Environment Agency

Evidence

Cooling Water Options for the New Generation of Nuclear Power Stations in the UK Project summary SC070015/SR3

Direct (once-through) cooling may be the best option for nuclear power stations to be built in the UK, according to a report by the Environment Agency.

Cooling water is required to remove heat from power stations regardless of whether the stations are nuclear or conventional: a 1,000 megawatt electric (MWe) power station typically rejects up to 2,000 megawatts of low-grade heat. The report explains how and why this so-called “waste heat” arises and gives an overview of cooling methods used by power stations in the UK and abroad. These include direct cooling from lakes, rivers and the sea; indirect cooling using natural or mechanical draught towers (these may be wet, dry or hybrid) and dry (air) cooling.

The report reviews factors affecting the choice of cooling method and the environmental costs associated with each option. Direct cooling generally is the most thermally efficient (MWs generated per unit of fuel) but potentially has the highest impact on the local (aquatic) environment, whereas air-cooling has the lowest thermal efficiency and probably the lowest local environmental impact; tower-cooled stations are intermediate in efficiency and impact.

The report examines the environmental issues associated with water abstraction at cooling water intakes and its discharge. Effects include fish and invertebrate impingement on filter screens and the entrainment (passage) of plankton and of larval and juvenile fish through the system where they encounter pressure and thermal changes and possible exposure to anti-fouling biocides. In addition, thermal, chemical and radionuclide pollution are discussed, as well as the dispersal of droplets from cooling towers. The report also discusses mitigation measures, such as ‘fish friendly’ intakes and screens designed to recover fish and return them to the waterway; and ways of minimising biocide use.

The report evaluates the various cooling options in terms of environmental concerns (including water demand and energy efficiency) and assesses the best options for different water environments (coastal, estuarine and fresh waters). Effects of climate change on the choice of cooling water options are also briefly considered.

It is likely that new UK nuclear stations will be built on coasts or estuaries. A key question is whether direct cooling is the best available technology (BAT) for large coastal and estuarine power stations, as set out by the European Commission. This report concludes that, despite the environmental issues, direct cooling may be the best option for estuarine and coastal sites, provided that the highest standards of planning, design and mitigation are followed.

Nevertheless there may be sites where, even using the best direct cooling technology, the potential impacts on the environment would be unacceptable. In these cases, seawater cooling towers would be the best alternative. Dry cooling methods (air-cooled condensers and dry towers) should be used only where water is in extremely short supply.

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