Radiological **Protection**

Radiation is all around us, occurring naturally in everyday objects, from the soil beneath us and from space above us. AWE is responsible for keeping exposure to radiation from the materials we work with as low as reasonably practical to protect the environment, our employees and the public.

Why radiological protection is necessary

AWE employs expert radiation protection advisors and health physicists, whose job it is to provide advice on protecting people from radiation. They ensure the company remains compliant with all relevant radiation protection legislation, and we strive to be industry leaders.

Types of radiation

There are many types of radiation, with the most common being: alpha particles, beta particles, gamma rays, X-rays and neutron radiation.

Alpha particles are most hazardous if inside the body, but they can be stopped from entering the body by the skin or a piece of paper.

Beta particles are less hazardous, but can also be harmful if inside the body.

Gamma and X-rays are electromagnetic (EM) waves and although less hazardous, can travel through most materials and require special shielding.

Neutron radiation is another form of ionizing radiation. The level of hazard is dependant on the energy, but like gamma, can travel long distances and requires special shielding.

Radioactivity in any material is measured in Becquerels. Radiation deposited in the body is measured in sieverts. A thousand millisieverts (mSv) is a sievert.

We deal with three main radiological materials at AWE.

Plutonium is a man-made element and poses the most significant health risk if inside the body. The primary hazard is the alpha radiation produced, but plutonium also produces gamma and neutron radiation.

Uranium is a heavy metal which is widely found, naturally occurring in the environment. Low levels of uranium can be found within most rock, soils and water. Uranium is not as hazardous to the body as plutonium. Apart from its radioactive properties, uranium is also chemically toxic as a heavy metal poison.

Tritium is a form of hydrogen but unlike hydrogen it is radioactive. It emits weakly penetrating radiation in the form of beta particles. Being only weakly radioactive, tritium is only considered to be hazardous at high concentrations.

The levels of exposure to radiation at AWE are typically very low. Public exposure to radiation as a result of AWE's discharges is less than 0.001 mSv. The UK average annual background radiation dose is 2.7 mSv.

Protecting our staff and the public

AWE is regulated by the Office for Nuclear Regulation, the Environment Agency and other agencies on how we handle and dispose of our radioactive materials.

AWE employees, the public and environment are protected using many layers of protection, much like the layers of an onion. If any one layer were to fail - there are many more levels of protection to restrict exposure.

Environmental Protection and **Monitoring**

AWE controls and monitors discharges of radioactive waste to the environment. One of the key pieces of legislation that applies to AWE sites in this area is the Environmental Permitting Regulations, which cover not only activities associated with radioactive substances but also other activities with the potential to harm the environment such as land filling.

Why this is important

When issuing permits for the discharge of radioactive waste to the environment, the Environment Agency ensures that exposure of any member of the public to radiation does not exceed dose limits.

The permit specifies what we are allowed to dispose of as well as where we are allowed to dispose of waste. There are also annual limits on our disposals as well as notification levels, which require us to inform the Environment Agency if we exceed them.

Our own dose limits are far lower than those stipulated by our regulators.

Disposal routes

AWE is permitted to discharge radioactive waste into water and air.

AWE disposes into water through the trade waste treatment plant, liquid effluent treatment plant and the North Ponds water management system.

The company disposes into air via authorised airborne discharge points known as 'stacks.'

In addition to staying within the limits, AWE also uses best available techniques and further reduces radioactive waste as part of our responsibility to the public and the environment. This includes further control measures to concentrate and contain the contamination.

How we monitor our discharge levels

Air is generally sampled as it is released via the stacks.

Water that is discharged from the liquid effluent treatment plant is monitored before it is released. We also collect samples from the holding tanks at North Ponds prior to discharge to the Aldermaston stream. We conduct comprehensive environmental monitoring. This includes air samplers at nine locations off site, soil and vegetation sampling on site and at five locations off site, and local milk sampling and groundwater sampling.

The annual dose level from discharges at AWE Aldermaston and Burghfield is currently less than 0.001 mSv. Comparatively that is one fifth of the dose impact of eating 135g of Brazil nuts.

The below table shows some examples of common radiation doses compared to AWE dose limits.

135g of Brazil nuts if eaten	0.005 mSv
Chest x-ray	0.02 mSv
Transatlantic flight	0.07 mSv
AWE investigation level (staff)	0.25 mSv
CT scan of the head	1.4 mSv
UK average annual radiation dose	2.7 mSv
Average annual radon dose living in Cornwall	7.8 mSv
AWE dose limit (staff)	10 mSv
Whole body CT scan	10mSv
Annual UK exposure limit for employees	20 mSv