

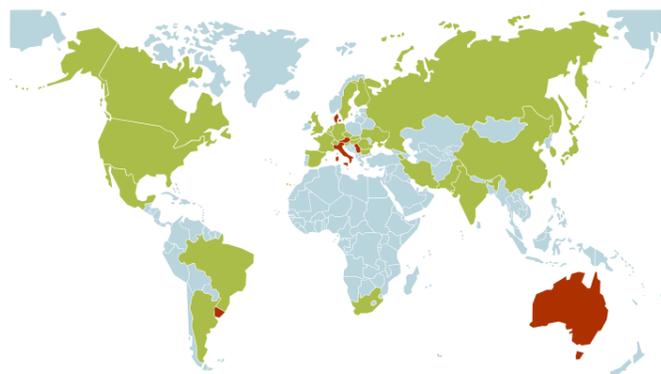
NUCLEAR WASTE AND ITS DISPOSAL

NUCLEAR POWER



435 NUCLEAR PLANTS WORLDWIDE
10,500 TONNES OF SPENT FUEL PER YEAR

As of 2019, nuclear power plants operate in 30 countries. Six countries have outright bans on use of nuclear reactors to generate electricity.



● Operating nuclear power plants ● Ban in place

10% OF THE WORLD'S ELECTRICITY

Nuclear fuel releases many times more energy per gram than fossil fuels. Nuclear plants don't release carbon dioxide while they are operating.

WHAT IS NUCLEAR WASTE?

About 3% of spent nuclear fuel consists of radioactive fission products. In some countries, the spent fuel is reprocessed to separate the waste from uranium and plutonium.

SPENT FUEL COMPOSITION



Radioactive waste contains unstable isotopes of elements which decay and emit alpha, beta or gamma radiation. Eventually they decay into non-radioactive elements.

HALF LIVES: UP TO 32 YEARS

Cs-137 Sr-90 Cm-243 Cm-244 Co-60

HALF LIVES: 460-24,000 YEARS

Th-229 Pu-239 Pu-240 Am-241 Am-243

HALF LIVES: 77,000-16,000,000 YEARS

Nb-94 I-129 Cs-135 Tc-99 Th-230 Np-237

As well as the radioactivity produced by nuclear waste, it also produces heat as isotopes decay. This poses issues for storage and disposal.

TYPES OF NUCLEAR WASTE

LOW LEVEL WASTE (LLW)

90% of all radioactive waste (by volume)

1% of the total radioactivity of all waste

LLW is defined as not exceeding 4 giga-becquerels per tonne (GBq/t) of alpha activity or 12 GBq/t of beta-gamma activity.

INTERMEDIATE LEVEL WASTE (ILW)

7% of all radioactive waste (by volume)

4% of the total radioactivity of all waste

ILW produces more radiation than LLW, but doesn't generate as much heat as HLW. It includes metal fuel cladding.

HIGH LEVEL WASTE (HLW)

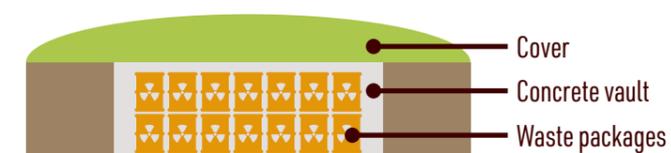
3% of all radioactive waste (by volume)

95% of the total radioactivity of all waste

HLW is defined as producing more than 2 kilowatts per metre cubed of heat due to its radioactivity. It requires shielding during transport and cooling before permanent disposal. It includes used fuel and separated waste.

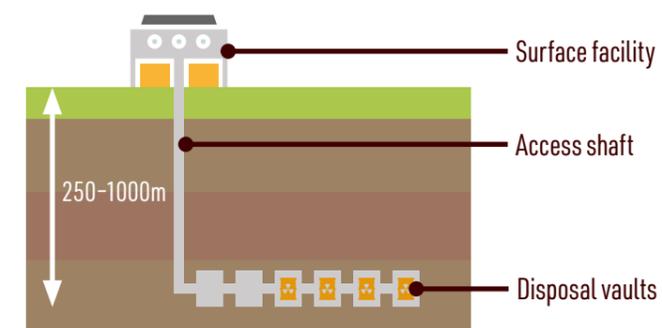
WASTE STORAGE & DISPOSAL

NEAR-SURFACE DISPOSAL



Low level waste's radioactivity is usually compacted into steel canisters and stored in concrete vaults underground. When full, vaults are sealed, covered and left. They ensure no significant radiation reaches the surface.

DEEP GEOLOGICAL DISPOSAL



Intermediate and high level waste generate heat and greater levels of radioactivity. Most countries plan to use deep geological disposal. The rock and soil acts as a barrier to the radiation. Before this, high level waste is incorporated into glass and stored for up to fifty years to allow heat to dissipate.

