency runs the scheme for England and Wales. You can find out more on our website: Environment Agency - EU Emissions Trading Scheme

9.1 Assessment Objectives

151 Our assessment was just aimed at identifying whether the AP1000 would be an installation under the EU ETS, that is a combustion installation with a rated thermal input exceeding 20 MW.

9.2 Westinghouse documentation

152 We referred to the following documents to produce this report:

Document reference	Title	Version number
UKP-GW-GL-790	UK AP1000 Environment Report	4

153 We use short references in this report, for example: ER section 2.7 = ERs2.7.

9.3 Assessment

154 As noted above in section 5.3 an AP1000 will have 25.8 MW (thermal) of combustion plant (standby diesel generators) (ERs4.1.1.2).

9.4 Conclusion

155 An AP1000 will be an installation required to hold a greenhouse gas emissions permit.

156 An operator of a specific site will need to obtain such a permit from us before any combustion plant operates.

10 Public comments

157 The public involvement process remained open during our assessment see http://www.hse.gov.uk/newreactors/publicinvolvement.htm

158 We did not receive any public comments by this route during this assessment relating to other environmental regulations.

159 The conclusions in this report have been made after consideration of all relevant responses to our consultation.

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While every effort has been made to ensure the accuracy of the references listed in this report, their future availability cannot be guaranteed.

Abbreviations

AP1000®	AP1000 is trademark of Westinghouse Electric Company LLC.
BAT	Best available techniques
BOD	Biological oxygen demand
C&I	Control and Instrumentation
COD	Chemical oxygen demand
COMAH	Control of major accident hazards regulations
CVS	Chemical and volume control system
CWS	Circulating water system
DCD	Design Control Document
EQS	Environmental Quality Standard
ER	UK AP1000 Environment Report
ERs*.*	Environment Report section reference e.g. 3.2.2.2
GDA	Generic Design Assessment
IWS	Integrated Waste Strategy
JPO	Joint Programme Office
MAPP	Major accident prevention policy
MATTE	Major accident to the environment
MCERTS	Monitoring Certification Scheme
MW	megawatt
MWe	megawatt electric
ONR	Office for Nuclear Regulation, an Agency of the HSE (formerly HSE's Nuclear Directorate)
P&ID	Environment Agency GDA Process and Information Document
PCSR	Pre-Construction Safety Report
PWR	Pressurised water reactor
RCS	Reactor coolant system
RI	Regulatory Issue
RO	Regulatory Observation
SBO	Station black out
SG	Steam generator
SWS	Service water system
te	Tonne
TQ	Technical Query
WEC	Westinghouse Electric Company LLC
WLS	Liquid radioactive waste system
WWRB	Wastewater retention basin
WWS	Wastewater system

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