

# Nuclear Energy: Is it Safe?

Ad-hoc Committee Report#2

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In this report, we begin with an overview of the health impacts of radiation. We then overview the history of nuclear accidents and the lessons learned. Last, but not least, we go over how safety is incorporated in the design of the existing nuclear fleet and the next generation reactors under construction.

# 65 years of safe operation

All energy sources have negative effects. But they differ enormously in size: as we will see, in all three aspects, fossil fuels are the dirtiest and most dangerous, while nuclear and modern renewable energy sources are vastly safer and cleaner.

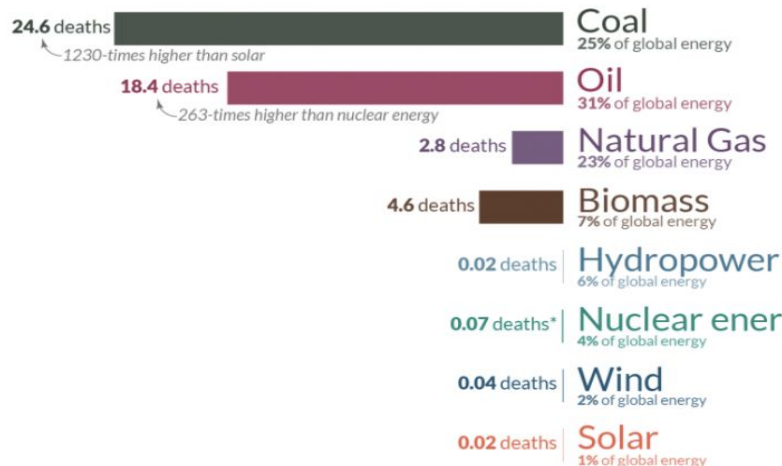
From the perspective of both human health and climate change, it matters less whether we transition to nuclear power or renewable energy, and more that we stop relying on fossil fuels.

Our World  
in Data

## What are the safest and cleanest sources of energy?

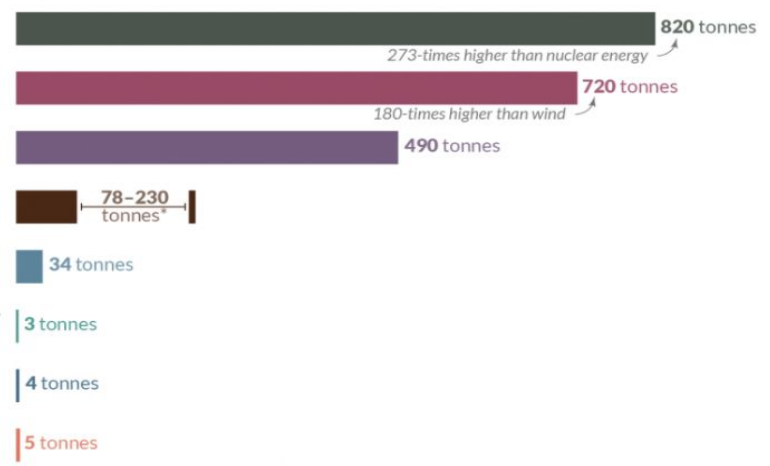
### Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of energy production.  
1 terawatt-hour is the annual energy consumption of 27,000 people in the EU.



### Greenhouse gas emissions

Measured in emissions of CO<sub>2</sub>-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.  
1 gigawatt-hour is the annual electricity consumption of 160 people in the EU.



\*Life-cycle emissions from biomass vary significantly depending on fuel (e.g. crop residues vs. forestry) and the treatment of biogenic sources.

\*The death rate for nuclear energy includes deaths from the Fukushima and Chernobyl disasters as well as the deaths from occupational accidents (largely mining and milling).

Energy shares refer to 2019 and are shown in primary energy substitution equivalents to correct for inefficiencies of fossil fuel combustion. Traditional biomass is taken into account.

Data sources: Death rates from Markandya & Wilkinson (2007) in *The Lancet*, and Sovacool et al. (2016) in *Journal of Cleaner Production*;

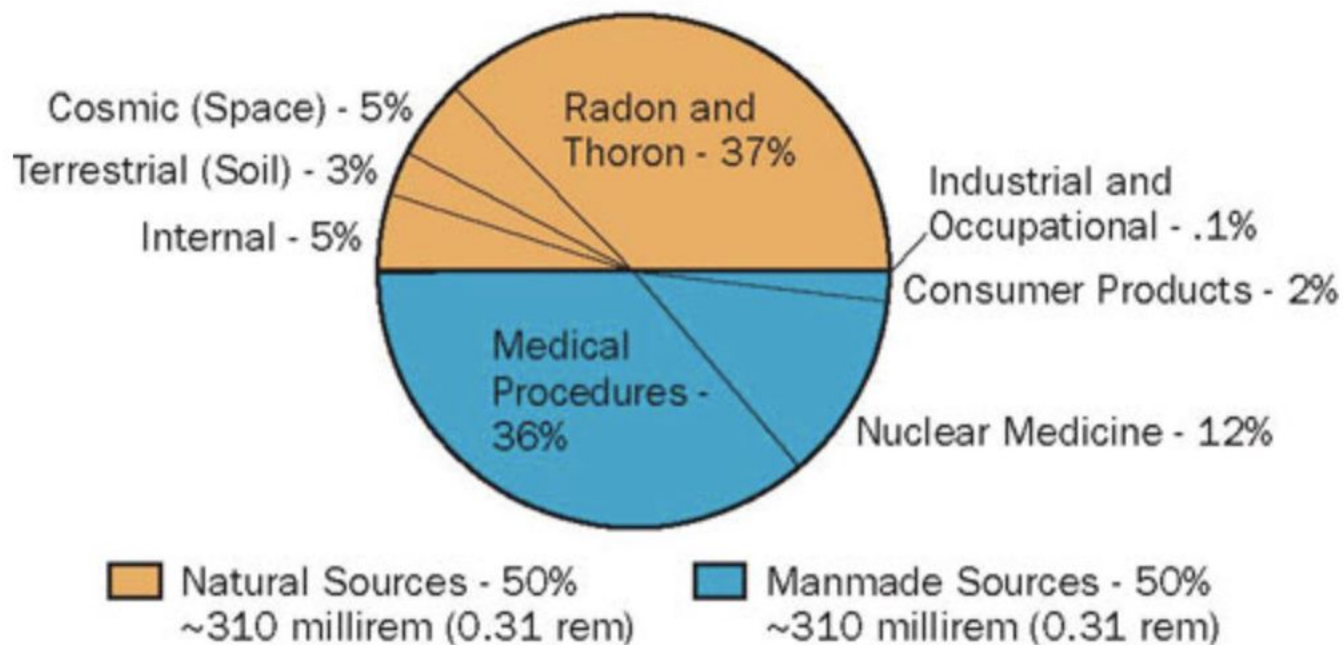
Greenhouse gas emission factors from IPCC AR5 (2014) and Pehl et al. (2017) in *Nature*; Energy shares from BP (2019) and Smil (2017).

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# Nuclear plants only account of 0.1% of the radiation exposure for the public

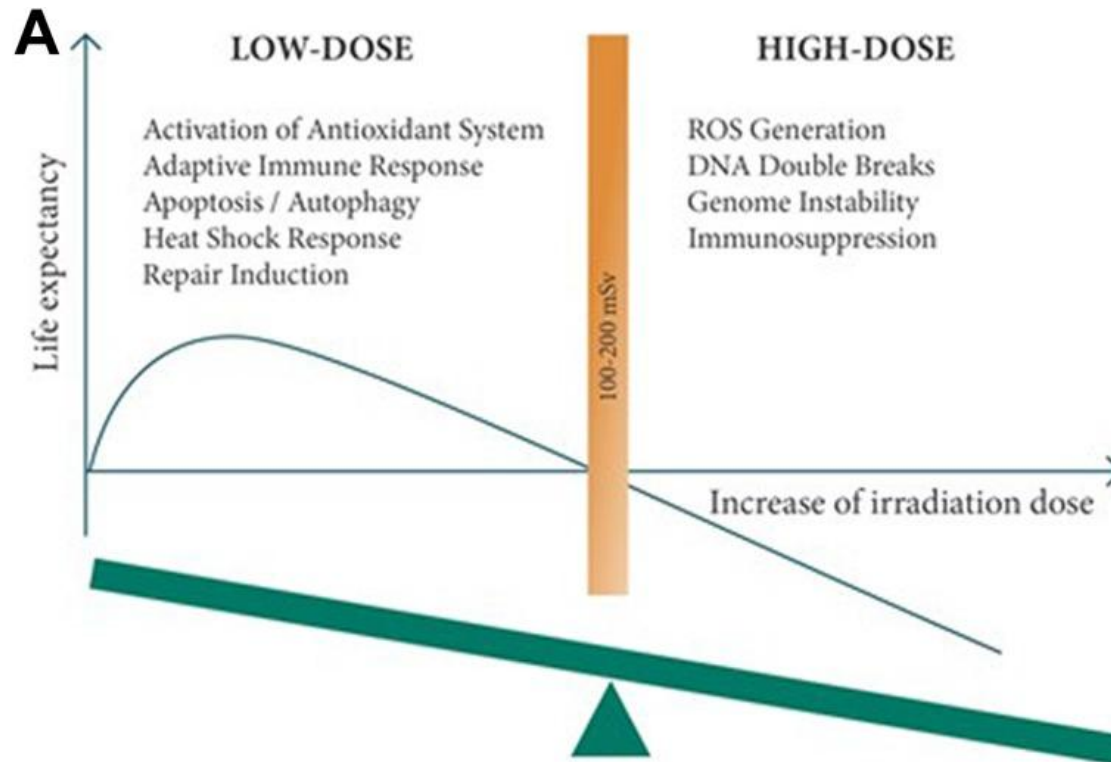
**Sources of Radiation Exposure in the United States**



Source: NCRP Report No.160(2009)

Full report is available on the NCRP Web site at [www.NCRPpublications.org](http://www.NCRPpublications.org).

# Health Effects of Ionizing Radiation



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6149023/>

# Nuclear Accidents

- Three Mile Island (1979): 0 deaths
- Chernobyl (1986): 30 deaths
- Fukushima (2011): 0 deaths

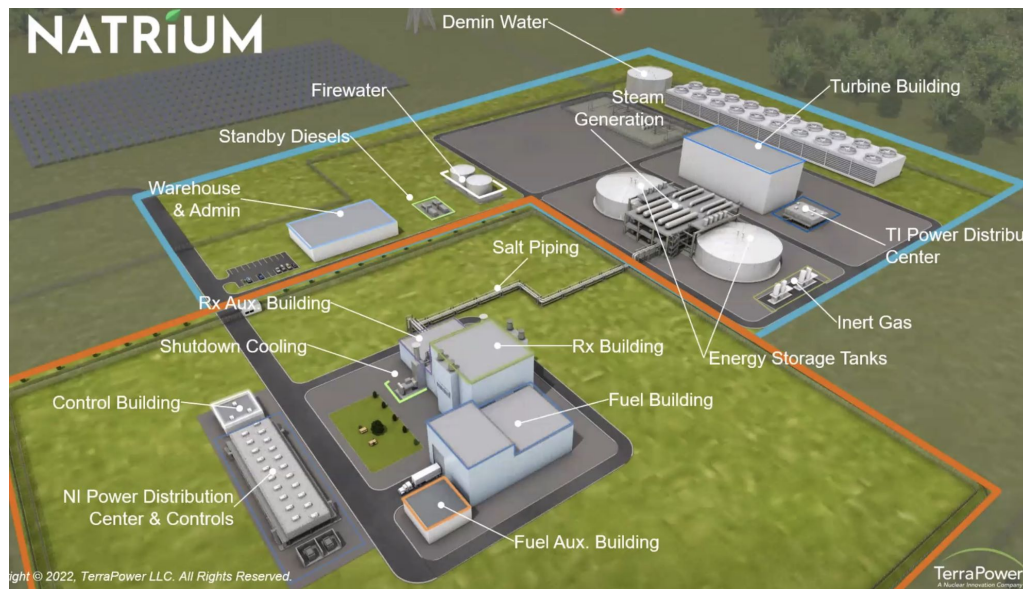
**Was there more incidence of cancer in the exposed populations that can be attributed to ionizing radiation?**

6000 thyroid cancer (15 deaths) due to Chernobyl

<https://www.unscear.org/unscear/en/chernobyl.html>

# Next Generation Safety

In the US, there are several **SMR's** (small modular reactors) that are in various stages of licensing. The improvements include better pressure and temperature tolerances, as well as improved burn-up efficiency, in addition to passive safety. The choice of new coolants allows higher temperature tolerance.



# Conclusion

Per Kilowatt-hour generated, nuclear is one of the safest forms of energy production, comparable in safety to renewables.