Summing the Health Effects of the Fukushima Nuclear Disaster

ABSTRACT: New emerging evidence from Fukushima shows that nuclear disasters and their aftermaths kill thousands of people due to necessary evacuations. In future, these deaths from ill-heath and suicides should be included in assessments of the fatalities from nuclear disasters. In sum, the human toll from Fukushima is horrendous: 2,000 Japanese people have died from the evacuations and another 5,000 are expected to die from future cancers.

1. Deaths from Necessary Evacuations

Official data from Fukushima show that nearly 2,000 people died from the effects of evacuations necessary to avoid high radiation exposures from the disaster, including suicides. http://www.reconstruction.go.jp/topics/main-cat2/sub-cat2-1/20141226_kanrenshi.pdf The uprooting to unfamiliar areas, cutting of family ties, loss of social support networks, disruption, exhaustion, poor physical conditions and disorientation can and do result in many people, in particular older people, dying.

Increased suicide have occurred among younger and older people following the Fukushima evacuations, but the trends are unclear. www.pref.**fukushima**.lg.jp/uploaded/attachment/62562.docx (4 minutes to download). A Japanese Cabinet Office report stated that, between March 2011 and July 2014, 56 suicides in Fukushima Prefecture were linked to the nuclear accident. http://www.japantimes.co.jp/news/2014/08/26/national/social-issues/fukushimas-high-number-disaster-related-suicides-likely-due-nuclear-crisis-cabinet-office/#.Vcstm_mrGzl. This should be taken as a minimum, rather than a maximum, figure.

2. Mental Health Consequences

It is necessary to include the mental health consequences of radiation exposures and evacuations. For example, Becky Martin has stated her PhD research at Southampton University in the UK shows that "most significant impacts of radiation emergencies are often in our minds".

She adds "…imagine that you've been informed that your land, your water, the air that you have breathed may have been polluted by a deadly and invisible contaminant. Something with the capacity to take away your fertility, or affect your unborn children. Even the most resilient of us would be concerned…. many thousands of radiation emergency survivors have subsequently gone on to develop Post-Trauma Stress Disorder (PTSD), depression, and anxiety disorders as a result of their experiences and the uncertainty surrounding their health." http://www.theguardian.com/science/brain-flapping/2015/aug/09/nagasaki-anniversary-radiation-nuclear-mental-health

It is likely that these fears, anxieties, and stresses will act to magnify the effects of evacuations, resulting in even more old people dying or people committing suicide.

The above sections should not be taken as arguments against evacuations: they are an important, life-saving strategy. But, as argued by Becky Martin, "we need to provide greatly improved social support following resettlement and extensive long-term psychological care

to all radiation emergency survivors, to improve their health outcomes and preserve their futures".

3. Untoward Pregnancy Outcomes

Recently, Dr Alfred Körblein from Nuremburg in Germany noticed a 15% drop (statistically speaking, highly significant) in the numbers of live births in Fukushima Prefecture in December 2011, ie 9 months after the accident. This might point to higher rates of early spontaneous abortions. He also observed a (statistically significant) 20% increase in the infant mortality rate in 2012, relative to the long-term trend in Fukushima Prefecture plus six surrounding prefectures. http://www.strahlentelex.de/Koerblein_Fukushima-update_engl.pdf. These are indicative rather than definitive findings and need to be verified by further studies. Unfortunately, such studies are notable by their absence.

4. Cancer and other late effects from radioactive fallout

Finally, we have to consider the health effects of the radiation exposures from the radioactive fallouts after the four explosions and three meltdowns at Fukushima in March 2011. Large differences of view exist on this issue in Japan. These make it difficult for lay people and journalists to understand what the real situation is. See box.

BOX: An explainer

The Japanese Government, its advisors, and most radiation scientists in Japan (with some honourable exceptions) minimise the risks of radiation. The official widely-observed policy is that small amounts of radiation are harmless: scientifically speaking this is untenable. For example, the Japanese Government is attempting to increase the public limit for radiation in Japan from 1 mSv to 20 mSv per year. Its scientists are trying to force the ICRP to accept this large increase. This is not only unscientific, it is also unconscionable.

Part of the reason for this policy is that radiation scientists in Japan (in the US, as well) appear unable or unwilling to accept the **stochastic** nature of low-level radiation effects. "Stochastic" means an all-or-nothing response: you either get cancer etc or you don't. As you decrease the dose, the effects become less likely: your chance of cancer declines all the way down to zero dose. The corollary is that tiny doses, even well below background, still carry a small chance of cancer: there is never a safe dose, except zero dose.

But, as stated by Spycher et al (2015) http://ehp.niehs.nih.gov/1510111R/, some scientists "…*a priori* exclude the possibility that low dose radiation could increase the risk of cancer. They will therefore not accept studies that challenge their foregone conclusion."

One reason why such scientists refuse to accept radiation's stochastic effects (cancers, strokes, CVS diseases, hereditary effects, etc) is that they only appear after long latency periods - often decades for solid cancers. For the Japanese Government and its radiation advisors, it seems out-of-sight means out-of-mind. This conveniently allows the Japanese Government to ignore radiogenic late effects. But the evidence for them is absolutely rock solid. Ironically, it comes primarily from the world's largest on-going epidemiology study, the Life Span Study of the Japanese atomic bomb survivors by the RERF Foundation which is based in Hiroshima and Nagasaki. http://www.rerf.jp/index_e.html

The mass of epidemiological evidence from the Chernobyl disaster in 1986 clearly indicates that cancer etc increases will very likely also occur at Fukushima, but many Japanese (and US) scientists deny this evidence.

For example, much debate currently exists over the existence and interpretation of increased thyroid cancers, cysts, and nodules in Fukushima Prefecture resulting from the disaster. From the findings after Chernobyl, thyroid cancers are expected to start increasing 4 to 5 years after 2011. It's best to withhold comment until clearer results become available in 2016, but early indications are not reassuring for the Japanese Government. After then, other solid cancers are expected to increase as well, but it will take a while for these to become manifest.

The best way of forecasting the numbers of late effects (ie cancers etc) is by estimating the collective dose to Japan from the Fukushima fall out. We do this by envisaging that everyone in Japan exposed to the radioactive fallout from Fukushima has thereby received lottery tickets: but they are negative tickets. That is, if your lottery number comes up, you get cancer[1]. If you live far away from Fukushima Daiichi NPP, you get few tickets and the chance is low: if you live close, you get more tickets and the chance is higher. You can't tell who will be unlucky, but you can estimate the total number by using collective doses.

The 2013 UNSCEAR Report (http://www.unscear.org/docs/reports/2013/13-85418_Report_2013_Annex_A.pdf) has estimated that the collective dose to the Japanese population from Fukushima is 48,000 person Sv: this is a very large dose: see below.

Unfortunately, pro-nuclear Japanese scientists also criticise the concept of collective dose as it relies on the stochastic nature of radiation's effects and on the Linear No Threshold (LNT) model of radiation's effects which they also refute. But almost all official regulatory bodies throughout the world recognise the stochastic nature of radiation's effects, the LNT, and collective doses.

5. Summing Up Fukushima

About 60 people died immediately during the actual evacuations in Fukushima Prefecture in March 2011. Between 2011 and 2015, an additional 1,867 people[2] in Fukushima Prefecture died as a result of the evacuations following the nuclear disaster[3]. These deaths were from ill health and suicides. http://www.japantimes.co.jp/news/2015/03/15/national/death-toll-grows-in-311-aftermath/#.Vcn84PmrGzm .

From the UNSCEAR estimate of 48,000 person Sv, it can be reliably estimated (using a fatal cancer risk factor of 10% per Sv) that about 5,000 fatal cancers will occur in Japan in future from Fukushima's fallout. This estimate from official data agrees with my own personal estimate using a different methodology http://www.ianfairlie.org/news/new-unscear-report-on-fukushima-collective-doses/.

In sum, the health toll from the Fukushima nuclear disaster is horrendous. At the minimum

[1] Credit to Jan Beyea in the US for the negative lottery idea.
[2] Correct as of March 2015.
[3] In addition, 1,603 people were killed directly by the earthquake and tsunami in Fukushima Prefecture, and approximately 1,350 tsunami evacuee deaths occurred in Miyagi and Iwate Prefectures: in the latter cases, the evacuations were not radiation-related.

- Over 160,000 people were evacuated most of them permanently.
- Many cases of post-trauma stress disorder (PTSD), depression, and anxiety disorders arising from the evacuations.
- About 12,000 workers exposed to high levels of radiation, some up to 250 mSv
- An estimated 5,000 fatal cancers from radiation exposures in future.
- Plus similar (unquantified) numbers of radiogenic strokes, CVS diseases and hereditary diseases.
- Between 2011 and 2015, about 2,000 deaths from radiation-related evacuations due to ill-health and suicides.
- An, as yet, unquantified number of thyroid cancers.
- An increased infant mortality rate in 2012 and a decreased number of live births in December 2011.

Non-health effects include

- 8% of Japan (30,000 km^2), including parts of Tokyo, contaminated by radioactivity.
- Economic losses estimated between $300 and $500 billion.

6. Conclusions

The Fukushima accident is still not over and its ill-effects will linger for a long time into the future. However we can say now that the nuclear disaster at Fukushima delivered a huge blow to Japan and its people. 2,000 Japanese people have already died from the evacuations and another 5,000 are expected to die from future cancers.

It is impossible not to be moved by the scale of Fukushima's toll in terms of deaths, suicides, mental ill-health and human suffering. Fukushima's effect on Japan is similar to Chernobyl's massive blow against the former Soviet Union in 1986. Indeed, several writers have expressed the view that the Chernobyl nuclear disaster was a major factor in the subsequent collapse of the USSR during 1989-1990.

It is notable that Mikhail Gorbachev, President of the USSR at the time of Chernobyl and Naoto Kan, Prime Minister of Japan at the time of Fukushima have both expressed their opposition to nuclear power. http://bos.sagepub.com/content/67/2/77.full
Indeed Kan has called for all nuclear power to be abolished.
https://wallofcontroversy.wordpress.com/2014/03/17/japans-ex-prime-minister-naoto-kan-on-how-fukushima-changed-his-mind-about-nuclear-power/

Has the Japanese Government, and indeed other governments (including the UK and US), learned from these nuclear disasters? The US philosopher George Santayana (1863-1962) once stated that those who cannot learn from history are doomed to repeat it.

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