

# Proposal to BEIS Nuclear NGO Forum for Joint Fact Finding on a radiation risk dispute

## Introduction

Disputes over radiation risk modelling have gone on since 1943 and much has been written about the science. This paper does not add to that literature; it is about process. It arises from the September 2018 meeting of the BEIS Nuclear NGO Forum in which Richard Bramhall of the Low Level Radiation Campaign (LLRC) argued for Joint Fact Finding (JFF) on issues arising from documented exchanges between LLRC and the BEIS Justification Application Centre (JAC) and subsequent recommendations from Welsh regulators Natural Resources Wales (NRW).

A meeting between Bramhall, Pete Wilkinson, and Umran Nazir with other BEIS officials briefly explored the background. It ended with RB and PW being asked for a proposal defining the scope and method of JFF. This paper is the outcome. BEIS asked for it to be available for discussion at the January 2019 Forum. Thirty minutes would be allocated at that meeting.

We begin by outlining the documents and their context. Since the documents from both LLRC and the JAC and its advisors address well-specified topics it has been possible to analyse their relevance and reliability. On that basis we feel there is a crisis of competence in bodies which have important policy roles but little accountability and no appetite for debate, even when Government Ministers have asked them to address specific issues.

At certain points the correspondence raises issues that are more to do with sociology than science. At the same time there are political, legal and regulatory implications which explain why this matter has come back to BEIS. The Joint Fact Finding is intended as a way of scoping and helping to resolve only the scientific differences of opinion. We leave aside the sociological, political, legal and regulatory aspects except for a section entitled *The frustrated search for consensus reporting*. We conclude with an outline of the structure of a JFF panel, its mode of working, and an agenda based on the correspondence between LLRC and JAC. COMARE's role cannot be overlooked but, for the sake of not over-complicating the paperwork, we do not propose to include their arguments (Footnote18) at this stage.

We recommend an initial read-through. The paper is intended to stand alone and to be comprehensible to a first-time reader. The web links to other documents are meant mostly to let readers check the account's veracity. The links are in footnotes.

## LLRC's application for a Justification review

The present proposal arises from LLRC's application (November 2016) to the JAC for a review of the justification of the Hinkley Point C EPR.<sup>1</sup> EU Basic Safety Standards Directives allow for such a review if there is *new and important evidence*. A 2009 letter from the European Energy Commissioner<sup>2</sup> outlines the Justification principle and the European Commission's role in scrutinising the process.

## The evidence put forward by LLRC

LLRC's application, which was copied to COMARE at the same time, was based on two pieces of evidence:

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<sup>1</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/47936/666-decision-EPR-nuclear-reactor.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47936/666-decision-EPR-nuclear-reactor.pdf).

<sup>2</sup> <http://www.llrc.org/llrc/regulation/subtopic/piebalgsletter030409.pdf>

**1) an exchange in the journal *Genetics*.** Bertrand Jordan, a CERN physicist, discussed <sup>3</sup> the LifeSpan Studies (LSS) of Hiroshima and Nagasaki bomb survivors which are the basis of radiation risk estimates advised by the International Commission on Radiological Protection (ICRP). He argued that public concerns about radiation are irrational because the LSS show that the highest dose survivors lose only one year of life despite having 42% more cancer than the low dose group, and their children appear to be unaffected. Chris Busby replied <sup>4</sup> that the LSS cannot be relied on because they have no information on internal radioactivity, because they ignore reports of acute radiation sickness in remote areas where there was Uranium fallout but where external doses were zero, and because the control population was abandoned when it turned out to be too healthy.<sup>5</sup> Dr. Jordan's response <sup>6</sup> did not address these criticisms.

**2) a review of congenital malformations** <sup>7</sup> reported by official registries after Chernobyl. The incidence rates observed are up to 59,000 times greater than ICRP would predict on the basis of the estimated doses. Since the LSS found no effect, ICRP assesses genetic risks using data from experiments in which large numbers of mice were exposed to X-rays.<sup>8</sup>

### Significance for regulation

Both pieces of evidence refer to recent changes in the understanding of the biological effects of radiation, especially for internal exposures to nanoparticles and elements such as Uranium that have chemical affinity for DNA. This defines a conceptual error in radiation risk assessments that employ the ICRP's *absorbed dose* quantities.<sup>9</sup> A large number of studies show health effects that cannot be explained since the doses as modelled by ICRP appear too low, leading to calls for re-evaluation.<sup>10</sup> There are far-reaching implications for regulatory standards based on radiation dose quantities and the concept of *tolerable risk* <sup>11</sup> as applied by environment agencies and others who in the last two years have declined to address the science of risk modelling,<sup>12</sup> leaving PHE and COMARE as the only interlocutors.

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<sup>3</sup> <http://www.genetics.org/content/203/4/1505>

<sup>4</sup> <http://www.genetics.org/content/204/4/1627>

<sup>5</sup> Moriyama, I. M., and H. Kato, 1973 Mortality experience of A-bomb survivors 1970–72, 1950–72. JNIIH-ABCC Life Span Study Report 7 (Technical Report 15–73); pp 6–7. Hiroshima Japan: ABCC (quoted in ref 4).

<sup>6</sup> <http://www.genetics.org/content/204/4/1631>

<sup>7</sup> Schmitz-Feuerhake, Busby C, Pflugbeil P *Genetic Radiation Risks-A Neglected Topic in the Low Dose Debate*. Environmental Health and Toxicology. 2016. <http://dx.doi.org/10.5620/eht.e2016001>.

<sup>8</sup> *Detriment adjusted nominal risk coefficient for heritable effects*: ICRP103 Table A.4.4.

<sup>9</sup> e.g. *There are important concerns with respect to the heterogeneity of dose delivery within tissues and cells from short-range charged particle emissions, the extent to which current models adequately represent such interactions with biological targets, and the specification of target cells at risk. Indeed, the actual concepts of absorbed dose become questionable, and sometimes meaningless, when considering interactions at the cellular and molecular levels.*

Report of Committee Examining Radiation Risks of Internal Emitters; Chapter 2 *Risks from Internal Emitters Part 2* para.11

(<https://webarchive.nationalarchives.gov.uk/20140108135436/http://www.cerrie.org/>)

<sup>10</sup> e.g. European Committee on Radiation Risk Recommendations 2010 <http://euradcom.eu/ecrr-recommendations-2010/>

<sup>11</sup> see <http://www.hse.gov.uk/risk/theory/r2p2.htm>

<sup>12</sup> e.g. <http://www.llrc.org/campaigns/justification/RResponseToPWilkinson-final170717.pdf>

## LLRC's dialogue with JAC and COMARE

There were two rounds of correspondence with the JAC:-

- the application<sup>13</sup>
- a response letter<sup>14</sup> which was based on and incorporated an advice note from Public Health England<sup>15</sup>
- a response from LLRC<sup>16</sup>
- a second response from the JAC<sup>17</sup> indicating that any further correspondence would be treated as vexatious and would not be considered.

COMARE also replied to LLRC<sup>18</sup> and made a brief verbal comment at the BEIS/ Nuclear NGO meeting in Church House, Westminster on 12th September 2017.

LLRC's position is that the responses from the JAC, PHE, and COMARE are, in various ways, irrelevant, evasive and misleading.

## The Cardiff mud dump and LLRC's correspondence with Natural Resources Wales

In December 2017 LLRC was asked to advise Welsh campaign groups on a licence<sup>19</sup> issued by Natural Resources Wales (NRW) that allows 300,000 tonnes of radioactively contaminated sediment from the seabed off the Hinkley Point C site to be dumped in the Severn Estuary close to Cardiff. The licence is based on tests conducted by the Government laboratory CEFAS. LLRC advised that although the CEFAS testing could not reveal directly whether the mud contained Uranium and Plutonium there was indirect evidence that these elements were present. Moreover, data from UNSCEAR<sup>20</sup> and RIFE<sup>21</sup> showed they were likely to be present in the form of relatively insoluble particles that, once dumped into a circulatory system of high tidal energy, would be resuspended by well-known mechanisms. This would make them available for inhalation and ingestion so the dumping was likely to cause the same kind of exposure as the Chernobyl accident, above-ground nuclear weapons tests, and the Hiroshima and Nagasaki bombs. The correspondence between LLRC, the JAC, COMARE and PHE was therefore germane and LLRC wrote twice<sup>22, 23</sup> to Diane McCrea the Chair of NRW arguing, on the basis of detailed analysis, that NRW was relying on inadequate radiological opinion. A reply from NRW<sup>24</sup> insisted that NRW was required to follow procedures developed by the International Atomic Energy Agency (IAEA) and that CEFAS had analysed the samples in accordance with these internationally recognised standards. Ms McCrea failed to address the submitted evidence on radiological risk, recommending only that LLRC should *continue to communicate with BEIS its advisory bodies*.

LLRC replied on 13th July<sup>25</sup> asking why NRW failed to require a more precautionary assessment than IAEA's; Dr. Tim Deere-Jones had briefed the Senedd Petitions Committee, 12 March 2018, that there is no legal restriction on the Welsh

<sup>13</sup> <http://www.llrc.org/campaigns/justification/JustificationBusbyBramNov2016.pdf>

<sup>14</sup> <http://www.llrc.org/campaigns/justification/Richard Bramhall - 2017 - 03.pdf>

<sup>15</sup> <http://www.llrc.org/campaigns/justification/PHE Analysis of Justification Request EPR.pdf>

<sup>16</sup> <http://www.llrc.org/campaigns/justification/LLRCtoJAC22052017.pdf>

<sup>17</sup> <http://www.llrc.org/campaigns/justification/Richard Bramhall - 2017 - 07.pdf>

<sup>18</sup> <http://www.llrc.org/campaigns/justification/COMAREbusby2017com.pdf>

<sup>19</sup> <http://www.valeofglamorgan.gov.uk/Documents/Committee Reports/Cabinet/2017/17-10-09/Appendices/Disposal-of-Dredged-Material-Associated-with-the-Construction-of-Hinkley-Point-C-Power-Station-Appendix-2.pdf>

<sup>20</sup> [http://www.unscear.org/docs/publications/2000/UNSCEAR\\_2000\\_Annex-C-CORR.pdf](http://www.unscear.org/docs/publications/2000/UNSCEAR_2000_Annex-C-CORR.pdf) Table 34

<sup>21</sup> RIFE 1 (1995) p.30, RIFE 22 (2016) p. 123; AEMR Number 23 (*Radioactivity in Surface and Coastal Waters of the British Isles 1989*: page 43.)

<sup>22</sup> <http://llrc.org/campaigns/muddump/June2018docs/RB2NRW050618.pdf>

<sup>23</sup> <http://llrc.org/campaigns/muddump/June2018docs/RB2NRW210618.pdf>

<sup>24</sup> <http://www.llrc.org/campaigns/muddump/June2018docs/NRWtoLLRC09072018.pdf>

<sup>25</sup> <http://llrc.org/campaigns/muddump/June2018docs/LLRCtoNRW13072018IAEA.pdf>

Government and NRW *taking or recommending independent action to require more than the normal protocols*. He had received no answer. LLRC now asked NRW to consider even more specifically whether the evidence provided was robust enough to trigger precautionary provisions of the Environment (Wales) Act 2016<sup>26</sup> and whether the Welsh Government and NRW might consequently be breaking Welsh law. Ms. McCrea resigned six days later for unrelated reasons.

### **LLRC's approach to the Welsh Environment Secretary**

LLRC then sent the same material to the Welsh Environment Secretary, Lesley Griffiths AM who replied<sup>27</sup> that

*all the tests and assessments carried out by NRW and their experts in this specific field concluded the material is within safe limits and poses no radiological risk to human health or the environment.*

Concerning the evidence on radiation risk she referred LLRC back to NRW as the licensing authority.

### **A further approach to NRW**

On 18 August 2018 LLRC emailed Dr. Madeleine Havard,<sup>28</sup> NRW's Acting Chair, asking how, in general, NRW assesses whether new information raises *uncertainties* in the terms of the Environment (Wales) Act 2016 and what NRW did to evaluate whether any uncertainty was raised by the two letters to Diane McCrea in June (<sup>22</sup>,<sup>23</sup>). Dr Havard's reply<sup>29</sup> gave no answer to the question of how NRW assesses whether new information raises uncertainties; on the question of what NRW did to evaluate LLRC's analysis of the Justification correspondence Dr. Havard relied on the irrelevant assertion that NRW were *satisfied that Cefas analysed the samples in accordance with [IAEA's] internationally recognised standards*. She repeated the advice to take the scientific issues back to BEIS.

### **A joint approach to the Welsh Environment Secretary**

On 4th September 2018 Bramhall wrote to Education Secretary Kirsty Williams AM<sup>30</sup> on behalf of LLRC and Cllr. Ernie Galsworthy, co-Chair of the Nuclear-Free Local Authorities' Wales Forum. He asked her to arrange a meeting with Environment Secretary Lesley Griffiths to discuss Joint Fact Finding on the scientific issues raised by the correspondence with the JAC. Noting that NRW has insisted the science be taken back to BEIS he wrote that there was no objection to BEIS contributing to JFF but that the peculiarly Welsh angle represented by the Cardiff mud dump and the large amount of public concern should lead Assembly Members to feel a sense of

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<sup>26</sup> specifically Part 1 Introduction Para. 4 which require NRW to adhere to principles of sustainable management of natural resources, viz.

- (a) to manage adaptively, by ... where appropriate, changing action;
- (b) to consider the appropriate spatial scale for action;
- (c) to promote and engage in collaboration and co-operation;
- (d) to make appropriate arrangements for public participation in decisionmaking;
- (e) to take account of all relevant evidence and gather evidence in respect of uncertainties;
- (f) to take account of the benefits and intrinsic value of natural resources and ecosystems;
- (g) take account of the short, medium and long term consequences of actions;

<sup>27</sup> [http://llrc.org/campaigns/muddump/JFFdocs/LG0153218\\_Outgoing\\_0.pdf](http://llrc.org/campaigns/muddump/JFFdocs/LG0153218_Outgoing_0.pdf)

<sup>28</sup> <http://llrc.org/campaigns/muddump/June2018docs/RichardBramhallEmailToNRWAug182018.pdf>

<sup>29</sup> <http://llrc.org/campaigns/muddump/June2018docs/NRWdutyofcaretoRichardBramhallAugust2018.pdf>

<sup>30</sup> <http://llrc.org/campaigns/muddump/JFFdocs/KirstyWilliamsJFFproposal04092018.pdf>

ownership. The message was passed on<sup>31</sup> but elicited only a brush-off from Ms. Griffiths' Assistant Diary Secretary.<sup>32</sup>

In a Senedd Plenary debate in May<sup>33</sup> Ms. Griffiths had dismissed concerns about the mud, saying *There is no scientific basis for any further testing or assessments to be done, so I think if they did that, that would set out a very dangerous precedent.* In an October Plenary she went further,<sup>34</sup> speaking of campaigners' *misinformation, scaremongering, lies, myths and untruths*, and she has committed considerable public expenditure by giving NRW a formal Direction that requires them *to reassure the public.* We therefore seem to have reached a complete breakdown of communication with no prospect of rational dialogue with the authorities in Wales.

### **BEIS Forum discussions and the meaning of *consensus***

NGO concern about the possible underestimation of radiation risks has been a consistent theme in the Forum. In 2011 the NGOs identified<sup>35</sup> a number of topics to inform discussion with COMARE in 2012.<sup>36</sup> On 28th February 2013<sup>37</sup> Bramhall told the Forum that most of those topics had not been discussed. He was asked to propose a way forward. The NGOs adopted resolutions requesting JFF and discussions about the process went on for two years. The most informative minutes on the topic<sup>38</sup> are missing from the Government archive but they show the Department willing to get on with JFF although they doubted that consensus *could be reached given two decades of discussions and formal processes which have not achieved [it].* Rather than argue about what has and hasn't been achieved we feel it's more constructive to ask what consensus would look like. Experience shows that the report is the key element.

### **The frustrated search for consensus reporting**

In 2001 Michael Meacher set up CERRIE with an oppositional structure. At that time he, like many other politicians and civil servants, was acutely aware of the embarrassment of finding that BSE could cross species barriers despite the consensus opinion of the Spongiform Encephalopathy Advisory Committee. To inform his position on radioactivity he wanted a more challenging kind of committee. The remit he set was

*The committee [...] aims to reach consensus where possible. On topics where differences of view remain after its deliberations, it will explain the reasons for these and recommend research to try to resolve them. [...] CERRIE will produce a report that is agreed by all its members. The report will not be subject to amendment [...].<sup>39</sup>*

<sup>31</sup> <http://llrc.org/campaigns/muddump/JFFdocs/JFFrequesttoEnvtSecviaKirstyWilliams04Sept2018.pdf>

<sup>32</sup> <http://llrc.org/campaigns/muddump/JFFdocs/ThankyouforyourinvitationEnvSecdeclinesJFF.pdf>

<sup>33</sup> <http://record.assembly.wales/Plenary/4986 - A43752> (= transcript; see para. 424 at 17:27 hrs)

<sup>34</sup> <http://record.assembly.wales/Plenary/5356?lang=en-GB - A45903> (para 471)

<sup>35</sup> Andy Blowers' *Key Issues and Controversies concerning the effects of radiation on health*, compiled to inform the 2012 meeting of the NGO Forum and COMARE. Not found on the archive:—  
[http://webarchive.nationalarchives.gov.uk/20121217153819/http://www.decc.gov.uk/en/content/cms/meeting\\_energy/nuclear/forums/non\\_gov\\_org/non\\_gov\\_org.aspx](http://webarchive.nationalarchives.gov.uk/20121217153819/http://www.decc.gov.uk/en/content/cms/meeting_energy/nuclear/forums/non_gov_org/non_gov_org.aspx)

<sup>36</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/66718/7033-minutes-decc-ngo-forum-panel-disc-comare.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/66718/7033-minutes-decc-ngo-forum-panel-disc-comare.pdf)

<sup>37</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/200217/minutes\\_decc\\_ngo\\_forum\\_meeting\\_28\\_feb\\_2013.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/200217/minutes_decc_ngo_forum_meeting_28_feb_2013.pdf)

<sup>38</sup> i.e. minutes of 10th Forum meeting 1<sup>st</sup> October 2013. At 5 Jan 2019 they are missing from <https://www.gov.uk/government/groups/non-governmental-organisation-forum>.

<sup>39</sup> Rt. Hon. Michael Meacher, Minister of State for the Environment, at DEFRA announcing formation of the Committee Examining Radiation Risk from Internal Emitters (CERRIE) July 2001.



In 2004 he wrote:

*Unfortunately, it seems that the procedures which prevailed in the Committee, while they have allowed discussion of a wide range of topics, have produced a Final Report which does not accommodate a full and fair representation of all views. More seriously, from the point of view of taking this debate forward, the Report fails to explain the reasons for the continuing disagreements. This applies, in some cases, to what look like quite basic issues.*<sup>40</sup>

Bramhall briefed the Forum in 2014<sup>41</sup> on CERRIE, SAFEGROUNDS and STOA as examples of biased reporting. Subsequently he found that archived documents of SAFEGROUNDS had been airbrushed even more extensively and more tendentiously than he'd realised. We can now add a further example from the Forum itself — Baroness Verma's suggestion<sup>42</sup> in 2015 that NGOs might be involved in a review or *Restatement* by Oxford University to be published in Proceedings of the Royal Society. In the event there was no NGO involvement and the *Restatement* as published<sup>43</sup> endorsed the ICRP position omitting any mention of the evidence in LLRC's application to the JAC although it had been published in the literature more than a year earlier. The *Introduction* reported that risks are *widely debated* and that *some people believe the dose limits are too strict and impose unreasonable costs on the use of radiation, while others believe that they are not strict enough and allow too much risk*. The review cited a paper arguing for less stringent regulation and a paper refuting that idea. It cited no evidence in support of the idea that risks might have been underestimated.

Richard Bramhall has also questioned the accuracy of the minutes of the Forum meeting with COMARE in September 2017. He has raised doubts about the claim that COMARE addressed the evidence of congenital malformations after Chernobyl (Fn7), as Energy Minister Richard Harrington had asked them to do.<sup>44</sup> This is unresolved at the date of writing.

### **Consensus reporting defined:— a report agreed by all its members**

We close this matter by recommending that Meacher's formula — *a report that is agreed by all its members* — adequately defines consensus. There is one caveat:— achieving the goal of a single report which captures disagreements will require differing views of any particular topic to go through as many iterations of the draft report as it takes for each side to address the other's arguments and to agree, finally, that the reasoning is clear.

### **A structure for Joint Fact Finding.**

We propose a panel composed of three NGO representatives from the Forum and three BEIS appointees, possibly departmental Scientific Advisers. We propose to appoint NGO representatives who display a co-operative frame of mind, a willingness to grapple with complexity, and an ability to write simply and clearly. NGO representatives will not necessarily be scientifically versed in radiological matters

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<sup>40</sup> Ex-Environment Minister Michael Meacher Foreword to Minority Report of Committee Examining Radiation Risks of Internal Emitters (CERRIE) 2004 ISBN: 0-9543081-1-5 p.1

<sup>41</sup> see page 3 of <http://llrc.org/campaigns/muddump/JFFdocs/JFFradhealth2014proposal.pdf>

<sup>42</sup> <http://llrc.org/campaigns/muddump/JFFdocs/BaronessVermatoBramhallandWilkinson.pdf>

<sup>43</sup> *A restatement of the natural science evidence base concerning the health effects of low-level ionizing radiation* <https://dx.doi.org/10.6084/m9.figshare.c.3838153> 7 September 2017

<sup>44</sup> <http://llrc.org/campaigns/muddump/June2018docs/App10EnergyMinistertoRB.pdf>

although they will possess a working knowledge of the issues. BEIS could appoint as panellists the scientists they wish to rely on for scientific input to the process. This panel of six people will be required to work closely together throughout the process to ensure a smooth progression of the exercise which will consist primarily of assessing written answers to the questions set out above – after suitable refinement should it be required - asked of a number of experts identified through a collaborative process entered into by the panel members. Although face-to-face meetings with experts will probably be necessary on occasions, a predominantly remote-working approach will reduce the number of ‘in-person’ meetings required to a minimum, limiting the costs of undertaking the exercise, reduce the need to travel and will ensure more effective use of time.

The secretariat should be external and professional, in the manner of CIRIA providing the secretariat for SAFEGROUNDS. The nature of the record of meetings will be agreed by the panel members with the objective of ensuring clarity and unambiguity.

It is likely that the panel will be required to meet face-to-face at least once before the process begins in order to agree structural and administration matters. This will include the manner in which the experts are identified and recruited, minuting and progressing the panel sessions, be they remotely conducted or face-to-face, remuneration issues, follow-up, dispute resolution and report writing. As in all matters associated with a joint fact-finding exercise, it is essential to conduct proceedings in a collaborative and co-operative manner: all aspects of the exercise as well as the final report and the process through which it is arrived at must be agreed by all members of the panel.

### **Proposed agenda for Joint Fact Finding.**

With reference to LLRC's first letter to NRW (footnote 22) and the studies cited therein and in the correspondence between LLRC and the JAC:

- 1) Do the Life Span Studies (LSS) of Hiroshima and Nagasaki survivors lack unexposed control populations and /or information on internal radioactivity? If so, what are the implications for radiation protection standards? (pp. 2, 3)
- 2) Do the studies of nuclear industry workers lack unexposed control populations and /or information on internal radioactivity? If so, what are the implications for radiation protection standards? (p.3)
- 3) Is an average absorbed dose model appropriate for assessing risks from exposure to internal particulates? Can any discrepancies be quantified? (pp. 3, 4)
- 4) Does fragmentation of radioactive particulates on beaches lead to increased hazard following inhalation, ingestion or absorption? (pp. 4, 5)

With reference to LLRC's second letter to NRW (footnote 23) and the studies cited therein and in the correspondence between LLRC and the JAC:

- 5) In respect of references 16, 17, 18 in the letter (footnote 23), is there epidemiological evidence from weapons test fallout and Chernobyl to support the hypothesis that internal particulates are more hazardous than predicted by ICRP? If so, can the discrepancy be explained and quantified
- 6) What are the implications for radiation protection of comments from BEIS and Professor John Harrison concerning individual dose estimates in ecological studies? ((footnote 23) p. 6 line No. (*Fourth* etc). ... and p.7)

With reference to Public Health England advice to BEIS (Footnote 15 of this document) and LLRC's response (Fn 16) [Note that page and line references in the PHE advice refer to the LLRC application to JAC - Fn 13 of this document]

7)

- a) Did PHE use a circular argument about the linear dose response assumption? (Fn 15 p.1, numbered item 1, 2nd para) and LLRC's response (Fn 16 p.2 lines 1-24)
- b) Did PHE misdirect BEIS on internal contamination and Uranium? (PHE's p.2 Section 2(b) and LLRC's answer Fn 16 p.4 last paragraph *PHE misdirection on LSS, internal contamination and Uranium.*)
- c) Did PHE misdirect BEIS on the significance of rainfall and acute radiation syndrome in areas remote from Hiroshima and Nagasaki? (PHE's p.2 Section 2(c) lines 7-17 and LLRC's answer Fn 16 p.5 lines 3-25 ending *fallout caused acute health effects in people who got no external irradiation.*)
- d) Did PHE misdirect BEIS on the interaction between natural gamma radiation and Uranium in body tissue? (Fn 15 2.(c) lines 1-7 and LLRC's answer Fn 16 p. 5 *Uranium: the Photoelectric Effect and Uranium binding to DNA as far as p.6 line 19*)
- e) Did PHE make an adequate argument for dropping the control group in the Life Span Study of Japanese A-bomb survivors when it turned out to be too healthy? (Fn 15 2.(a) *selection of control groups* and LLRC's answer Fn 16 p.6 *Dropping the controls* as far as p.7 line 5)
- f) What is the significance of differing conclusions in studies of the ratios of male to female babies born to Japanese A-bomb survivors? (LLRC's letter 16 p.7 line 14-22 and JAC's answer Fn 17 p.2 *Ratios of male to female births*: line 32 etc.)
- g) Did PHE provide any relevant response to the reported increases of congenital malformation in babies born after the Chernobyl accident (ref 13 p.2 para.2 *Evidence of genetic damage leading to heritable effects in those exposed to Chernobyl fallout in Europe*)?

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Supported and endorsed by NFLA

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