



**The non-cancer mortality experience of male workers at British Nuclear Fuels plc, 1946-2005**

**Some questions and answers**

**Q1 This all sounds quite complicated to the layman, can you explain in simple terms what it means?**

A1 We have shown that workers at BNFL sites have a substantially lower mortality rate than the general population, but also that workers with the highest levels of occupational radiation exposure have a higher risk of dying from circulatory disease than those with the lowest levels of exposure. We cannot say from the results that radiation exposure is causing this difference in risks.

**Q2 It looks pretty obvious to the layman that radiation causes the increased risk – why do you say that you have doubts about this?**

A2 There are many well known risk factors for circulatory disease – for example diet, exercise, body mass index, cholesterol levels, smoking habits – that affect the risk of circulatory disease.

For example, a small increase in blood pressure from the ‘optimal’ level of 120/80 to a ‘high normal’ level of 130/85 increases the risk of circulatory disease by 20%; a small increase in cholesterol levels from the UK average of 5.5 mmols/l to 6 also increases the risk by 20%; and the risk of circulatory disease in smokers is about twice that in non-smokers.

The potential effect of these factors, especially in combination, is much larger than the difference we have seen between the highest and lowest exposed workers. As we have been able to control for these factors only very indirectly, through allowance for employment in ‘blue collar’ or ‘white collar’ jobs, we cannot say that the effects we have seen are really due to radiation.

**Q3 Are there any occupational risks other than radiation that might be influencing your results?**

A3 We have reviewed the literature on occupational causes of heart disease, and consider that occupational exposure to chemicals is unlikely to be a relevant factor. It is conceivable that combinations of shiftwork and stress may have an effect, and this may merit examination in future.

**Q4 What is the chance of any ‘average person’ dying of circulatory disease?**

A4 Circulatory diseases are a major cause of death - they account for one third to one half of all deaths. The major risk factors for death from circulatory disease are well known and include smoking, poor diet, lack of exercise, high blood pressure and elevated levels of cholesterol in the blood.

**Q5 What is the increased risk of dying of these diseases if you are a radiation worker?**

A5 Radiation workers overall showed similar death rates to non-radiation workers.

At current average death rates for England and Wales, a 20 year old man has a 75% chance of surviving to and beyond his 70<sup>th</sup> birthday. *If the increased risks that were seen in the most highly exposed workers were indeed caused by radiation exposure*, then exposure at the current average occupational dose rates for a working lifetime would reduce this probability by 0.1 percentage points, i.e. to about 74.9%.

**Q5.1 But what about the most highly exposed people in the early years?**

A5.1 *If radiation exposure were a cause*, then these people would have experienced higher risks than current workers – perhaps a 73% chance of surviving to and beyond the age of 70, again compared to 75% in the absence of exposure.

**Q6 Are the results reliable?**

A6 Yes the results are reliable. Our study has been reviewed by other eminent scientists even prior to submission to the Journal and subsequently, of course, by referees nominated by the Journal, prior to publication. We believe we have made a balanced interpretation of the results, and that was confirmed by the Journal’s referees.

**Q7 Can this effect be seen in other groups e.g. bomb survivors, cancer treatment patients?**

A7 As our paper explains, it is generally accepted that acute exposure to high doses of radiation – say, in excess of 1 Sv delivered in a short period of time – leads to an increase in risk of death from circulatory disease later in life. This effect is seen both in the atomic bomb survivors and in patients given high doses during radiotherapy, and the biological effects of high acute doses make such a link very plausible. Evidence for a link between circulatory disease and occupational exposure, where doses are much lower and delivered over an extended period of time, is weak and contradictory. There are no generally accepted biological mechanisms that could explain such a link.

**Q8 Are any studies taking place of other groups of radiation workers to see if they show the same results?**

A8 A study, led by the International Agency for Research on Cancer, (IARC), combining the results for cohorts of workers in 15 countries (including the UK) was recently published. This found that the association between radiation exposure and circulatory disease was not statistically significant, but allowing for the bounds of statistical confidence the results were not inconsistent with this latest study of the BNFL workforce. We are aware of several other studies which are underway that we anticipate will look at this area (the UK National Registry of Radiation Workers, international collaboration on studies of Russian nuclear workers at the Mayak reprocessing plant, and ongoing studies of the A-bomb survivors Radiation Effects Research Foundation in Hiroshima) As far as we are aware the results have not yet been published.

**Q9 Can you explain the current dose limits for nuclear workers and do workers actually receive these?**

A9 The current annual dose limit to radiation workers, set by the International Commission of Radiological Protection (ICRP) is 20 mSv per year. The Sellafield site currently operates to a dose limit of 10 mSv per year. In reality BNFL's radiation workers only receive an average dose of about 1 mSv per year; this is against an annual background dose in this area of around 2.5 mSv per year.

**Q10 Doesn't the industry have a compensation scheme for workers who get illnesses which could have been caused by the effects of radiation?**

A10 There is a nuclear workers compensation scheme which was jointly set up by BNFL and its unions in 1982; subsequently, most UK employers of radiation workers have joined the scheme.

It is designed to provide an alternative to legal action for those employees who have been employed as radiation workers and who are subsequently diagnosed to be suffering from radiation linked diseases – currently, cancer or cataracts of the eye. At the moment the scheme does not include non-cancer diseases other than cataracts.

The scheme is, in effect, a collective agreement between the employers and trades union involved; it is overseen by an expert panel, appointed by agreement between the parties. We have made sure that the compensation scheme secretariat is aware of our findings.