

## COMMENTARY

# Too soon for a final diagnosis

Twenty years ago, the nuclear accident at Chernobyl exposed hundreds of thousands of people to radioactive fallout. We still have much to learn about its consequences, argue **Dillwyn Williams** and **Keith Baverstock**.

Why should we still be concerned about the Chernobyl accident after 20 years, some 3,000 papers and many conferences? One reason is that the consequences of the world's worst peacetime nuclear accident are relevant to national debates about building new nuclear power stations. Another is that at this point we cannot predict the future health consequences of Chernobyl with any certainty.

The radiation exposure from the Chernobyl accident differed greatly from that created by the atomic bombs in Japan, yet only fragmented studies have tracked the human consequences of Chernobyl, in contrast to the coordinated approach of Japan's Atomic Bomb Casualty Commission (now the Radiation Effects Research Foundation). Without a similar approach, speculation about Chernobyl's human cost will be unconstrained by hard evidence, and interested parties will be able to exaggerate or underplay the consequences.

This month, UN agencies will mark 20 years since Chernobyl by publishing an international

assessment of the accident's health, environmental and economic effects. A draft<sup>1</sup> issued last year detailed the health consequences and predictions for the future, but the accompanying press release downplayed the predicted number of cancers, emphasizing reassurance rather than the uncertainties.

### Misplaced confidence

For example, simply by citing a specific number — up to 4,000 predicted deaths from radiation exposure — the press release suggested a certainty unwarranted by the underlying studies (see Special Report, page 982). The figures quoted in the body of the report suggested that there may be an additional 5,000 radiation-related deaths in heavily contaminated regions. Yet these predictions ignore the large number of Europeans who received very low radiation doses. The dose–response relationship at low doses remains uncertain; it could be linear, but also higher or lower<sup>2,3</sup>. If it is linear, there may be tens of thousands more attributable deaths.

In 1965, 20 years after the atomic bombings in Japan, the Atomic Bomb Casualty Commission reported significant increases in the incidence of just two cancers — thyroid cancer and leukaemia. It was another decade before a significant increase in other cancers was reported. Almost 45 years after the bombs, unexpected and significant increases in a range of non-cancer diseases, including heart disease, were found<sup>4</sup>. And nearly 50 years after exposure, significant increases were reported for ten different cancers, with risks approximately doubled for colon, lung, breast, ovary and bladder tumours<sup>5</sup>. Given that about one in four people anywhere develops cancer, detecting these and more modest increases in other cancers would have been impossible without the long-term, large-scale studies conducted on some 80,000 Japanese bomb survivors.

In Chernobyl, the type of radiation exposure was different from that in Nagasaki and Hiroshima, and the aftermath will take a different



Check up: a Russian woman living near Chernobyl is examined for signs of thyroid cancer.

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form. The atomic bombs resulted largely in whole-body radiation from  $\gamma$ -rays and neutrons, exposing all tissues uniformly. Exposure from Chernobyl was, apart from in those working near the reactor, largely internal, from radioactive isotopes in fallout — so different tissues initially received different doses.

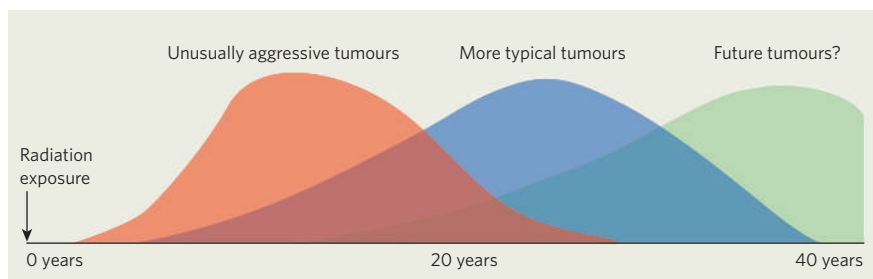
The large increase in childhood thyroid cancer so soon after the Chernobyl accident<sup>6,7</sup> — the first cases appeared after just four years — took experts by surprise. Experts' expectations were based on known adult exposure risks (minimal) and assumptions about latency times (ten years or more). They were wrong, and there is every reason to expect more surprises over the next 20 years. The high incidence of thyroid cancers has been linked to the huge amount of <sup>131</sup>I-iodine in fallout, and to consuming local milk in particular. But the thyroid is not the only tissue to concentrate radioiodine: the salivary glands, breast and stomach also take it up to a lesser extent, potentially increasing their risk of malignancy. Any female who was lactating or pubescent at the time of the accident could be particularly at risk of breast cancer. The future is uncertain, although there is recent evidence for an approximate doubling in breast-cancer incidence in Gomel, Belarus, and other heavily contaminated areas of Belarus and Ukraine<sup>8</sup>. Studies of the atomic bomb show that 20 years is far too early to assume, as some have, that radioactive fallout causes only thyroid cancer.

The most detailed studies since Chernobyl, of the thyroid-cancer epidemic, yielded much valuable information<sup>9</sup>. We have learnt that the risk of developing thyroid cancers depends heavily on the age of exposure to fallout, with children under one being the most susceptible. Several thousand excess cases of thyroid cancer have occurred so far in the three most exposed countries, allowing researchers to link the speed of tumour development with molecular changes and with different tumour types (see figure). The early tumours were clinically aggressive and pathologically unusual. Later ones were more typical and less aggressive, with a changing pattern of oncogene mutation. But the future epidemiology even for thyroid tumours is unpredictable. Other types of thyroid tumour may emerge, and an increase in the lethality of these usually curable tumours cannot be ruled out. Continuous medical surveillance is necessary.

As well as radioactive iodine, Chernobyl exposed millions of people to much lower doses to the whole body from <sup>134</sup>- and

<sup>137</sup>-caesium. The dose range overlaps with that received by survivors 1 to 2 kilometres from the hypocentre of the atomic bombs. In addition, the <sup>90</sup>-strontium released is a potential source of bone cancers.

The UN report acknowledges the need for further epidemiological studies to assess the effects of low-dose exposure after Chernobyl; such studies must include verification of the primary data. But existing patchy and uncoordinated studies will not answer all the questions. We believe that, even now, a coordinated



**Early cases of thyroid tumours after Chernobyl differed from later ones in unexpected ways.**

approach to monitoring exposed populations would at least provide an upper limit to the long-term health risks from fallout.

Fortunately, very few of those who contracted thyroid cancer have died from the disease (15 children so far), but it is too early to conclude that present or future cases will show a similarly low death rate. Other cancers are not so easily treatable. The need for an international effort to monitor all possible health consequences, using the studies of Japanese bomb survivors as a model, cannot be overstressed. At the very least, comprehensive studies should be conducted on the hundreds of thousands in the most affected areas of Belarus, Ukraine and Russia.

#### A loss of trust

Who should fund such studies? The 2005 budget for the Radiation Effects Research Foundation was US\$40 million. Currently, the United States and the European Union are committed to providing more than a billion dollars to

**“Studying the effects of Chernobyl would cost a tiny fraction of the amount spent by the nuclear industry.”**

make the Chernobyl sarcophagus safe, in addition to the many millions they have already contributed to humanitarian assistance and other studies. We do not suggest diverting funds from these worthwhile efforts, but comprehensive studies of the health consequences of Chernobyl would cost only a tiny fraction of the amount spent annually by the nuclear industry on energy production.

In terms of public health, the psychological consequences of exposure to the accident are probably more important than the physical consequences. Millions were exposed to fallout; all must have some concern for themselves and their children. For hundreds of thousands, fear of the unknown was

compounded by forced evacuation and loss of trust in government, caused by poor risk communication. Those living near the 30-kilometre exclusion zone were troubled by rulings that it was dangerous to live just inside the boundary, but perfectly safe to live just outside.

Public mistrust of the authorities was heightened by mismanaged responses to the accident. At the time, the Soviet nuclear industry and government failed to alert the public to take safety precautions. Later, various national and international organizations downplayed the

effects, while others exaggerated them to gain financial support, often contrary to the best evidence. Environmental organizations and the media have been important whistleblowers, but have also used unsubstantiated figures, selective quotations and horrific images to paint the

worst possible picture of the consequences. The nuclear industry has been equally selective in its use of figures and quotations, often equating a lack of evidence for an effect with evidence of its absence. As a result, rational public debate is very difficult.

The importance of Chernobyl lies therefore not only in numbers of cancers or deaths, or the economic costs, but also in its effect on people's attitudes. Villagers meeting a team from the International Atomic Energy Agency in 1990 voiced their fear of radiation, fear for their children, and mistrust of officialdom<sup>10</sup>: “What chance do the inhabitants of strict control regions have to raise normal children?” “People have been deceiving us for five years — will you tell us the truth?”

If a full, independent study of the consequences of the world's worst nuclear accident is not established, and its results published for all to assess, wildly differing claims will continue, and public mistrust of the nuclear industry will grow further.

Dillwyn Williams is in the Thyroid Carcinogenesis Research Group, Strangeways Research Laboratories, Worts Causeway, Cambridge CB1 8RN, UK.

Keith Baverstock is in the Department of Environmental Science, University of Kuopio, 70211 Kuopio, Finland.

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