

UK ABWR

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UK ABWR Generic Design Assessment

Generic PCSR Sub-chapter 20.7 : Dose Assessment for Public from Direct Radiation



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20.7.1 Scope

Direct radiation from buildings containing radioactive substances, such as the reactor, turbine, radioactive waste buildings and so on, may lead to external exposure of the public. Also in this case, adequate shielding, distance and minimisation of radioactive sources keep the dose through direct radiation to the public ALARP.

The scope of this sub-chapter is to provide regulatory requirements related to exposure to the public and to summarise the dose assessment for the public by direct radiation from all radioactive sources on the site. This is considered in Operation Condition I.

The turbine building is one of the largest buildings on-site that contains radioactive material and is considered to be the significant contributor to direct radiation off-site. This contribution is provided in GEP document "Prospective Dose Modelling" GA91-9901-0026-00001; HE-GD-0005 Rev.D in Step 2.

Other ancillary buildings, such as interim spent fuel and radioactive waste storage, may contribute to direct radiation. Direct radiation from all sources will be addressed in a Topic Report of this sub-chapter in Step 3.

In addition, it will be demonstrated that external exposure to the public from direct radiation during Operation Condition I is ALARP in Step 3.

Dose assessment for the public during design basis accidents and severe accidents is discussed in PCSR Chapter 24 and 26, respectively.

20.7.2 Regulatory Requirements for the Public Off-site Dose

The Office for Nuclear Regulation (ONR) regulates off-site doses received as a result of direct radiation from sources on the site. The Environmental Agency (EA) is responsible for regulating off-site doses resulting from radioactive discharges.

The Ionising Radiation Regulations 1999 (IRR99) [Ref-1] and supporting Approved Code of Practice provide the framework for the radiation protection of workers and the public involving ionising radiation. They include a duty to keep exposures as low as reasonably practicable (ALARP) and among other requirements set limits on exposures.

Euratom Basic Safety Standards Directive provides the Council Directive 2013/59/Euratom [Ref-2] taking into account the 2007 Recommendations of the International Commission on Radiological Protection (ICRP Publication 103) [Ref-3].

For individual members of the public the effective dose limit is 1 mSv/y.

The ONR sets numerical targets in its Safety Assessment Principles (SAPs) for nuclear facilities, – the Basic Safety Level (BSL) and the Basic Safety Objective (BSO) - for judging whether radiological hazards are adequately controlled and risks are ALARP.

For doses to any person off site from sources of ionising radiation originating on the site the BSL is set at 1mSv/y, which is the IRR99 legal dose limit. The BSO is set as 0.02 mSv/y; a level appropriate for new facilities designed to modern standards.

Table 20.7-1: Effective Dose Criterion to be used in the Assessments

| Dose | Dose Criterion |
|------------|--|
| 1.0 mSv/y | This is the UK public annual dose limit (Basic Safety Level Legal Limit: BSL LL) as defined in the Ionising Radiations Regulations 1999 (IRR99). |
| 0.02 mSv/y | This is the Basic Safety Objective (BSO) defined by the ONR for any person off the site during normal operation of a facility. |

20.7.3 Dose Assessment for the Public from Direct Radiation

The dose assessment for the public of direct radiation resulting from the turbine building is discussed in GEP "Prospective Dose Modelling" GA91-9901-0026-00001; HE-GD-0005 Rev.D in Step 2.

Dose rate to the public from direct radiation from all sources during Operation Condition I will be calculated in Step 3 based on following considerations:

- (1) Radioactive concentration for each radioactive source (this is associated with RO-ABWR-0006 Source Terms)
- (2) Geometry such as layout and size of radioactive sources and the buildings
- (3) Density and composition of shielding materials, gamma ray energy, computer codes and so on

The calculation results will be explained in a Topic Report of this sub-chapter in detail.

20.7.4 References

- [Ref-1] The Ionising Radiations Regulations, 1999 No. 3232, Statutory Instrument
- [Ref-2] The Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom
- [Ref-3] The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann ICRP, 37, 2-4. ICRP (2007)