

Prof. Dr Chris Busby
Castle Cottage, Sea View Place, Aberystwyth SY23 1DZ UK

Statement of Chris Busby in relation to provisional injunction against Education Committee of Koryama City, Fukushima to evacuate the children for the radioactively contaminated area being filed on 24th June 2011.

I will make a brief statement below which outlines the main considerations in this matter and I will conclude that the children and adults living in areas which are contaminated to the extent that the external gamma dose rate at 1m from the contamination surface exceeds 1?Sv per hour should immediately relocate to an uncontaminated area. The continued presence of children in areas where greater than this level of external dose rate exists will have a serious health problems and these may lead to their deaths within the following ten years. Exposure of pregnant mothers to contamination at levels resulting in an excess dose rate at 1m from the ground of 1?Sv per hour will have a significant effect on the viability of the fetus and the survival and health of the baby.

1.1 The case

As I understand it, this plea is for court to make an order to permit the evacuation of children living and attending schools in radioactively contaminated areas in the Fukushima prefecture.

1.2 My expertise

I have a First Class Honours Special degree in Chemistry from the University of London and also hold a Doctorate in Chemical Physics from the University of Kent. I was elected to the Royal Society for Chemistry in 1974 and I am presently a Member of the International Society for Environmental Epidemiology and the Ukraine Committee *Physicians of Chernobyl*. I am a scientific reviewer for *The Lancet* and *The European Journal of Cancer*, *The Journal of Paediatric Radiology* and the *European Journal of Biology and Bioelectromagnetics* and *Science and Public Policy*

I have studied the health effects of low dose radiation for more than 20 years and conducted research both at the fundamental cell biology level, theoretically and as a radiation epidemiologist. I have been a member of two UK government committees on this issue (Committee Examining Radiation Risks for Internal Emitters, CERRIE, and the Ministry of Defence Depleted Uranium Oversight Board). I also have officially advised British Government and other expert or investigative committees e.g. The Committee on Radioactive Waste Management (CORWM), the US Congressional Committee on Veterans Affairs and Security, The Royal Society, The House of Commons Enquiry into the health of A-Bomb veterans and the European Parliament. I am an official expert witness for the Canadian Parliament on the health effects of Uranium. I was until 2007 a fellow of the University of Liverpool in the Faculty of Medicine and I am currently Visiting Professor Department of Molecular Biosciences in the University of Ulster in

Northern Ireland where I am supervising research on uranium photoelectron enhancement effects. I am also Guest Researcher at the Julius Kuhn Institute of the German Federal Agricultural Laboratories (FAL) in Brunswick near Hanover where I am examining the health effects of uranium exposure. I am Scientific Secretary of the European Committee on Radiation Risk (ECRR) based in Brussels (*Comite Europeen Sur Le Risque de l'Irradiation (CERI)*) and senior editor of its report *ECRR2003 Recommendations of the European Committee on Radiation Risk: The Health Effects of Ionising Radiation Exposure at Low Doses for Radiation Protection Purposes*. This report has now been translated into French, Russian, Japanese and Spanish and has been used for radiation protection purpose scoping by many organisations including most recently (2006) the UK Committee on Radioactive Waste Management (CORWM). I also edited the latest ECRR report (ECRR2010). I was invited by the nuclear industry in the UK (CIRIA) to provide advice for best practice in the remediation of contaminated land based on the ECRR risk model. I was, between 2003 and 2006 Science Policy Interface Group Leader of the EU Policy Information Network for Child Health and Environment PINCHE and also the senior *rapporteur* on both Ionising Radiation and ultraviolet solar radiation effects on children's health. I have acted as an expert witness in over 40 court cases in the UK and the USA on the issue of radiation and health

My particular area of expertise is the health effects of internally deposited radionuclides. I have made fundamental contributions to the science of radiation and health in this area and have published many articles and reports on this issue.

My researches have led me to the conclusion that the health consequences of exposure to internally deposited radionuclides cannot be either scientifically or empirically assessed using the averaging methods currently employed by risk agencies (ICRP, NCRP) based on the Japanese A-Bomb studies and other external high dose exposures. The radionuclide dose coefficients published by the ICRP and employed in calculations made by these organisations are unsound since they depend on inappropriate averaging of energy in tissue, as I shall elaborate. This is actually common sense; and it is increasingly seen to be so by many official radiation risk agencies and committees yet the historic weight of the conventional approach to radiation risk (with whole organisational and bureaucratic structures committed to the simplistic historic approaches) has prevented any change in policy in this area. Such an official acceptance of the scientific illegitimacy of the current radiation risk model for internal radiation exposures would have far reaching and financially costly policy implications.

1.3 Evaluating the health effects of exposures from Fukushima releases

The risk from exposure to ionising radiation is currently assessed by the Japanese authorities using the absorbed dose approach of the International Commission on Radiological Protection. The ICRP approach is based on the belief that the health effects of exposure to ionising radiation may be linearly related to the absorbed dose of radiation received. There is now overwhelming evidence that this is not true for certain kinds of internal exposures, including the exposures received by children and adults in Fukushima prefecture following the explosion and melt down and the on-going fissioning of the nuclear reactors and spent fuel element tanks

Measurements made by MEXT and by various universities, agencies and individuals in areas near and remote from the site of the releases show that the levels of radioactivity may be assessed through contamination by a range of radionuclides and also by gamma dose rate measurements. The limits for exposure decided on by the Japanese authorities are based on external gamma dose rate measured in microSieverts μ Sv per hour. This enables the cumulative dose to be calculated and compared with the recommendations of the ICRP that no individual should have greater than 1mSv (1000 μ Sv) in any year. Many areas where children and adults are now living continuously have radiation dose rates greater than 1 μ Sv per hour. Thus being in such an area for more than 365hours will already exceed the ICRP recommendations. In many parts of the area where children go to school they have already exceeded this limit.

However the use of this limit is dangerously incorrect in areas contaminated with material from Fukushima for a number of reasons:

1. Many of the radioactive substances present in the Fukushima environment are not gamma emitters and will not be included in the gamma radiation data. Examples include the beta emitters Strontium 90, Barium 140, Plutonium 241, Tritium (radioactive water), the alpha emitters plutonium 238, 239, 240, uranium 238 and Uranium 235 and Americium241. Thus the exposure is underestimated.

2. The environment contains alpha and beta emitting hot particles which are inhaled and ingested. These have now been detected in car air filters as far away as Tokyo. Their effects are extremely serious and we already hear reports of nose bleeds and diarrhoea resulting from the destruction of nasal passages and intestinal lining following exposure to these substances.

3. The internal radionuclides carry a far greater hazard in terms of their assessed dose than the same dose delivered externally. This is the position of the European Committee on Radiation Risk, an independent group of scientists and radiation experts of which I am the Scientific Secretary. The report ECRR2010 The Health Effects of Exposure to low doses of ionising radiation has been translated into Japanese (http://www.jca.apc.org/mihama/ecrr/ecrr2010_dl.htm)

4. The ECRR recommendation is that no member of the public should be exposed to any source from any man made process such that their total annual dose from all such sources is greater than 0.1mSv. This compares with the ICRP limit of 1mSv.

5. The status of the ECRR and ICRP is equivalent. For an outline of the general position of the ECRR with regard to current radiation risk models see The Lesvos Declaration (www.euradcom.org/2009/lesvosdeclaration.htm)

The normal natural background gamma radiation dose rate in the Fukushima area is less than 0.1 μ Sv per hour. An increase above about 0.2 μ Sv per hour signals a source for this extra radiation. This source is fallout contamination from the reactor site. This fallout contamination, modelled as Caesium-137, can be assessed at 300kBq/sqm for every 1 μ Sv per hour above gamma background. The Chernobyl exclusion zone was defined as 500kBq/sq metre. Measurements of Cs-137 on the ground as far away as 60km from the reactor site have shown levels of Cs137 between 1000 and 10,000kBq/sq m. It is my expert opinion that to permit children to remain in areas where these levels of contamination exist is irresponsible, will result in certain ill health and mortality and cannot be condoned in any civilised society. It is particularly sad and ironic, in my

opinion, that the country Japan which suffered first and so badly from the effects of the radiation from the atomic bomb is now destroying its own children and their parents as a result of slavishly following the recommendations of a risk agency dominated by the nuclear industry and its supporting scientists, recommendations which are based on a outdated risk model which has been shown to be false by epidemiological and theoretical developments for at least 15 years.

Chris Busby
June 23rd 2011