

# Radiation and Nuclear Waste

# 6

## Starting Point

What is nuclear waste? Where does it come from? Is it something that you should know about? Did you know that nuclear waste exists in countries such as France, America, Russia, Britain, Korea, and many more?

Some of you may have heard about radiation and nuclear waste, and you will certainly hear more as old nuclear power stations are being closed down and plans to build new, more efficient ones are taking shape. That is because **nuclear power stations**, which **generate electricity**, create **nuclear waste** as well. **Nuclear waste is radioactive.**



## QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ QUIZ

Take the quiz to see what you know about nuclear waste.

True or False?

1. Nuclear power stations give off Carbon Dioxide by burning fuels, and so speed up global warming.
2. Nuclear waste made now will still be dangerous in thousands of years' time.
3. Nuclear waste can be washed off pretty easily if you get some on you.
4. Nuclear waste is only a problem if you breathe it in.
5. "**Radioactive**" means dangerous invisible particles or waves of energy fly off the waste as it decays.
6. Nuclear waste is stored in barrels and looks like bright green goo.

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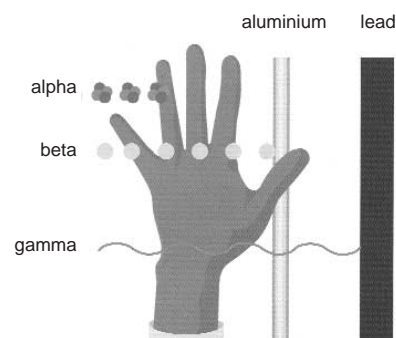
But nuclear waste doesn't just come from nuclear power stations. You get it from using some machines in hospitals, and from experiments in university laboratories, among other places. But what is it?

It is material that falls apart, by itself. Imagine a hunk of metal that shoots off **invisible energetic particles**, or dangerous **waves of energy**. That's what nuclear waste does. Don't worry! Only certain types of material do this, and it's all carefully looked after. How it's looked after is what we're coming to!

Nuclear waste can give off 3 types of **radiation**. These types of radiation are dangerous types of radiation, called **ionising radiation**, which can change the cells in your body so they don't work. This can cause diseases like cancer.

Anything that gives off ionising radiation is called **radioactive**.

The 3 types of radiation that nuclear waste gives off are called **alpha radiation**, **beta radiation** and **gamma radiation**. You can stop each one, but you need different things to do it. The diagram below shows you what stops each.



### Is all nuclear waste very dangerous?

In Britain, only 1% of nuclear waste is the most dangerous kind - called **High Level nuclear waste**. High Level nuclear waste is the most radioactive type of nuclear waste but it is not created in nuclear power stations. High Level Waste is created when you recycle nuclear fuel, after it has been used in a nuclear power station. Used fuel can be recycled and re-used in a nuclear power station.

High Level nuclear waste is ground down and put into a special, molten glass, then stored.

**19%** of nuclear waste in Britain is **Intermediate Level nuclear waste**. This is far less radioactive than High Level nuclear waste. This kind of waste is the old casing around nuclear fuel, and the sludge from nuclear power stations.

# Task 1

There is a symbol that warns of things that are radioactive. Find out what it is, and draw it on your answer sheet.

At Sellafield, in Cumbria, there are two plants where this sort of waste is put into stainless steel drums, which are then filled with cement. These drums are then lidded, washed and monitored before being placed into a special above-ground storage.

**80%** of all nuclear waste is **Low Level nuclear waste**, and it is only slightly radioactive. It includes things like protective clothing, laboratory equipment, paper towels and gloves that have been used in research labs, in hospitals or at nuclear power stations.

In England, this low level nuclear waste is treated at the **Waste Monitoring and Compaction Plant - WAMAC**. This waste is placed inside drums which are monitored and then compacted down to a quarter of their original size.

These drums are then called “**Pucks**”. These pucks are taken, usually on train, to the national Low Level Waste repository near the village of Drigg in Cumbria. At the repository, the freight containers from the trains are filled with cement before being placed into a purpose-built concrete lined vault. When a vault is full it is capped with a waterproof membrane and landscaped.

The majority of waste disposed of at Drigg is from Sellafield. The rest comes from hospitals, universities, research establishments and industries around the UK.



Nuclear waste store at Drigg in Cumbria.

## Task 2

Research what environmental groups such as Greenpeace think of nuclear power. What do they think is the answer?

Why do you think some people might support nuclear power?

## Task 3

Conduct a survey to see what people you know think about nuclear power and nuclear waste. Do they think the UK should be using nuclear power? Do they know of the problems with nuclear waste? Do they think it's worth it?

## “ THE DEBATE ”

Nuclear power stations produce Intermediate Level nuclear waste. This type of nuclear waste contains higher amounts of radioactivity than Low Level and so requires shielding. At the moment the UK has not agreed what should happen with Intermediate Level nuclear waste in the long term. Internationally the preferred approach is to put Intermediate Level nuclear waste into an engineered repository deep underground. However, if this is the option chosen by the Government for the UK, we will have to decide where the repository should be built.

Until it is decided, one option for storing Intermediate Level nuclear waste is for it to stay on site in an existing building when a nuclear power station is decommissioned (dismantled), such as the reactor buildings, or in a newly built Intermediate Level storage facility.

Some people think that nuclear power shouldn't be used at all because of the problem of disposing of nuclear waste. But then some people say that without it, we will never be able to produce enough electricity and nuclear waste can be disposed of safely.

# o p i n i o n

Below are 4 sources that tell you about the issues in this module, or give you different opinions on those issues. They may help you in your own summary.

## **Source 1**

'Radiation Education Resources for Ohio is a set of 39 factsheets written by a team at the Ohio State University(OSU) to provide citizens with information on low-level radioactive waste. The fact sheets are designed to present accurate, researched-based information that will help Ohio's citizens and their elected officials to participate confidently and competently in discussions and decisions related to low-level waste.

The team which produced the fact sheets consisted of faculty and graduate students from both the OSU Nuclear Engineering program and OSU Extension. Each fact sheet was reviewed by more than 20 people with different levels of education and areas of expertise. Reviewers with widely differing points of view were selected.'

**From an Ohio State education service (USA).**

[www.ag.ohio-state.edu](http://www.ag.ohio-state.edu)

## **Source 2**

### **Time and Half-Life**

Radioactive material loses its radioactivity naturally. The time it takes for a radioactive substance to halve its level of radioactivity is called its half-life. Iodine 137 is radioactive but has a half life of only 20 seconds. Uranium 238 on the other hand has a half-life of 4,500 million years.

Because radiation can be harmful to living things, and because some radioactive substances are radioactive for huge spans of time, it is not surprising that care and caution are required on all aspects of the use and safety of these substances.

It is generally considered that after 10 half lives the level of radiation has decreased to an insignificant amount. This fact is helpful in deciding how to deal with spent nuclear fuel and other forms of radioactive nuclear waste.

**From Beyond U235 - British Nuclear Group educational magazine.**

## **Source 3**

### **1Km underground**

Storage vaults dug thousands of feet underground are the best place to store nuclear waste according to Government advisers. At least one repository costing around £10 billion would be needed to cope with current levels of nuclear waste in the UK. If new nuclear power stations are built there would be a need for more.

The Committee For Radioactive Waste Management in the UK warned that the Government would have to compensate residents near storage sites and that the sites should not be imposed on communities but should only be built near communities where they are accepted voluntarily. In return for agreeing to host these underground stores communities should be rewarded, not bribed, with new rail links, roads, libraries, schools and hospitals.

The vaults would be built (3,300ft) underground and construction of the first would take 39 years. It would provide a space five times the size of the Albert Hall in London.

**Committee on Radiation Waste Management (CoRWM)**

[www.corwm.org.uk](http://www.corwm.org.uk)

# o p i n i o n

## Source 4

### Dumping Nuclear Waste

Shocked campaigners have revealed that Thoresby Colliery has been earmarked as a possible nuclear waste dumping ground. With the Government looking to build a new generation of nuclear power stations across the country, experts admit that the geological reasons that made Thoresby suitable as a dumping ground 20 years ago remain the same today.

Greenpeace fears that the controversial new energy policy could quadruple the amount of nuclear waste created and had dubbed the plan a potential time bomb.

“There is no failsafe way to deal with nuclear waste,” said a local campaigner. “Dumping it underground simply creates an environmental time bomb for our children and grandchildren.”

### From a local news website

[www.mansfieldtoday.co.uk](http://www.mansfieldtoday.co.uk)

# Main Task

Write an essay on *Radiation and Nuclear Waste*. Split it into several parts:

Do an *Introduction*. This should be a brief section about what nuclear waste is, and where it comes from.

Next, do a section on how we deal with it at the moment, and any ideas you found for the future.

Then do a *Debate* section comparing the people who say we should use nuclear power and deal with the waste, and the people who say we shouldn't use nuclear power at all. Who gives the best reasons?

Lastly, finish off with a *Conclusion*. This should be a little summary of the debate, and then a section on what you think and why.

## More Sources of Information

Although there are lots of articles here, they won't be enough to tell you everybody's opinion. Have a look at some more places to find more information. Some places you could look:

**Google key phrases:** Radiation and Nuclear Waste, Nuclear Energy, Nuclear Power, Radioactive Waste.

## And finally...

Look again at the Quiz you did at the start of this module. Have any of your answers changed? Don't worry if they have - that's what your research was for.

How did you do? Find out at the end of this booklet...

**Quiz Answers**  
1. **False.** Although Carbon Dioxide is produced during construction, operating nuclear power stations don't produce it. So nuclear power can actually help prevent climate change by taking over from fossil-fuel burning power stations.  
2. **True.** At the moment the UK has not agreed what should happen with Intermediate Level nuclear waste in the long term.  
3. **False.** Nuclear waste radiates dangerous particles and waves of energy. The most dangerous will pass straight into you and alter your body's cells.  
4. **False.** Some types of radiation from nuclear waste are only dangerous if you take them into your body. But other types are dangerous even if you don't breathe them in or swallow them.  
5. **True.** Radiation is invisible - but that doesn't mean it's not there!  
6. **False.** Radioactive materials that produce nuclear waste tend to be dull-coloured metals. The green goo is a common mistake. Near the beginning of the 20th Century, radioactive materials were used to light up watches. The particles would shoot off the material and hit a special substance that would glow green when it got the energy from the particles. So it wasn't the radioactive material glowing at all!

**QUIZ**

Your answers: Is it true or false?

1.                      2.                      3.                      4.                      5.                      6.

**TASK 1**

The "Radioactive symbol"

**TASK 2**

What do Greenpeace think of Nuclear Power and Nuclear Waste? What is their alternative?

Who might support nuclear power stations? Why?

**TASK 3**

Nuclear Power and Nuclear Waste Survey

Name	Should the UK build more nuclear power plants? Why/why not?	Do you know what the problems of nuclear waste are? Do you have an opinion on what to do with it?