Low Level Radiation Campaign
Times Building,
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17th July 2017

The Rt Hon Greg Clark MP
Secretary of State for Business, Energy and Industrial Strategy

The Rt Hon Jeremy Hunt MP
Secretary of State for Health

Dear Sirs

Responses of BEIS and various agencies to new evidence on radiation risk.

1) The matters discussed in this letter are relevant to the acceptability of nuclear power and many other practices which entail releases of radioactivity. They also stand as *new evidence* in the sense required for applications for review of the Justification of a practice under both the existing and new European Basic Safety Standards directives, and we and other people acting separately submitted them to BEIS's Justification Application Centre in applications for review of the Justification of the EPR at Hinkley Point and an emissions licence at Bradwell. There may have been others in UK that we don't know about. [LLRC Application is Appendix 0] Similar applications have been submitted to the competent authorities in most other EU member states. In November 2016 we sent the evidence to COMARE and ICRP. On 17th February 2017 we submitted it to Radioactive Waste Management (RWM) for inclusion on their Issues Register. In January 2017 we submitted it to the Welsh Government (Radioactivity Policy) in connection with GDF. Pete Wilkinson, a colleague on the BEIS Nuclear NGO Forum, has sent the Environment Agency a calculation based on the new evidence showing that the so-called *acceptable risk* target of one in a million deaths or health detriments per year will be missed by a factor of 10,000 if they allow discharges at the dose limit they presently propose (20 microSieverts per year). In other words the health effects will occur at a rate of one in a hundred per year. [Wilkinson letter Appendix 1 and see EA reply Appendix 7]

2) The evidence submitted consists of two recent publications in reputable scientific journals. One is a review by Inge Schmitz-Feuerhake *et al.* of genetic effects in children following exposure to radioactivity released to the environment, predominantly from Chernobyl.[1] The data indicate that such releases are very substantially more harmful than ICRP risk coefficients predict.

The second publication is a letter. Given its provenance in the Genetics Society of America's journal *Genetics*, it indicates the extent to which, in this field, social science is becoming as important as radiation biology and epidemiology. It is an answer by Dr. Chris Busby[2] to a *Perspectives* article by Dr Bertrand Jordan.[3] Like Professor Wade Allison's 2009 book *Radiation and Reason: the Impact of Science on*

[1] Schmitz-Feuerhake, Busby C, Pflugbeil P Genetic Radiation Risks-A Neglected Topic in the Low Dose Debate. Environmental Health and Toxicology. 2016. 31Article ID e2016001. http://dx.doi.org/10.5620/eht.e2016001
[2] *Genetics* December 1, 2016 vol. 204 no. 4 1627-1629
[3] *Genetics*, Vol. 203, 1505–1512 August 2016

a Culture of Fear, Jordan argued that popular anxiety of radiation is irrational and he tried to dispel it by reference to the LifeSpan Studies (*LSS*) of Hiroshima and Nagasaki survivors. Busby's reply is a summary of methodological problems with the LSS and with ICRP's recommendations which depend heavily on LSS. In particular, assumptions such as the concept of absorbed dose and the Linear No Threshold model of radiation risk are seen to be problematic. The letter also addresses a cultural blindness which has caused decision makers and advisory committees to ignore or dismiss findings which challenge their beliefs.

3) There have been substantive **replies from BEIS and COMARE** which are discussed below. **RWM has replied** that evaluating the information is a matter for PHE and COMARE[4]. At the date of writing RWM has not posted the material in its Issues Register web site. **The Welsh Government** has expressed an interest in the outcome of planned discussions between COMARE and NGOs and has agreed that the issues need consideration in the development of a GDF. The **Environment Agency** has offered to meet Pete Wilkinson to discuss the *acceptable risk* target referred to above. We understand that he has agreed, though he also asked for a written response on the technical issues. **ICRP'**s reply [Appendix 2] is so evasive that it's not worth discussing here. It offers no remedy in any politically relevant timeframe.

4) COMARE's response

In March 2017 COMARE's Chairman, Dr Chris Gibson, replied that the evidence submitted did not lead to a change in the committee's views. His letter [Appendix 3] identified *several important issues*, which we discuss below. He ignored all the detailed discussion of the LSS in the *Genetics* letter. He ended with a rehearsal of studies on which COMARE's views on genetic effects of radiation are based.

4.1) His first *important issue* (para 3 first bullet) makes an irrelevant distinction between hereditary and teratogenic effects:

> *[Schmitz-Feuerhake make] No clear distinction between hereditary effects […] and teratogenic effects […] and hence confusion in describing and obtaining hereditary risk estimates.*

For the avoidance of doubt, hereditary effects are those passed to the infant via parental genes; teratogenic effects are caused by influences acting on the developing foetus in the womb. Dr. Gibson has ignored the points clearly made by Schmitz-Feuerhake:

> *The question of germ cell damage in parents vs. in utero damage to development, though important, seems to us to be beside the point. All these CM* [congenital malformation] *effects are caused by mutation of DNA whether in the parental germ cells and precursors or from implantation to birth. Our aim is to assess the genetic risk based on observations. […]*[5]

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[4] *We would advise that Public Health England as the public body responsible for carrying out certain public health duties on behalf of the Secretary of State for Health or the Committee in Medical Aspects of Radiation in the Environment would be better placed to evaluate challenges with respect to radiation risk and provide appropriate advice to regulators and others.*
The action we propose to take in response [to your concern as recorded on our issues register] is to continue to monitor developments in this area led by the relevant UK and international radiation protection organisations with whom we understand you have already raised your concerns. Thomas Reilly Issues Manager RWM to LLRC 17 May 2017

[5] footnote 1: second half of the paragraph headed *Genetic vs. Genomic, Mendelian vs. In Utero*.

In other words, the studies reviewed by Schmitz-Feuerhake show genetic conditions diagnosed at or shortly after birth. There is no way to tell whether they were caused by irradiation of gametes (fathers' sperm and mothers' eggs) before conception, or by irradiation of the fertilised egg/foetus. Whichever it is, the effect is thousands of times greater than predicted by official risk estimates. COMARE ought to know that ICRP, whose recommendations they follow, don't have separate coefficients for hereditary and teratogenic effects; there is only the *Detriment adjusted nominal risk coefficient for heritable effects* in ICRP103 Table A.4.4. COMARE should also know that ecological studies such as those reviewed by Schmitz-Feuerhake cannot distinguish between pre- and post-conceptional effects - that is for laboratory research.

It should be noted that the Schmitz-Feuerhake review is in agreement with a later study that shows, over the last 30 years in Chernobyl-affected areas of Ukraine, Belarus and Russia, increased genome damage in all groups of children who were exposed to doses significantly higher than 1 mSv per year. This is found in both evacuated and non-evacuated families, irrespective of whether the exposure was prenatal or postnatal, and irrespective of whether a child's father had been irradiated while working as a liquidator or whether both parents were exposed environmentally.[6]

4.2) His second *important issue* (para 3 second bullet) is

> *No adequate discussion of biological mechanism behind complex dose response for hereditary effects.*

Dr. Gibson refers to the fact that minimally contaminated areas have higher rates of CM than areas with more contamination. One has to ask whether he read the paper since, as it says, one of the reviewers asked for an explanation of this same point and the paper does explain it clearly and in simple terms. As the "dose" is increased from zero there are many biological blocks to the journey from fertilised egg to viable baby. Biological plausibility would predict that, at very low levels, there would be an increase in damage and an increase in recordable CM. At higher levels there would be more damage leading to foetal loss through failure to implant, early miscarriage and abortion. Only the survivors would be registered as malformed; the failures would not. So there is a saturation or "hogs-back" dose response in the lowest dose region. (As Schmitz-Feuerhake illustrate, the published data show a yet more complex relationship since, at still higher levels of pollution, there is a second peak and a second dip.)

4.3) His third *important issue* (para 3 third bullet) is

> *Selective reporting of studies, including some key studies and reviews. As examples of these , we note that the paper in* Genetics, Vol. 204, 1627–1629 December 2016*] is in fact a letter in response to an earlier detailed paper([7]), and it was rebutted by the authors of that paper (*Genetics, Vol. 204, 1631–1632 December 2016*)*

This is just snide. First, Dr. Gibson is suggesting that Dr Jordan's piece in *Genetics* has a higher scientific status than Busby's. In fact it is a *Perspectives* article and, in *Genetics, Perspectives* articles are opinion pieces, like letters. Contrary to the impression Dr. Gibson gives, Busby's reply is no less detailed than Jordan's article. As Dr. Gibson says, there was a short response from Dr. Jordan (just the one author, so Dr. Gibson's *authors* is spurious), but there is no way it can be called a rebuttal since

[6] Archives of Toxicology DOI 10.1007/s00204-016-1766-z *Follow-up studies on genome damage in children after Chernobyl nuclear power plant accident* Aleksandra Fucic, Anna Aghajanyan, Vladimir Druzhinin, Varvara Minina, Elizaveta Neronova

[7] Genetics, Vol. 203, 1505–1512 August 2016 1505

it failed to answer any of Busby's points - Dr. Jordan merely reiterated his faith in the LSS. Dr. Gibson further suggests that in not referring to Jordan's *rebuttal* we are guilty of selectivity but in fact we wrote to COMARE some weeks before the relevant issue of *Genetics* was published.

4.4) Dr. Gibson continues his accusation of selectivity (para 3 third bullet)

> *Similarly the paper in Environ. Health Prev. Med. 13: 264-370 2008)*[8] *was subject to significant challenge by two other groups in the same journal (Environ. Health Prev. Med. 2009 July 14(4): 247-249* [9] *and Environ. Health Prev. Med. 2009 Mar; 14(2): 155-156.*[10]

It's Dr. Gibson who is being selective. Watanabe *et al.* made three main points:-

- they criticised the LSS for defining the lowest dose exposed group in Hiroshima as a zero dose control;
- they defined a genuine zero dose control group and found that the LSS false controls in fact had elevated cancer rates;
- they criticised the LSS for its failure to measure the effects of radioactive fallout particles which, they said, *are easily taken into the body and have large effects on people exposed to them,* and they suggested that this explains the high cancer rate in the LSS false controls.

Watanabe *et al.* thus show that risk factors based on LSS are insecure and it is unsurprising that their study made headlines in Japan. Dr. Gibson is right to say that the authors were challenged in two letters, but he fails to mention that the authors immediately gave robust answers to both ([11], [12]). He also ignores a paper we cited ([13]) showing that people who lived so far from Hiroshima that the prompt gamma and neutron doses were zero nevertheless reported acute radiation symptoms from the black Uranium-polluted rain - a phenomenon that supports Watanabe *et al.*'s assertion that ingested and inhaled fallout has large effects. As Busby wrote in *Genetics*, LSS is silent on this type of hazard. There are large regulatory consequences.

4.5) The rest of Dr. Gibson's letter rehearses studies on which COMARE's views are based. This is not the place to discuss them in detail although that could be done if Dr. Gibson still wishes to rely on them as falsifying Schmitz-Feuerhake. Most of these studies are exclusively of external irradiation, unlike the inhaled and ingested Chernobyl fallout which is the type of exposure involved in the Schmitz-Feuerhake review. The A-bomb studies in Dr. Gibson's list are totally incapable of giving information on internal exposures for the reasons explored in the Watanabe correspondence we have discussed here. The studies of nuclear workers are flawed by using control groups of nuclear industry workers rather than the general public (the same error as the LSS makes). Dr. Gibson cites only one study that is solely of internal radiation.[14] It's a study of the Thorium-based contrast medium *Thorotrast*, which fell into disuse around 1950 as it proved to be carcinogenic and leukaemogenic

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[8] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2698250/ (Watanabe *et al.*)
[9] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2711884/ (Grant)
[10] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2684779/ (Shibata)
[11] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2711885/ (Watanabe *et al.* answer Grant)
[12] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2684778/ (Watanabe *et al.* answer Shibata)
[13] Sawada S. *Cover-up of the effects of internal exposure by residual radiation from the atomic bombing of Hiroshima and Nagasaki* https://www.ncbi.nlm.nih.gov/pubmed/17370859
[14] https://doi.org/10.1093/jnci/86.24.1866 - Dr. Gibson's reference 6

in the people who were injected with it. The study he cites looked at mortality and cancer in the children subsequently born to those patients. Examination shows that it's a very small study; that it's about ill people, not a typical population; that it doesn't record congenital malformation; and that perinatal mortality was 60% lower than in the general population, which could be due to the data loss problem detailed above. The number of babies born to the Thorotrast patients appears very low but the paper is so weak that it's pointless to speculate on the reason for the low fertility. We are surprised that COMARE places any reliance on such worthless studies.

5) BEIS response: Applications for review of the Justification of practices which expose people to radiation.

5.1) Both the old and the new European Basic Safety Standards Directives (BSS) require that anybody can apply for a review of the Justification of any practice if there is new and important evidence about its effects. Since November last year BEIS and the authorities in most of the EU member states have received applications based on the Schmitz-Feuerhake review and the correspondence in *Genetics*.

5.2) Matt Clarke, on behalf of BEIS, rejected our own application on the grounds that we had not submitted new and important evidence as required by the Directives. His letter is Appendix 4. It was based on a short and confusingly written advice note from Public Health England [Appendix 5] in which they ignored the Schmitz-Feuerhake review except for claiming that they couldn't work out the implied error in the ICRP genetic risk factor. We replied to Matt Clarke on 24th April [Appendix 6] showing how to calculate the error and analysing in detail how PHE misrepresented various elements of our application. We showed how PHE cited studies that they claimed disproved components of the application but are actually irrelevant; how they were silent on other components and relied on assumptions which are falsified by the evidence submitted. We have received no reply. Please ensure that our application is considered properly.

5.3) Among other Governments which have received applications for Justification reviews Ireland and Sweden have been the quickest to respond. Ireland has accepted the applications as valid and within its competence but argues that the radioisotopes involved mean none of the practices within its jurisdiction are affected. Discussions are ongoing. Later this year the Swedish Land and Environmental Court will hear evidence and criticisms of the radiation risk model upon which an application for review of the justification of the Forsmark repository is based. The Swedish radiation protection agency will respond, followed by an opportunity for a response to their response. Discussions are under way with the French Autorité de Sûreté Nucléaire who say, irrelevantly, that Justification is a matter for operators although they accept that, where a nuclear activity no longer appears justified, it is a matter for the competent authority to close it down or establish a way for justification to be reestablished.

6) This afternoon the Environment Agency provided [Appendix 7] the written reply Pete Wilkinson asked for expressing the Agency's view of the evidence (see paras 1 and 3 and Appendix 1). The Agency says it *considers that the standards and limits set in legislation are underpinned by sound science* and ICRP's recommendations *are based on the best available and rigorously peer reviewed scientific information and represent a strong international consensus*. They decline to discuss radiation health effects and radiation risk factors and close with the suggestion that the most appropriate bodies for discussing such topics are PHE and COMARE. But we have shown that PHE and COMARE have addressed relevant scientific issues combatively rather than

competently. Your Departments and the Environment Agency face a crisis of confidence. We are willing to discuss a way forward.

Yours sincerely

Richard Bramhall