

**Generic design assessment
UK EPR nuclear power plant design by
AREVA NP SAS and Electricité de France SA**

**Assessment report
Monitoring of radioactive
disposals**



We are the Environment Agency. It's our job to look after your environment and make it **a better place** - for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

Published by:

Environment Agency
Rio House
Waterside Drive, Aztec West
Almondsbury, Bristol BS32 4UD
Tel: 0870 8506506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

© Environment Agency

All rights reserved. This document may be reproduced with prior permission of the Environment Agency.

Generic design assessment

UK EPR nuclear power plant design by AREVA NP SAS and Electricité de France SA

Assessment report - monitoring of radioactive disposals

| | |
|---|---|
| Protective status | This document contains no sensitive nuclear information or commercially confidential information. |
| Process and Information Document¹ | <p>The following sections of Table 1 in our Process and Information document are relevant to this assessment:</p> <p>1.5 – show that the best available techniques will be used to minimise the production of waste</p> <p>2.6 – describe the sampling arrangements, techniques and systems proposed for measuring and assessing discharges and disposals of radioactive discharges.</p> |
| Radioactive Substances Regulation Environmental Principles² | <p>The following principles are relevant to this assessment:</p> <p>RSMDP 13 – Monitoring and Assessment: The best available techniques, consistent with relevant guidance and standards, should be used to monitor and assess radioactive substances, disposals of radioactive wastes and the environment into which they are disposed.</p> <p>ENDP10 – Quantification of Discharges: Facilities should be designed and equipped so that best available techniques are used to quantify the gaseous and liquid radioactive discharges produced by each major source on a site.</p> |
| Report author | Jane Rowe and Rob Allott |

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>

Table of contents

| | | |
|----------|--|----|
| 1 | Summary | 5 |
| 2 | Introduction..... | 5 |
| 3 | Assessment..... | 7 |
| | 3.1 Assessment Methodology | 7 |
| | 3.2 Assessment Objectives | 7 |
| | 3.3 EDF and AREVA documentation..... | 7 |
| | 3.4 Monitoring of gaseous disposals | 8 |
| | 3.4.1 Other issues for monitoring of gaseous disposals | 8 |
| | 3.5 Monitoring of liquid disposals | 9 |
| | 3.5.1 Other issues for monitoring of liquid disposals | 10 |
| | 3.6 Monitoring of solid waste disposals | 10 |
| | 3.7 Compliance with our REPs..... | 11 |
| 4 | Public comments | 11 |
| 5 | Conclusion..... | 12 |
| | References..... | 13 |
| | Abbreviations..... | 14 |

1 Summary

1 This report covers the assessment of the sampling arrangements, techniques and systems proposed for measuring and assessing discharges and disposals of radioactive waste for the EDF and AREVA UK EPR design as required in Table 1 section 2.6 of our process and information document (P&ID) (Environment Agency, 2007). This assessment covers both gaseous and liquid effluents and solid waste disposals.

2 It is noted that much of the requested information has not been provided as the designs have not yet been completed.

3 We did not conclude that the UK EPR utilises the best available techniques to measure and assess radioactive disposals and therefore our conclusion is subject to the following other issue which will need to be addressed during site-specific permitting:

- a) The monitoring of gaseous, aqueous and solid discharges and disposals of radioactive waste.

2 Introduction

4 We expect the design to use the best available techniques (BAT) to measure and assess discharges of radioactive waste to the environment. This will enable any operational UK EPR to:

- a) confirm that discharges are as predicted by the designer;
- b) assess compliance with limits;
- c) provide good quality data for dose assessments.

5 We set out in our P&ID the requirements for a requesting party to provide information. Section 2.6 of the P&ID requires a description of and supporting reasoning for the sampling arrangements, techniques and systems proposed for measurement and assessment of discharges and disposals of radioactive waste. This included whether these are sufficient and adequate to determine all discharges and disposals from the facility at the levels of detection specified in EU Commission recommendation 2004/2/Euratom (EC, 2004) and showing that they represent the best practicable means for such analyses.

6 In this report we assess the techniques EDF and AREVA use in the UK EPR to monitor radioactive disposals. EDF and AREVA submitted their UK EPR design for generic design assessment (GDA) in August 2007.

7 We found that the submission did not contain the level of information we needed to carry out a detailed assessment but EDF and AREVA committed to providing further information. In 2008, EDF and AREVA provided this additional information, a pre-construction environmental report (PCER) with supporting documents.

8 Although the information provided was generally much improved it was still not complete in regard to the monitoring of radioactive discharges and disposals and hence technical queries (TQ-EPR-223 (gaseous) and TQ-EPR-224 (liquid)) were issued. A final revision of the PCER was received in March 2010 which is published along with other documents on their website (<http://www.epr-reactor.co.uk>).

9 The initial submission lacked detail and it became apparent through the responses to Technical Queries that in relation to gaseous discharges, the detailed design of the main stack and the associated monitoring arrangements for the reference EPR are not yet finalised. Also that the height of the stack will be site-specific. In relation to liquid discharges the monitoring arrangements (equipment and procedures) for the UK EPR will not be specified until later stages during site

licensing. Detailed information was not provided on monitoring of solid waste disposals.

- 10 Our findings on the wider environmental impacts and waste management arrangements for the UK EPR reactor may be found in our Consultation Document (Environment Agency, 2010a).

3 Assessment

3.1 Assessment Methodology

11 The basis of our assessment was to:

- a) review appropriate sections of the PCER and its supporting documents;
- b) hold technical meetings with EDF and AREVA to clarify our understanding of the information presented and explain any concerns we had with that information;
- c) raise Regulatory Observations (ROs) and Technical Queries (TQs) where we believed information provided by EDF and AREVA was insufficient;
- d) assess the techniques proposed by EDF and AREVA for the monitoring of radioactive discharges and disposals;
- e) decide on any GDA Issues or other issues to carry forward from GDA.

3.2 Assessment Objectives

12 The assessment considered:

- a) The sampling arrangements, techniques and systems proposed for measurement and assessment of the discharges and disposals of radioactive waste.
- b) The specific nuclides to be monitored and whether systems are adequate to meet the levels of detection specified in EU Commission recommendation 2004/2/Euratom (EC, 2004).
- c) Whether the arrangements represented Best Available Techniques (BAT).
- d) How monitoring proposals compared to our Technical Guidance Notes (TGNs) M1, M11 and M12, and whether any commitment to our MCERTS (Monitoring Certification Scheme¹) was given (Environment Agency, 2010b, 1999a, 1999b and, 2008, respectively).

3.3 EDF and AREVA documentation

13 The pre-construction environmental report is divided into chapters and sub-chapters (provided as separate documents) and has supporting documents. We referred to the following documents to produce this report:

| Document reference | Title | Version number |
|--------------------|--|----------------|
| UKEPR-0003-070 | PCER – Chapter 7 – Measures for monitoring discharges | 01 |
| UKEPR-0003-080 | PCER – Chapter 8 – Best Available Techniques | 01 |
| UKEPR-0007-001 | Monitoring of liquid and gaseous discharges: Prospective arrangements for the UK EPR | 01 |

14 We use short references in this report, for example:

¹ MCERTS is the Environment Agency's Monitoring Certification Scheme. It provides the framework for businesses to meet our quality requirements. If Operators comply with MCERTS we can have confidence in the monitoring of emissions to the environment. You can read about how MCERTS is used to approve instruments, people and laboratories by visiting www.mcerts.net.

a) PCER sub-chapter 6.2 section 1.2.1 = PCERsc6.2s1.2.1;

3.4 Monitoring of gaseous disposals

- 15 Activity concentrations will be determined for tritium, noble gases, iodine and other activation or fission products and carbon-14 and emission rates determined using an average flow rate through the stack for the discharge period. EDF and AREVA state measuring techniques correspond to BAT with some justification given in PCERsc8.4, including broad consistency to Sizewell B methods. Sampling procedures appear reasonable, but lacking information on sampling locations. EDF and AREVA understand the need for isokinetic sampling and stated arrangements implemented to meet ISO 2889:1975². EDF and AREVA committed to determining detection limits, decision thresholds and expression of results in compliance with EU Commission recommendation 2004/2/Euratom, however proposed krypton-85 and carbon-14 limits of detection would not meet required levels (PCERsc8.4 Table 1).
- 16 The UK EPR gaseous effluent treatment system presents some major differences to that currently in place in existing stations. As such it is expected that some of the monitoring activities may be different in the UK EPR (PCERsc7s2.2).
- 17 A technical query was issued to confirm the location and facilities for the monitoring, sampling and flow measurement of gaseous effluent discharges from the UK EPR. Also, at this early design stage, to confirm that the design includes provision for adequate facilities to allow independent monitoring to our required standards. Further, we intend to extend the application of our MCERTS Monitoring Certification Scheme to radioactive discharges in the future (see our Nuclear Sector Plan (Environment Agency, 2009)). Therefore we wished to confirm that the UK EPR design will be able to comply with these future requirements.
- 18 The response to the technical query indicated the detailed design of the main stack and the associated monitoring arrangements for the reference EPR are not yet finalised. Additionally EDF and AREVA state that the height of the stack will be site-specific. Further site-specific verification will be needed on the sample probe locations and compliance of the purchase specifications for devices to meet guidance and MCERTS requirements. (PCERsc7.3s1.1.2).
- 19 The EDF and AREVA response did indicate that there was redundancy built into the systems which would allow for continuity of monitoring and provision of independent samples. Also that installation of sampling and monitoring equipment would take account of engineering rules, regarding space for monitoring operations and maintenance.

3.4.1 Other issues for monitoring of gaseous disposals

- 20 Information is still required on exact locations of the sampling points within the stack. However, from the preliminary information it would appear that, due to probe positioning and location of the monitoring rooms next to the plenum, the sample lines are going to be long as they descend the stack. Although EDF and AREVA state that actual lengths of sampling lines will be determined during implementation studies taking into account ISO2889 recommendations. This information will be required and assessed by us in the site-specific permitting phase.

² Note this standard has been revised in 2010. see ISO 2889:2010. Sampling airborne radioactive materials from the stacks and ducts of nuclear facilities, International Standards Organisation, 2010.

- 21 No information has been provided on upstream and downstream disturbances or location of filtration relative to the sampling points. This information will be required and assessed by us in the site-specific permitting phase.
- 22 EDF and AREVA state calculations show particulate air flow would be already homogenous at 15 m of height, but no evidence was provided. This information will be required and assessed by us in the site-specific permitting phase.
- 23 Little evidence was provided to demonstrate locations will ensure representative sampling (some reference was made to calculations) and little reference made to M1 (Environment Agency, 2010b). This information will be required and assessed by us in the site-specific permitting phase.
- 24 Precision and bias of continuous stack monitoring devices is not known – EDF and AREVA indicated it would be up to the supplier to identify appropriate monitoring equipment. This information will be required and assessed by us in the site-specific permitting phase.
- 25 Reporting is stated by EDF and AREVA to be a matter for the operator.
- 26 The design of the nuclear auxiliary building ventilation system (DWN), in particular flow measurement equipment, is still to be defined and timescales are not indicated. This information will be required and assessed by us in the site-specific permitting phase.

3.5 Monitoring of liquid disposals

- 27 Pre-discharge screens are undertaken for tritium, check of the absence of gross alpha activity, gross beta, gross gamma and gamma spectrometry. Checks are then undertaken on a sample after discharge either taken from the tank before discharge or an aliquot sample representative of all the discharges from the tanks over one period (PCERsc7.3s2.1). Activity concentrations will be determined for tritium, iodines and other activation or fission products and carbon-14 and activity discharged by multiplying by volume discharged. EDF and AREVA state measuring techniques correspond to BAT with some justification given in PCERsc8.4, including broad consistency with Sizewell B. No details provided on how the discharge volume is measured and samples taken, but EDF and AREVA do demonstrate they understand the need for homogenous representative samples in PCERsc7.3. EDF and AREVA committed to determining detection limits, decision thresholds and expression of results in compliance with EU Commission recommendation 2004/2/Euratom (EC, 2004), however proposed tritium limit of detection would not meet the required level (PCERsc8.4 Table 2).
- 28 EDF and AREVA are not proposing to monitor for strontium-90 and also not proposing to seek authorisation for alpha emitters (plutonium-239,240 and americium-241).
- 29 Originally EDF and AREVA were proposing pre-discharge analysis for accounting purposes to take place on samples taken from the storage tank mixing line after homogenisation. EDF and AREVA also propose online monitoring of ongoing discharge which is for check purposes not for accountancy, stating this was in line with French practices. It was unclear whether there would be any sampling during discharge using flow proportional samplers. We regard sampling during discharge using proportional samplers as BAT, and following discussions EDF and AREVA have now stated that flow proportional sampling during discharges will be used for retrospective assessment and statutory reporting.
- 30 EDF and AREVA originally stated that independent sampling arrangements were a site-specific matter, but that the Regulator would be able to take samples on the mixing tank line after homogenisation. Following discussions EDF and AREVA stated in the PCER update sc7.3s2.1.3 that separate flow proportional sampling will

be arranged as required by the Regulator to enable independent samples to be collected.

31 A technical query was issued to confirm the location and facilities for the monitoring, sampling and flow measurement of liquid effluent discharges from the UK EPR.

32 The Environment Agency's Nuclear Sector Plan (Environment Agency, 2009) has the intention to extend the application of the MCERTS monitoring scheme to radioactive discharges in the future and the response to the technical query acknowledges EDF and AREVA will take into account MCERTS, but they have not given any information as to how and if they have considered whether appropriate instrumentation (for example flow meters) are available (PCERsc7.3s2.1.4.1).

33 There are requirements for sampling and monitoring equipment to be protected from the weather and interference by unauthorised personnel and for analysis to achieve ISO17025 (BSi, 2005) and MCERTS accreditation. EDF and AREVA's response stated that sampling is to be carried out in the pumping station, which is in a controlled area, and recognised the need for the laboratory to be accredited so that sampling should meet MCERTS requirements, but EDF and AREVA stated that these would be operator responsibilities (PCERsc7.3s2.2.3).

3.5.1 Other issues for monitoring of liquid disposals

34 Little information was provided on the monitoring equipment and analysis in terms of the minimum specification for detection limit, precision, bias and availability / reliability. EDF and AREVA state they will follow MCERTS requirements. This information will be required and assessed by us in the site-specific permitting phase.

35 Reporting is stated by EDF and AREVA to be a matter for the operator.

3.6 Monitoring of solid waste disposals

36 EDF and AREVA have not provided any detailed information on monitoring of solid waste disposals.

3.7 Compliance with our REPs

37 Our radioactive substances regulation environmental principles (REPs) (Environment Agency, 2010c) were considered in our assessment of EDF and AREVA's monitoring of radioactive disposals (see above). The table below summarises the position in regards to those REPs from EDF and AREVA's submission:

| REP number | REP title | Information in submission |
|------------|------------------------------|---|
| RSMDP13 | Monitoring and assessment | EDF and AREVA state measuring techniques correspond to BAT with some justification given, including broad consistency with Sizewell B. Detail on gaseous sampling locations lacking and how liquid discharge volume is measured and samples taken. Showed understanding of processes. |
| ENDP10 | Quantification of discharges | See RSMDP13. Recognised that the laboratory will have to have suitable accreditations, but given as an operator responsibility. |

4 Public comments

38 No relevant public comments were received on this subject during our detailed assessment stage.

5 Conclusion

39 Section 2.6 of the P&ID requested a description of and supporting reasoning for the
sampling arrangements, techniques and systems proposed for measurement and
assessment of discharges and disposals of radioactive waste.

40 The information provided by EDF and AREVA on the UK EPR design for the
determination of both gaseous and aqueous discharges have been assessed
against the requirements of our Technical Guidance Notes M1, M11 and M12
(Environment Agency, 2010b, 1999a, and 1999b, respectively) and other best
practice for monitoring (e.g. Environment Agency 2008).

41 The process for nuclear new build can be divided in to early design stage, late
design stage, construction / commissioning and operation and it has become
apparent from the information provided that many of the details requested will only
be available at a later stage.

42 The conclusions from this report therefore focus on those matters that need to be
incorporated in the early design stage to avoid costly retrospective correction.

43 As the process moves into late design and construction more information will be
required on the general monitoring facilities, the samplers / instruments used and
measures taken to obtain a representative sample. Then, moving into
commissioning and operations, information will be required on analysis,
maintenance, management arrangements and quality assurance.

44 We have concluded that for the monitoring of gaseous disposals:

- a) BAT has not been comprehensively demonstrated for the monitoring on the UK
EPR gaseous effluent systems. This matter needs to be closed-out by
submission of a BAT assessment at the site-specific permitting phase.
- b) We could not make an assessment on the suitability of the sampling line, EDF
and AREVA say that arrangements may be site-specific. We require sampling
lines to be as short and direct as possible. This matter needs to be closed-out
by submission of appropriate evidence at the site-specific permitting phase.
- c) Evidence has not been provided to back up statements about how
representative sampling would be achieved, therefore we cannot assess
whether the monitoring locations being planned are appropriate. This matter
needs to be closed-out by submission of appropriate evidence at the site-
specific permitting phase.

45 We have concluded that for the monitoring of liquid disposals:

- a) We were unable to assess whether monitoring locations being planned are
appropriate as there was insufficient information in the submission. This matter
needs to be closed-out by submission of a BAT assessment at the site-specific
permitting phase.

46 EDF and AREVA have not provided any detailed information on monitoring of solid
waste disposals. This matter needs to be closed-out by submission of appropriate
evidence at the site-specific permitting phase.

47 Overall, we did not conclude that the UK EPR utilises the best available techniques
to measure and assess radioactive disposals and, therefore we have the following
other issue:

- a) The monitoring of gaseous, aqueous and solid discharges and disposals of
radioactive waste.

References

- (BSi, 2005) General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)
- (EC, 2004) Commission Recommendation of 18 December 2003 on standardised information on radioactive airborne and liquid discharges into the environment from nuclear power reactors and reprocessing plants in normal operation (*notified under document number C(2003) 4832*)
http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/2004_2_en.pdf
- (Environment Agency, 1999a) Technical Guidance Note M11: Monitoring of Radioactive Releases to Atmosphere from Nuclear Facilities, 1999.
- (Environment Agency, 1999b) Technical Guidance Note M12: Monitoring of Radioactive Releases to Water from Nuclear Facilities, 1999.
- (Environment Agency, 2007) 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>
- (Environment Agency, 2008) Minimum Requirements for the Self-monitoring of Effluent Flow Environment Agency, Version 3.2, February 2008.
<http://publications.environment-agency.gov.uk/pdf/GEHO0108BNQA-E-E.pdf>
- (Environment Agency, 2009) Environmental sector plan for the nuclear industry, v2, Environment Agency, July 2009
<http://publications.environment-agency.gov.uk/pdf/GEHO0709BQGI-e-e.pdf>
- (Environment Agency, 2010a). Generic design assessment. UK EPR nuclear power plant design by AREVA NP SAS and Electricité de France SA. Consultation Document.
- (Environment Agency, 2010b) Technical Guidance Note M1: Sampling Requirements for Monitoring Stack Emissions to Air from Industrial Installations, v6, Environment Agency, January 2010.
<http://publications.environment-agency.gov.uk/pdf/GEHO0110BRRO-E-E.pdf>
- (Environment Agency, 2010c) Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation - Environmental Principles (REPs), 2010.
<http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSB-e-e.pdf>

Abbreviations

| | |
|---------------|--|
| BAT | Best available techniques |
| DWN | Nuclear auxiliary building ventilation system |
| GDA | Generic design assessment |
| MCERTS | Monitoring Certification Scheme |
| P&ID | Process and information document |
| PCER | Pre-construction environmental report |
| PCERsc3.3s4.1 | PCER sub-chapter 3.3 section 4.1 (example reference) |
| REPs | Radioactive substances regulation environmental principles |
| RO | Regulatory observation |
| TQ | Technical query |

Would you like to find out more about us, or about your environment?

Then call us on

08708 506 506* (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)

floodline 0845 988 1188

***Approximate calls costs: 8p plus 6p per minute (standard landline).
Please note charges will vary across telephone providers**



Environment first: This publication is printed on paper made from 100 per cent previously used waste. By-products from making the pulp and paper are used for composting and fertiliser, for making cement and for generating energy.