Communicating Health Risks from Nuclear Accidents

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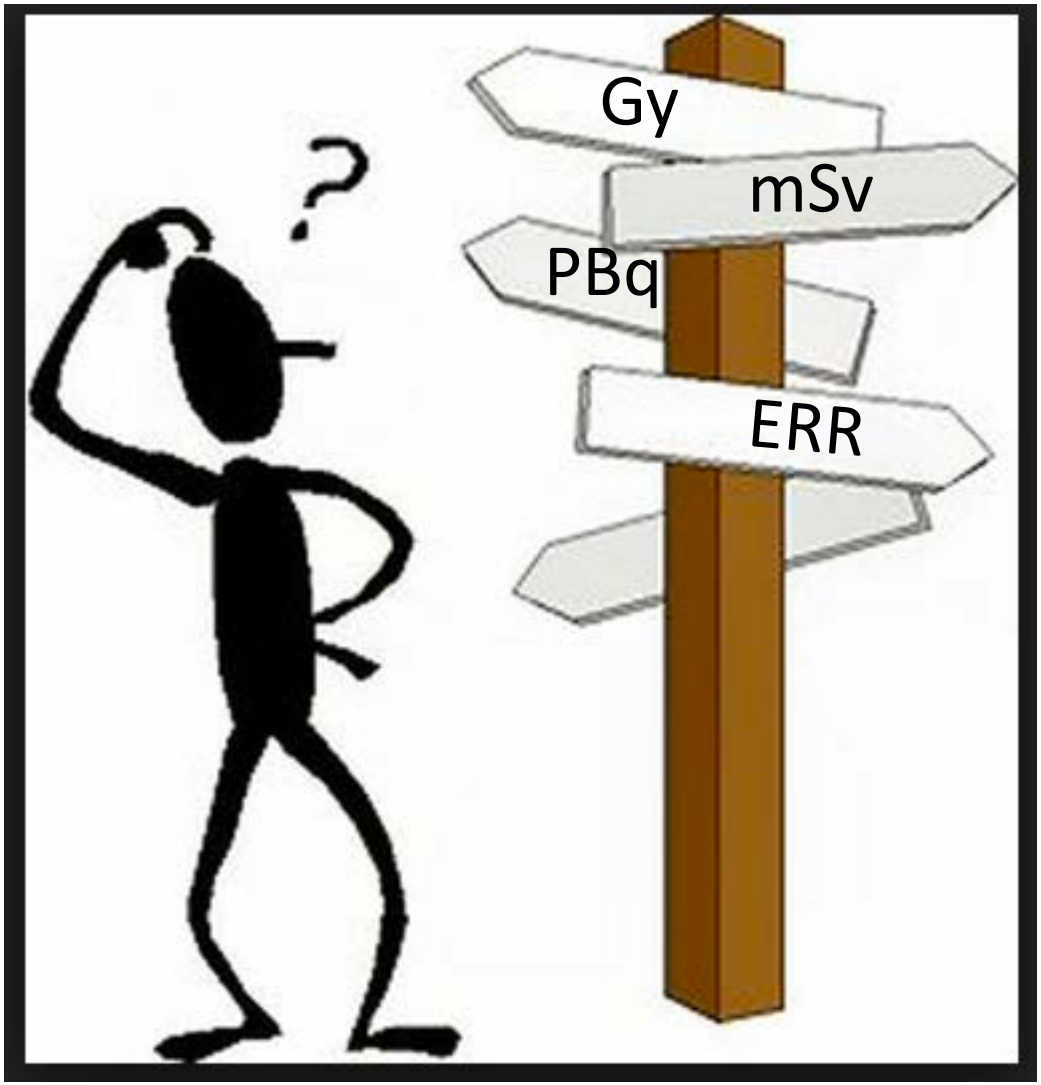
The problem with radiation….

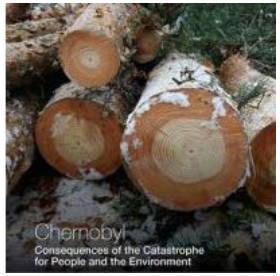
- Long history of being made to fear radiation (from atomic weapons)
- General acceptance of medical radiation exposure, and exposure to natural radiation (e.g. Spas) believed to be beneficial
- Relationship between dose and response to all toxins (including radiation)
- Perception that individual dose from nuclear accidents is much higher than it is
- Atomic bomb exposure very different to nuclear accident

The problem with radiation risk communication



- Too much jargon
- Health effects depend on physics, chemistry and biology
- Political football
- Lots of misinformation and very little understandable science
- Constant emphasis on safety – **must be unsafe**

Context matters



New Book Concludes – Chernobyl death toll: 985,000, mostly from cancer

http://www.globalresearch.ca/new-book-concludes-chernobyl-death-toll-985-000-mostly-from-cancer/20908

2065 toll

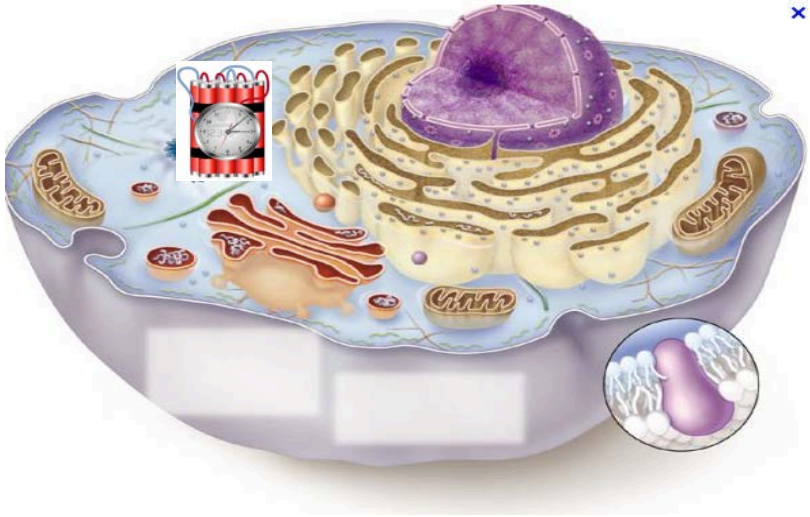
The mainstream view puts the toll in five figures. Environmental physicist Jim Smith of the University of Portsmouth, UK, prefers to cite a 2006 study by Elisabeth Cardis of the International Agency for Research on Cancer in Lyon, France. This predicted that by 2065 Chernobyl will have caused about 16,000 cases of thyroid cancer and 25,000 cases of other cancers, compared with several hundred million cancer cases from other causes.

http://www.newscientist.com/article/dn20403-25-years-after-chernobyl-we-dont-know-how-many-died.html

Health effects of radiation – simple facts

Health effects involve a combination of exposure and tissue dose (c/w health effects of sunlight)

- People must have been exposed to radiation to see a health effect
- Effect depends on the radioactive isotopes they are exposed to
- Dose must be large enough to have a demonstrable effect in the numbers exposed (very small doses need very large populations to be exposed to demonstrate an effect)



Biological effect of radiation depends on the amount of time the radioactive isotope stays in the body (biological half-life) and the frequency with which the isotope emits radiation (physical half-life)

- Long physical half-life, short biological half-life – little effect (e.g. Cs-137)
- Short physical half-life, long biological half-life – big problem (e.g. I-131)

Dose matters…..

- Annual exposure (Po-210) to average smoker
  - Dental X-ray
  - CT scan (whole body)
  - Radiotherapy for breast cancer
- 135g of brazil nuts
  - Average annual dose (UK)
- Average dose to 6M residents near to Chernobyl (over 25 years)
  - Transatlantic flight

- Dental X-ray
- 135g of brazil nuts

0.005mSv

- Transatlantic flight — **0.07mSv**
- Average annual dose (UK) — **2.7mSv**
- CT scan (whole body) — **9mSv**
- Av dose 6M Chernobyl residents — **10 mSv**
- Annual exposure to average smoker — **13 mSv**

100mSv

- Radiotherapy for breast cancer — **50 Sv**

Radiation releases in perspective

	131-I	137-Cs
A-bomb tests in 1960s	675,000 PBq	948 PBq
Chernobyl	1,760 PBq	85 PBq
Fukushima	100-500 PBq	6-20 PBq

Sources: www.unscear.org/docs/reports/2008/11-80076_Report_2008_Annex_D.pdf
http://www.unscear.org/docs/reports/2013/13-85418_Report_2013_Annex_A.pdf

Chernobyl vs Fukushima

Chernobyl

- evacuees mean thyroid dose 500 mGy (range 50-5000mGy)
- Non evacuees: 100mGy
- Lifetime exposure 9mSv (6M residents); 50mSv , 150,000 residents

Fukushima

- evacuees estimated thyroid doses up to 80mGy,
- Non evacuees estimated 45-55mGy
- Actual measured doses mean 4.2 mGy
- Estimated lifetime exposure 10mSv (if no remediation)

NB – lifetime exposure to background radiation approx 170mSv

Limiting exposure

- Move population away from source ☑ ☑
- Limit inhalation by staying inside and keeping windows and doors shut ☒ ☑
- Stop ingestion of contaminated foodstuffs ☒ ☑
- Block uptake of radionuclides (e.g. stable iodine prophylaxis) ☒ ?

Chernobyl – Health effects

- 28 from ARS
- 15 deaths from thyroid cancer in 25 years
- 1% death rate overall predicted for thyroid cancer. 16,000 excess thyroid cancers in total predicted – therefore 160 deaths
- No (scientific) evidence of increased thyroid cancer outside 3 republics
- No effect on fertility, malformations or infant mortality
- No conclusion on adverse pregnancy outcomes or still births
- Heritable effects not seen and very unlikely at these doses
- No proven increase in any other cancer (including liquidator cohorts)

Fukushima Health effects

- No radiation related deaths compared with 1656 who died as a result of the evacuation or stress related to it, and 20,000 in tsunami
- Unlikely to be any increase in thyroid cancer at the doses received
- Psychological harm due to evacuation and radiophobia – very likely
- Huge economic effect on local area and Japan as a whole

Health Monitoring Programme

Fukushima Health Management Survey

- ultrasonography thyroid screening of 360 000 residents below the age of 18;
- comprehensive medical check-ups of 210 000 evacuees;
- mental health and lifestyle survey of 210 000 evacuees;
- survey of 30 000 pregnant women and nursing mothers.

Yasumura, S., M. Hosoya, S. Yamashita et al. J Epidemiol 22(5): 375-383 (2012)

- Fukushima health survey will produce large amounts of data that must be interpreted for the public – or it will be **mis**interpreted by the press and others

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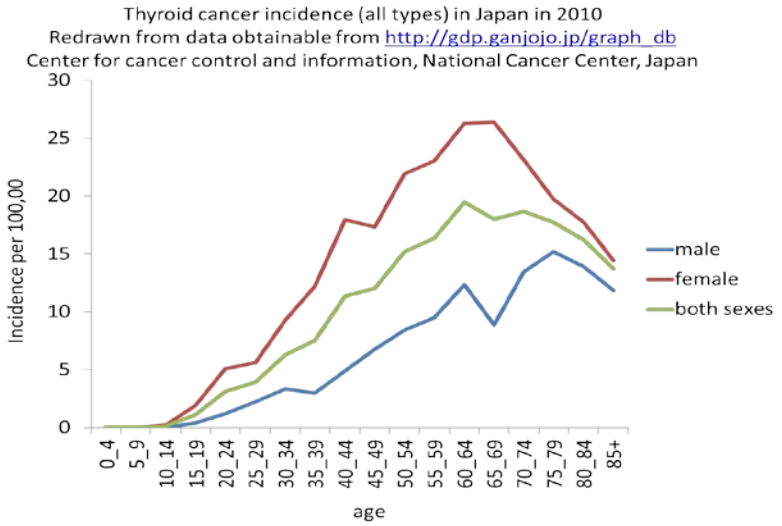
Rise in childhood cancer in Fukushima sparks debate

Three years after the worst nuclear accident in a generation, the Japanese prefecture is reporting a rise in the number of children showing cancer symptoms

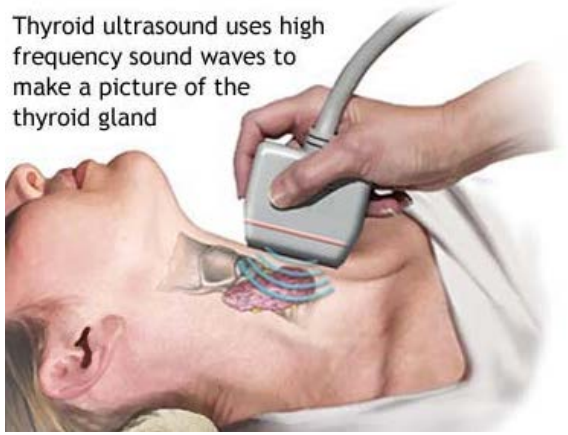
The Guardian in Fukushima

PUBLISHED : Monday, 10 March, 2014, 10:47am
UPDATED : Monday, 10 March, 2014, 12:37pm

Every cancer has a spontaneous incidence and a natural age curve



How you look matters



- Cancer statistics are usually reported on operated cases
- Screening finds smaller lumps, earlier
- Using US will push the natural incidence curve to the left
- Pool of undetected thyroid cancer in the screened population estimated to be around 3 per 10,000 – some autopsy studies suggest higher
- Possibility of over treatment due to radiophobia

- UNSCEAR, WHO reports on Fukushima both conclude that the health effects of radiation from Fukushima will be negligible
- BUT the psychological effects on public health will be considerable
- Same conclusion as the WHO report on Chernobyl (published on line Feb 2011, but dated 2008)

We seem to have learnt nothing in 28 years

How do we get the message across?

- Put risks from radiation into perspective with other common place risks
- Take on the pseudoscientists and point out the errors in their arguments
- Correct myths put out by the media
- Engage the public/media and explain benefits/risks of all types of energy production

Exposure scenario	Exposure	Health endpoint	Approximate lifetime increased mortality
Living in Central London compared to Inverness.	Mix of air pollutants indicated by average $PM_{2.5}$ = 6.9 μg m^{-3} higher.	Mortality	**2.8 %** Postulated 2.8% higher air pollution related mortality in central London compared to Inverness (see text).
N.B. Extrapolates from data in the US. May be confounding factors which, if accounted for, would change the excess risk. Time-lag between exposure and effect is uncertain.			
Passive smoking – risk to non-smoker at home if spouse smokes.	Mix of pollutants in secondhand smoke.	Mortality	**1.7 %** 1.7% lifetime excess IHD mortality risk from passive smoking: average for men and women [36].
N.B. Heart disease risk: does not include strokes or the (significantly lower) risk from lung cancer or other illnesses. May be confounding factors/ limitations of meta-analysis data.			
Chernobyl emergency workers in the 30-km Zone 1986–87.	Radiation exposure: 100 mSv 250 mSv	Mortality	**0.4 %** **1.0 %**

Smith BMC Pubic Health 2007 7:49

Risk scenario	Average Years of Life Lost (YOLL)
Smoking Male doctor who is a lifetime smoker compared to non-smoker.	10
Obesity White male aged 35 who is obese (BMI = 30.0–39.9) or severely obese (BMI >40): risk relative to BMI = 24.	Obese: 1–4 [a] Severely obese: 4–10[a]
Radiation Atomic bomb survivor who was in the most exposed group: within 1500 metres of the hypocentre. Shielded whole body kerma > 1 Gy, mean 2.25 Gy.	2.6 (1.3–5.2)[a]

NB Radiation doses from nuclear accidents much lower than from A-bomb, so risk even lower

Health effects of energy production

Deaths and illness expressed as per TW (W^{12})/hr for different sources of energy

	Deaths from accidents		Air pollution-related effects		
	Among the public	Occupational	Deaths*	Serious illness†	Minor illness‡
Lignite[30]	0·02 (0·005–0·08)	0·10 (0·025–0·4)	32·6 (8·2–130)	298 (74·6–1193)	17 676 (4419–70 704)
Coal[31]	0·02 (0·005–0·08)	0·10 (0·025–0·4)	24·5 (6·1–98·0)	225 (56·2–899)	13 288 (3322–53 150)
Gas[31]	0·02 (0·005–0·08)	0·001 (0·0003–0·004)	2·8 (0·70–11·2)	30 (7·48–120)	703 (176–2813)
Oil[31]	0·03 (0·008–0·12)	..	18·4 (4·6–73·6)	161 (40·4–645·6)	9551 (2388–38 204)
Biomass[31]	..	..	4·63 (1·16–18·5)	43 (10·8–172·6)	2276 (569–9104)
Nuclear[31,32]	0·003	0·019	0·052	0·22	..

Markandya and Wilkinson, Lancet (2007) 370: 979-90

Suggestions for public communication

- Engage the media in providing facts not fiction
- Engage scientists to provide an independent voice – we need to get out more!
- Discuss openly with all sections of the community
  - Schools, community groups, environmental campaigners etc
- Make everyone feel part of the decision making process – local engagement

Is this response from the media justified?

Or has it just made a difficult situation worse?

Contact: report@tky.ieej.or.jp