

Winfrith Site

Application to Environment Agency for on-site disposal of solid radioactive waste and deposit for recovery of non-radioactive waste at the Steam Generating Heavy Water Reactor and the Dragon Reactor

Non-technical summary of applications

Nuclear Restoration Services (NRS) is submitting applications to the Environment Agency (EA) for the demolition, infilling of below ground voids, and capping of the Steam Generating Heavy Water Reactor (SGHWR) and the Dragon reactor. This is part of a site wide programme to complete facility and infrastructure decommissioning and achieve a site end state of heathland with public access; an end state agreed with stakeholders through community engagement over the past 10 years. The Winfrith site will be the first NRS site to reach its end state. Figure 1 shows the Winfrith site location and the reactor locations on site.



Figure 1: Location of Winfrith in the U.K. and the reactors on the site

The preferred approach for the final stages of decommissioning includes management of demolition wastes on the site. On-site management of wastes requires permission from the Environment Agency. This nontechnical summary supports applications for Environmental Permits to carry out waste activities at the Winfrith site.

A planning application, with supporting Environmental Statement, will be submitted to Dorset Council alongside the applications for Environmental Permits.

The operator of the Winfrith site is NRS, a wholly owned subsidiary of the Nuclear Decommissioning Authority (NDA) which owns the site. NRS is responsible for safely decommissioning nuclear power and research sites across the UK.



Why our work matters

At Nuclear Restoration Services (NRS), we are dedicated to the safe, secure, and sustainable decommissioning and restoration of nuclear sites. Our mission extends beyond merely dismantling reactors; we aim to create a positive legacy for future generations and bolster resilient local economies.

Transforming Winfrith for the future

The decommissioning and restoration of the Winfrith site is set to be the first of its kind in the UK. Our approach not only considers the technical challenges but also places a strong emphasis on the community and environment. By restoring the site to heathland, we're creating valuable habitats for local wildlife and providing amenity value for the local community. The decommissioning and restoration of the site will be a world leading example in sustainable decommissioning that is built on the views of the local community. Restoration of the site will support development of valuable and rare habitats that are unique to Dorset.

The Winfrith site operated nine nuclear reactors, numerous laboratories and support facilities between 1959 and 1992. The site started decommissioning works in the 1990s and seven nuclear reactors, all the laboratories and most ancillary facilities have been decommissioned. Much of the original land area for the site has been successfully released for reuse.

The remaining structures on the site, including the SGHWR and Dragon reactors, are in the final stages of decommissioning. Currently, the reactor cores are being removed ahead of packaging and transfer to an off-site storage facility. Following removal of the cores, concrete floors and walls with low level radioactive contamination will be the only material remaining below ground.

The environmental agencies have produced guidance that sets out the options and requirements for management of radioactive waste in the final stages of decommissioning (hyperlink: <u>sepa.org.uk/media/365893/2018-07-17-grr-publication-v1-0.pdf</u>). Therefore, regulatory permissions will be required for the proposed waste activities at SGHWR and Dragon:

- Leaving radioactively contaminated structures in the ground will be regulated by the EA as a type of onsite radioactive waste disposal, termed "in-situ disposal". Filling the sub-surface structures with radioactive waste is termed "disposal for a purpose". If approved, this will be a variation (amendment) to the site's existing Environmental Permit granted by the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016 (EPR16);
- The use of non-radioactive waste in filling sub-surface structures is termed "deposit for recovery" and a new environmental permit application will also be submitted to allow this.

This non-technical summary relates to both permit applications.



Why is on-site waste disposal preferred at Winfrith?

NRS, and its predecessor organisations RSRL and Magnox, have undertaken 10 years of assessment to determine the preferred approach to managing the sub-surface concrete structures at SGHWR and Dragon. These assessments have included input from the local community into decision making and detailed risk assessments.

The preferred approach for managing these structures has been identified as leaving the large sub-surface concrete structures in place and backfilling with concrete blocks and concrete and brick rubble from demolition. The structures are contaminated with very low levels of radioactivity that can be safely managed in-situ. Managing the waste on-site is preferred because:

- It can be achieved safely whilst allowing reinstatement of heathland habitats that provide biodiversity value. Safety can be demonstrated through many scenarios including climate change;
- It minimises road transport on local roads (a particular concern for local residents), and therefore it minimises the impact on local communities and the size of the carbon footprint from decommissioning;
- It minimises impacts on protected heathland habitats;
- It minimises cost to taxpayers from decommissioning the UK nuclear liability.

Figure 2 summarises the overall benefits from on-site waste management that apply at Winfrith.





Figure 2: The benefits of on-site management of wastes from decommissioning

What are NRS applying to do?

The volume of the SGHWR disposal, including the sub-surface structures left in-situ and the sub-surface voids amounts to approximately 40,000 m³ (equivalent to about 16 Olympic-sized swimming pools), with a maximum depth of approximately 16 m below ground level. After backfilling the sub-surface voids with blocks and rubble, an engineered cap will be placed on top of the disposal, thereby providing long-term protection. Local soil will be used to cover the SGHWR cap to support re-growth of local habitats, Figure 3.

Figure 3: SGHWR before and after demolition and achieving its end state





The volume of the Dragon disposal, including the sub-surface structures left in-situ and the sub-surface voids amounts to approximately 9,000 m³ (equivalent to more than 3 Olympic-sized swimming pools), with a maximum depth of approximately 11 m below ground level. Again, after backfilling the sub-surface voids with blocks and rubble, an engineered cap will be placed on top of the disposal, thereby providing long-term protection, Figure 4.

XISTING VIEW



ROPOSED VIEW

Safety and environmental protection

Before granting such permissions, the EA will need to be satisfied that the proposed on-site disposals and recovery activities will not prevent the site from being released from regulatory control after all decommissioning work at the site is completed. Guidance from EA and other UK environment agencies states:

"Our **fundamental protection objective** is to ensure that a nuclear site is brought to a condition at which it can be released from radioactive substances regulation, through a process which protects the health and interests of people and the integrity of the environment, both during the period of regulation and afterwards, and which inspires public confidence and takes account of costs".

To demonstrate the safety and regulatory compliance of the proposals, NRS is submitting to the EA a "sitewide environmental safety case," supported by a range of technical reports. The application includes cautious assessments of the potential risks of the proposed disposals on people and the environment, extending from the near term into the far future. Here "cautious" means erring towards over-estimating the potential impact.

The contaminants will be contained in the disposals for hundreds of years and, even when the structures slowly degrade, the concentrations of contaminants that might be released into the environment are much lower than regulatory levels that ensure public and environmental safety. Consequently, the potential impacts on people and the environment from the disposals will be significantly less than impacts from the background substances that people are exposed to in their everyday lives.

The technical assessments address how the disposals will behave over a long timeframe and through a range of climate change scenarios to assess any risks to humans and the environment. Figure 5 shows the comparisons of the estimated radiation doses from farming and leisure use on the restored site compared with other routine activities, expressed as an equivalent amount of bananas, as they contain naturally occurring radioactive material in the form of potassium-40.

Figure 4: The Dragon reactor before and after demolition and achieving its end state



Figure 5: Comparison of estimated radiation doses to a range of routine scenarios, including the amount of radioactive material found in bananas

Levels of radioactivity	Value per year	Units (mSv)*	Equivalent dose of radioactive material in bananas
Farming and leisure use of Winfrith site (preliminary results from the Steam Generating Heavy Water Reactor assessment)	0.000001	mSv	Equals eating 0.01 of a banana
Levels of radioactivity	Value per year	Units (mSv)*	Equivalent dose of radioactive material in bananas
🕑 150 g banana	0.0001	mSv	Equals eating 1 banana
Dental x-ray	0.005	mSv	Equals eating 50 bananas
Chest x-ray	0.014	mSv	Equals eating 140 bananas
Transatlantic flight (London to New York)	0.08	mSv	Equals eating 800 bananas

*Sievert (mSv) is a unit used to measure the radiation dose to the human body. The larger the value expressed, the larger the effects of radiation to which the body is exposed. (1/1000th is a mSv).

The site-wide environmental safety case demonstrates the overall safety of the proposed disposals and that the "fundamental protection objective" will be met.

What happens if permissions are granted?

Plans for the timing of the demolition of the reactors continue to be refined as part of the overall site decommissioning programme, but the expectation is that the work to complete the Dragon reactor disposal is likely to commence in the late 2020s, while the SGHWR disposal should begin in the 2030s, with the work taking two to three years each to complete.

Other facilities currently remaining on-site will be decommissioned and demolished to 1 metre below ground level. Site drains will be decommissioned to reinstate the natural water balance on-site. Tarmac topped roads, paths and site fencing will be removed once all works on site are complete and the site is safe for public access. Figure 6 shows the decommissioning roadmap.

Off-site structures are also being decommissioned as part of the site restoration work, including the fresh water reservoir at Blacknoll and the Sea Discharge Pipeline which runs from site to the coast. The Blacknoll reservoir will be filled with soil and made safe, whilst the Sea Discharge Pipeline, which will contain minor levels of radioactive contamination, will be excavated and removed for disposal elsewhere.

A significant percentage of the site is designated as protected habitats, and this will continue into the future. Where decommissioning is to be completed, land will be landscaped to encourage habitat regeneration. NRS will continue to manage the site for several decades after the disposals have been made to ensure they perform as expected and in line with the EA's regulatory requirements. This period of time is called 'stewardship'.

All of this work will deliver a land use of heathland, that supports the development of biodiversity and protects habitats, whilst allowing public access.



Figure 6 – Winfrith End State Delivery Roadmap





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