We still don't really know the health hazards of a nuclear accident

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Five years after the nuclear disaster in Fukushima and 30 years after the Chernobyl accident, scientists are still disagreeing about the impact on human health – such as how many people have got cancer as a result and how dangerous the exclusion zones currently are.

In Fukushima, residents are forbidden to permanently return to their homes within the exclusion zone. And in Ukraine the city of Pripyat,

4km from Chernobyl, still remains largely deserted. While some experts have recently said that the areas surrounding these accidents are not as dangerous as previously thought, others are concerned about the high levels of radiation remaining in plants and animals, particularly seafood.

It is true that large doses of radiation can be fatal. Marie Curie, who carried radium in her pockets, eventually died of cancer. But small doses of radiation are all around us, every day. They are measured in millisieverts (mSv). The average person in the UK receives a dose of 2.7 mSv per year (or 7.8 mSv per year if you happen to live on top of granite in Cornwall, which emits radon gas).

A transatlantic flight will give you a dose of 0.08 mSv from cosmic radiation. Even eating a humble banana will expose you to 0.001 mSv of radiation, from the tiny amount of radioactive potassium inside. But it is only really when you are exposed to annual radiation doses of more than 1,000 mSv that things start to get a bit hairy.

Chernobyl sign. Credit: D. Markosian/wikimedia

The type of radiation you are exposed to matters too. Some types only cause severe damage when ingested (lodged in the stomach or lungs). Other types can penetrate the body from outside, putting you at risk just walking by the source.

In the case of an accident, we have to take into account what sort of radiation is released – and how much – to take the right precautions. When radioactive gas from the Three Mile Island reactor in the US was released after an accident in 1979, people were advised to stay indoors and to keep farm animals under cover. Later, pregnant women within a 20-mile radius of the reactor were recommended to evacuate. Within three weeks, 98% of the evacuees had returned. These were sensible

precautions – after 18 years of monitoring, no unusual health trends were reported. People only received an average dose of 0.08 mSv.

In the far more severe Chernobyl accident, radioactive elements including iodine-131 and cesium-137 were spread by graphite fires across a wide area. People in the vicinity of the fires (mainly firefighters) were exposed to fatal doses of radiation (300,000 mSv per hour). Nearly a third of them died in the months following the accidents.

But for people who have lived in the most contaminated areas of Belarus, the Russian Federation and Ukraine at some point since the accident it is more difficult to estimate the impact. They have received relatively low doses of radiation over a long time, estimated as 1 mSv per year on average. While there was an initial spike in thyroid cancer cases, it is difficult to work out whether other cancers in this population are due to radiation or other lifestyle factors.

So is Chernobyl now safe? If you take a tour of it today, expect radiation doses of 0.2 to 20 mSv per hour depending on how close to the reactor you go. The levels of radioactivity from radioactive cesium and strontium have already dropped by half – and in 30 years time they will half again. After ten "half-lives" (300 years) the radioactivity would decayed to normal background levels.

Abandoned playpark in Pripyat. Credit: Robarmstrong2/pixabay

Relocation versus radiation

But the effect of radiation is not everything. More than 116,000 people from the area surrounding Chernobyl were evacuated but about 1,200 refused. These so-called "Babushkas of Chernobyl", all over 40 at the time of the accident, defiantly ignored the law and decided to take their chances against the radiation rather than being displaced from their beloved homes and communities. More than 200 of these remain living in the area today.

And perhaps they were right to stay – the World Health Organisation

(WHO) cites relocation from Chernobyl as a cause of stress, anxiety, mental illness and "medically unexplained physical symptoms". To this day, we do not know the true cost of relocation on lives because it was not formally measured.

The radioactive fallout at Fukushima was less than 10% of that at Chernobyl. A number of scientists have suggested the evacuation was therefore too cautious. Others recommend that the acceptable radiation dose to the public set by international organisations is too conservative and could be significantly increased without causing harm.

There seems to be little evidence to suggest that lower doses of radiation causes a big risk. It has even been suggested that the body may have some sort of cellular repair mechanisms to deal with lower doses. The problem is we simply just don't know for sure – the only way to find out is to study the people who have been exposed to these low doses over their entire lives, an enormous task that not everyone is willing to take part in.

The people of Fukushima, except those in the worst contaminated areas, will eventually be encouraged to return to their homes. In the absence of better understanding, scientific and political arguments about how safe the radiation levels are will continue. What is abundantly clear, though, is that we need to understand the comparative health effects of radiation versus relocation. Developing a new approach in our response to nuclear accidents and the decisions that are made in their immediate aftermath is vital so that we can avoid unnecessary panic and evacuation – something virtually all scientists agree on.

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