Times Building
South Crescent
Llandrindod Wells
LD1 5DH
phone: xxxxxxxxx
21st June 2018

Diane McCrea
Chair, Natural Resources Wales
c/o Kirsty Williams AM

Dear Diane McCrea

Scientific evidence relevant to Petition P-05-785 *Suspend Marine Licence 12/45/ML to dump radioactive marine sediments from the Hinkley Point nuclear site into Wales coastal waters off Cardiff*

My previous letter to you (5th June) discussed three issues:

- studies of Atom bomb survivors and nuclear industry workers on which the ICRP risk model depends are silent on internal radioactivity;
- the use of Absorbed Dose is inappropriate for modelling exposures to internal particulates, in other words the type of material that CEFAS has failed to look for in the sediment;[1]
- fragmentation of radioactive particulates on beaches and the consequent increase in hazard following inhalation.

I concluded by offering this further letter. I discuss evidence in the peer-reviewed literature that shows health effects from weapons test fallout and Chernobyl which challenge the ICRP risk model and strongly suggest that the relevant vector is radioactive particulates; it is not a compendium of such evidence — that has been done in other places by me and others. The point is to show how scientific dialogue has been frustrated.

People argue that an international consensus supports confidence in ICRP and that a large number of scientific committees endorse its methodology. This, however, is more interesting to a sociologist than to a scientist. It is often and rightly said that science is not a popularity contest — a single, credible and unrefuted piece of evidence is enough to destroy a thesis, never mind how many people cling to it. The evidence I discuss here has been presented to various departments and agencies. This letter is devoted to showing how these bodies attempt to falsify our thesis by misrepresentation, evasion and by offering unscientific and illogical responses.

It is plainly not possible for NRW to resolve all the scientific questions, especially since your Environment Agency mentors have quit the field.[2] But you can see that the evidence strongly suggests alpha emitting particulates cause increases in disease that ICRP does not predict. CEFAS indisputably failed to use a test that would have settled whether the mud contains alpha emitting particulates and I have told you that post-dump fragmentation of particulates would increase the exposure. I am arguing that you should insist on new sampling and testing using methods acceptable to the campaigners. This would be a reasonable precautionary stance.

---

[1] See 4Feb2018HinkMudRept.pdf attached to my 5th June letter.
[2] *Environment Agency have quit the field* see top of page 8.

Justification review application to the Justification Application Centre (JAC) of the Department of Business, Energy and Industrial Strategy (BEIS)

Under European Basic Safety Standards (BSS) Directives any practice that exposes people to radiation must be Justified; that is, the social and economic benefits must be weighed against the radiation detriment it will cause. The Directives also give citizens a power to apply for a review of the Justification of any practice or class of practice if *there is new and important evidence about their efficacy or potential consequences*.[3]

In 2017 I and a colleague applied for review of the Justification of the planned Hinkley Point C nuclear power station. I am not attaching the application document as I need refer only to the two pieces of evidence it contained:

1. a pre-publication copy of the letter in *Genetics*[4] that discusses methodological failings in the crucial LifeSpan Studies (LSS) of Hiroshima and Nagasaki survivors. My earlier letter explained why the LSS have no information on the health effects of internal radioactivity and told you that there has been no coherent response in *Genetics*.
2. a 2016 review of congenital malformations (CM)[5] after the Chernobyl accident dispersed Uranium fuel particles across large areas of Europe and the near East.[6] The review shows a very large discrepancy between rates predicted by ICRP and what was clinically observed. It has extensive discussion of the methodological and conceptual reasons for this discrepancy.

BEIS (Appendix 4) rejected the application using arguments based on advice from Public Health England (PHE); see Appendix 5. I responded to BEIS (Appendix 6) analysing their arguments. A summary of my points is:

- PHE advice to BEIS is evasive, selective and misleading and consistently misrepresents the application. It makes philosophical errors of well-defined types;
- PHE ignore the evidence because it contradicts the dogmas that radiation detriment is well understood and that dose response is linear; PHE arguments about the linear dose response assumption are circular;
- PHE pretend to be incapable of calculating the error in ICRP's Heritable Effects risk factor that is implied by the evidence;
- misdirection on internal contamination and Uranium;
- misdirection on the significance of rainfall in LSS;

---

[3] A new Directive (Council Directive 2013/59 of 5th Dec 2013) comes into force this year. It expresses the review power as: *Member States shall consider a review of existing classes or types of practices with regard to their justification whenever there is new and important evidence about their efficacy or potential consequences* (Article 19.2).

[4] http://www.genetics.org/content/204/4/1627 I referred to this in my letter to you 5 June 2018.

[5] 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.

[6] *The particles that may cause a serious health risk via inhalation or deposition on the skin can be transported hundreds of kilometres via air flows.* http://iopscience.iop.org/article/10.1088/0952-4746/14/1/006/pdf

- misdirection the significance of acute radiation syndrome in remote areas outside Hiroshima and Nagasaki;
- playing down the significance of the interaction between natural gamma and Uranium in body tissue causing high densities of ionisation (Einstein's photoelectric effect);
- misdirection on dropping the LSS controls;
- inconsistent argument over how monitoring exposed study groups affects the results of epidemiological studies;
- failure to address our analysis of differences in ratios of male to female births.

From a sociological point of view the following is interesting. The Application contained the following:

> *... evidence presented in the Royal Courts of Justice in the Pensions Appeals Tribunal (Abdale and Others vs. Secretary of State for Defence; June 13th 2016) showed that all the epidemiological groups were exposed to rainout and subsequent contamination of the city by Uranium nanoparticles. The LSS study did not address internal contamination resulting from inhalation of the nanoparticles*.

This is a reference to evidence presented in war service pensions appeals brought by veterans of the UK nuclear tests in Christmas Island and Australia. The PHE did not refer to this but BEIS/JAC (Appendix 4) quoted the following passage from the Appeals Tribunal's Determination which ruled against the veterans:

> *Nothing has emerged from the evidence of the [Battersby/Smith* (part of the Abdale and Others group)*] expert witnesses and the materials they cite to throw any doubt on the ICRP model. Indeed our evaluation of this evidence merely confirms the reasons given by others for rejecting it. The positive case that risk assessment using ICRP is flawed is rejected. The rejection is not a matter of preferring one body of scientific opinion to another, but an acceptance of the consensus of scientific opinion against the unscientific assertions of another body of campaigners.*

The Appeals Tribunal excluded all the evidence provided by expert witnesses for the veterans on the grounds that they and Dr. Chris Busby, who represented Battersby and Smith, were all contributors to the European Committee on Radiation Risk. As we see in the Determination, these scientists[7] were downgraded to *campaigners* — a less cruel fate than Galileo Galilei's 400 years ago but with greater implications for health. Another appeal has been lodged and Dr. Busby is again representing the appellant. The process has been stalled for several months, apparently because the MoD hasn't been able to find an expert willing to provide evidence and face being cross examined by Busby.

BEIS's reply (Appendix 8) raises further points of sociological interest.

> *I advise that your request … for a review of the EPR class of practice*[8] *does not satisfy the necessary criteria … . The Secretary of State has … concluded that it does not provide new and important*

[7] Witness statements including CVs, court transcripts and other documents are at http://www.llrc.org/campaigns/testvets/2016/courtdocs.htm

[8] The EPR (European Pressurised Reactor) is a type of practice in the terms of the BSS Directives. Its justification was confirmed in 2010.

> *evidence about the efficacy or consequences of the EPR class of practice. The Secretary of State does not consider the information you have provided to be "important" because it still does not significantly change his view of the balance of the economic, social and other benefits of the EPR class of practice relative to is potential health detriments.*
>
> *In particular, the Secretary of State remains satisfied that the potential health detriment from the EPR class of practice is very low and well understood. The Secretary of State also remains satisfied that you have not presented any sufficiently compelling evidence to demonstrate that the ICRP approach to radiological protection is flawed or is not the appropriate basis for assessing the potential health detriments of radiation.*

The crucial expression here is *new and important*, which is derived from the wording of the BSS Directives; this is a government lawyer's approach, not a scientist's. The next paragraph raises the bar on what can be considered as *new:-*

> *A number of the points made in your letter of 24 April 2017* (i.e. App.6) *are re-statements of points made in your letter of 12 November 2016, and were dealt with in my response of 30 March 2017. There is no benefit in repeating large parts of that here, so this response addresses only the main additional pieces of information provided in your letter of 24 April 2017*

So we are to understand that once BEIS has received and responded to a piece of information they will never reconsider it, however inadequate their first response might be. This has nothing to do with scientific dialogue. The correspondence has more of the same but I am not going to analyse any more because my point is made: we have reached a stage where BEIS would treat any further correspondence as vexatious and ignore it. Does NRW have the same barrier?

The other criterion is *important.* The CM paper (ref.5) defines a 10,000-fold error in ICRP risk factors for heritable effects of radiation. BEIS's response is confused and confusing. It boils down to:

> *we are unable to find evidence in the literature cited by Dr Busby for the claimed 1000 fold underestimation of hereditary disease risks and this is clearly out of agreement with widespread international consensus values*.

This claim is silly. My reply (Appendix 6, p.2) outlined the method for working out the error and gave some examples using some of the individual studies the paper had reviewed. The errors for those examples are between 13,000 and 49,000. I should explain that what we are concerned with here is the levels of fallout and the genetic effects observed. Fallout was monitored extensively and maps are published.[9] Radiation doses from the varying levels of contamination, as they would be understood by official risk agencies, are not too difficult to work out and the authors of the CM paper did this for each of the studies they reviewed. Once the dose to a population is known a risk factor can be applied to estimate the rate of disease that that dose would cause in that population. The source of those risk factors is ICRP. The figures BEIS quibbled about — 49,000 in the case of the Lazjuk study of Belarus — are the difference between the number predicted by the ICRP risk factor and what was actually recorded by the health registry. BEIS prefers to rely on Public Health England's advice that

[9] e.g. by UNSCEAR http://www.unscear.org/docs/JfigXI.pdf

> *… international consensus reviews do not support the conclusion that there are increased congenital malformations or hereditary effects in the children of those exposed to radiation in the post-Chernobyl environment or from involvement in clean-up operations.*

This flat denial of the CM studies reviewed by Schmidt-Feuerhake sheds some light on the conventional view that effects are always linearly proportional to dose.[10]
First, the issue of what *dose* means must be considered. The Committee Examining Radiation Risks of Internal Emitters, of which I was a member, failed its remit of publishing a single final report that explained any unresolved differences of opinion. But there's one aspect of the Majority report I can endorse:

> *..... 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.*[11]

As discussed in my 5th June letter, when alpha-emitting particulates are inside the body they are a source of extremely high doses to extremely small volumes of tissue. This is possibly the most extreme of the situations where the concept of absorbed dose becomes questionable or meaningless. It is relevant to the CM review because you can use dose as a surrogate for the presence of radioactive contaminants. Levels of Cs137 deposition were mapped (it can be done from a helicopter because ^{137}Cs is a gamma emitter). As the CM review says (see *What is the correct risk coefficient?)* the data can be taken as indicating the co-location of other radioactive contaminants including the alpha-emitting particulates that no-one has mapped, as far as I know (I am aware of no data on how much Uranium was released; just bear in mind that the reactor core contained around 200 tonnes of Uranium before the explosions shattered it, and that it burned for 20 days. Data for the amount of Plutonium released are available; the mass of Uranium released must have been far greater).

Second, we have to consider the origin of the ICRP risk factor for genetic effects. In the crucial LifeSpan Studies of Hiroshima and Nagasaki the high and low dose survivor groups showed no difference in the rate of genetic effects among the children. Since no-one would have believed there *were* no genetic effects ICRP derived a risk factor experimentally using externally irradiated (X-rayed) mice. This leaves an obvious hole in the knowledge base for alpha-emitting particulates.

Third, PHE and BEIS refuse to acknowledge that the malformations observed are not linearly related to dose; they simply suggest that there were no increased rates of CM. On the other hand, the completely conventional UN Chernobyl Forum observed that in areas of greater fallout rates of CM were significantly lower:

> *There has been a slow but steady increase in congenital malformations recorded in both high and low contamination areas, but the increase does not show a dose-response pattern. In the period 1983-1999, there were 12,167 congenital malformations registered among newborns and abortuses. In fact, there were statistically*

[10] For the sake of not being nit-picked, I am not speaking of the high dose region which shows the curve is *linear-quadratic.*
[11] CERRIE Majority Report Chapter 2.1 paragraph 11 and see Appendix 12.

> *significantly less congenital abnormalities in the high contamination areas compared with low contamination areas … .* [12]

The UN authors didn't speculate on this and left the reader to infer that factors other than fallout were to blame. Interestingly, one of the reviewers of the CM review asked its authors to explain the non-linear phenomenon and this was done — see *How Is It That the ICRP Risk Factor is Wrong?* It's basically a matter of biological plausibility.

Fourth, a meeting with COMARE was convened last year to discuss the CM review (see Appendix 10, a letter to me from energy minister Richard Harrington). In the event COMARE did not respect the minister's wish; the only respect in which they did refer to the CM review came from Professor John Harrison who said

> *You can't derive risk factors from this kind of study because the doses are unknown.*

BEIS offered the same argument (probably on advice from Professor Harrison who still has some kind of position at PHE):

> *Many of the studies employed either ecological or population correlation methodology that do not provide a reliable estimate of risk at the individual level.* (App. 8 p.2)

These comments are irrelevant. The CM authors didn't have to derive a risk factor nor *a reliable estimate of risk at the individual level*;[13] the review as they originally wrote it (before the reviewer started asking intelligent questions) showed plainly enough that the ICRP risk factor is wrong by four orders of magnitude. That's what NRW has to consider.

Professor Harrison's comment undermines the current theoretical basis of official radiation protection standards. Population doses from all kinds of exposure scenarios including Chernobyl are known (or have at least been estimated). The Linear No Threshold model (LNT) on which ICRP recommendations depend predicts the total number of radiogenic diseases in the exposed population. Linear means proportional - double the dose, double the risk, and so on. Differences between individual doses are immaterial - it is the mean dose that counts. The method is:

> *If we assume the excess cancer incidence is proportional to radiation dose (the linear model) we can estimate the number of cancer deaths that will occur in a population exposed to radiation: Number of deaths = number of people exposed x dose equivalent (in Sv) x risk factor (per sievert)*[14]

Professor Harrison's comment is surprising, coming from such an eminent figure[15] and shows either a lack of arithmetical understanding or a deliberate attempt to mislead.

Before I leave the ping-pong match with BEIS, I must deal with their attempted rebuttal of what I wrote about infant mortality and the atmospheric weapons tests. I

---

[12] Health Effects of the Chernobyl Accident and Special Health Care Programmes: Report of the UN Chernobyl Forum Expert Group "Health" ISBN 978 92 4 159417 2 p.86

[13] I do, however, think the new coefficient is valid for conditions where there is a mix of fission spectrum radionuclides as assessed by Cs137 contamination.

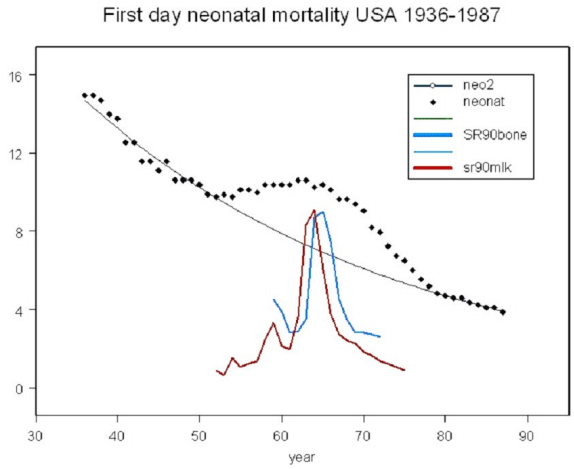
[14] This passage from a well-regarded book intended for a lay audience:- *Radiation Risks* David Sumner et al. 3rd Edn. 1991 ISBN 1 870781 04 X p.95. The passage quoted is about cancer deaths. Regulators now use the concept of *radiation detriment* which includes cancer incidence, cancer deaths, and genetic effects. The principle remains the same.

[15] Professor Harrison is an ex-Director of Public Health England's radiation protection wing, CoMARE member, Chair of ICRP Committee Two 2017-2021, member of ICRP Main Commission; chairman of ICRP Task Group on the use of Effective dose, UK Representative of the United Nations Scientific Committee on the Effects of Atomic Radiation 2013-2015, serves on the editorial board of the Journal of Radiological Protection.

wrote (App.6 p.8) that the scale of the error in ICRP's risk factor shown by the CM review is also apparent from increases in infant mortality in England and Wales and the USA at the time of the global nuclear test fallout. BEIS replied (App.8 p.2)

> *Infant mortality: The claim that there was a rise in infant mortality in the UK "at the time of the global nuclear fallout" is contradicted by the publicly available data from the Office for National Statistics which shows a clear sustained decreasing trend in infant mortality over the whole 20th Century.*

This is either sloppy and ignorant or an example of using a truth to tell a deliberate lie. The bit about the long-term trend is true and the solid curved line in this figure is part of it.



The coloured lines show officially monitored fallout as Strontium90 in milk and bone — another instance showing co-location of fallout isotopes. The black diamonds show annual rates of babies who died within 24 hours of being born. This figure is for America but the same phenomenon happened in the UK, and is also apparent in data for stillbirths and for 28-day mortality on both sides of the Atlantic.[16] There is an actual increase relative to 1950. The deviation from the underlying trend peaks in 1964, the year after the above-ground tests stopped but the trend was not regained until 1980 as fallout persisted. The author of the paper this image comes from explicitly wrote that the fallout was the cause. Also see Appendix 11 for extracts of a letter he wrote to me not long after the paper was published.

Airborne radioactive particles are concentrated near high voltage power lines and the possibility that there is an effect on leukaemogenesis has received some attention over the last two decades. In 2005 an association was found between proximity to electricity power lines and increased rates of childhood leukaemia. Later it appeared that there was no overall significant effect but a more recent paper[17] re-examined the data showing an effect associated with levels of radioactive fallout. This supports the idea that you should not ignore particles.

---

[16] Whyte R. K. (1992) `First Day Neonatal Mortality since 1935: a Re-examination of the Cross Hypothesis` *British Medical Journal*, 304: 343-6
http://www.bmj.com/content/bmj/304/6823/343.full.pdf

[17] Childhood leukemia atmospheric test fallout and high voltage power distribution lines: C. Busby, Dec. 2017 Pediatric Dimensions Volume 2(4): 1-4 2017 doi: 10.15761/PD.1000154
ISSN: 2397-950X http://www.oatext.com/pdf/PD-2-156.pdf

I know you rely on the English Environment Agency for help. Appendix 7 is a letter from them replying to Pete Wilkinson. This exchange took place in the context of the BEIS/NGO Forum where, since 2013, NGO proposals for Joint Fact Finding on radiation risk have been resisted by officials and EA's usual representative. Wilkinson raised the CM review and asked the Agency *to ensure that a suitably competent person from its ranks is asked to attend the meeting to respond … etc.* The Agency replied (App.7 last para.)

> *… we would be happy to explain our regulatory role and approach* but *… if you wanted an in-depth discussion of radiation health effects and radiation risk factors then I would suggest that PHE and the Committee on the Medical Aspects of Radiation in the Environment would be the most appropriate bodies.*

This is a slammed door that leaves the NGOs facing three such doors. PHE is the origin of BEIS's irrelevant and misleading responses which, as I have said, probably come from Professor Harrison who is also a member of COMARE and was a member of CERRIE. Professor Richard Wakeford represented British Nuclear Fuels Ltd. on CERRIE and was a member of COMARE for 10 years until last November. Looking at COMARE members' areas of expertise I suspect that Professors Harrison and Wakeford are or were the only ones who know enough about radiation risk modelling to be able to address the issues we are concerned with.

You ought to see it as relevant that the minutes of COMARE's 118th meeting in November 2017 show:

> *Professor Harrison suggested that the issue of the underestimation of risk from internal emitters discussed at the forum is of interest for COMARE. The Chairman agreed that this issue could be considered for COMARE's work programme next year and he would discuss this with DH and the secretariat, together with reviewing the committee's communication strategies with the general public.*

The first part of this minute may suggest that Professor Harrison recognises a genuine reason to think that risks from internal emitters have been underestimated; it may not, but either way you have cause to enquire. The second part is interesting in view of the fact that two of COMARE's newest recruits are "lay" members — an initiative that coincided with Dr Chris Gibson's return to the committee after a break of some years; he is now Chairman. Lay member Ray Kemp is a sociologist who (according to his own web site) specialises in handling controversial health, safety and environmental issues, planning and strategy for public engagement, running workshops, preparing communications materials, and training staff dealing with concerned stakeholders. In other words, it's a sociological matter rather than scientific. This is very relevant to NRW's decision making. The other is Helen Warner. I don't know anything about her. I have emailed COMARE secretariat to see what they can tell me.

The minutes of the same COMARE meeting show the Chairman thanking Professor Kemp for his advice on

> *responding to challenges under pressure. Members discussed dealing with difficult situations and how to better engage with third parties.*

With this in mind I turn to Dr Gibson's letter (App.3) as I dealt with it in section 4 of my letter to the Secretaries of State (App.9) I am not pasting my whole treatment here but it is a crucial part of this submission and I ask you to study it.

I showed

- that Dr Gibson made an irrelevant distinction between hereditary and teratogenic effects (4.1);
- that he ignored the fact that the biological mechanism behind complex dose response had (as I discuss above) been raised by a reviewer and answered by the CM authors (4.2);
- that he tendentiously misrepresented the exchange of letters in Genetics (4.3);
- that he wrongly accused us of selectivity but was himself selective (4.4);
- that he relied on studies of external irradiation, on studies of nuclear workers whose flaws I have already discussed in correspondence with you, and on only one study of purely internal radiation that is so weak that it can't dispose of the issue we raised (4.5).

The Energy Minister Richard Harrington replied to me on behalf of the Secretaries of State (App.10). Referring to my criticisms of Dr. Gibson's letter and the scheduled meeting between the BEIS/NGO Forum, he wrote:

> *I believe that the matter will be best taken forward through that discussion with COMARE.*

I have indicated above, COMARE did not address it, except for Professor Harrison's curious statement (*Fourth*, top of p.6) so we have the full set of slammed doors. I appreciate that this puts you in a difficult position but, as I said at the outset, you can resolve it by requiring fresh samples and proper testing.

Yours sincerely

Richard Bramhall

The numbering of appendices 0 to 7 is from a 17th July 2017 letter from LLRC to Rt Hon Greg Clark Secretary of State for Business, Energy and Industrial Strategy (BEIS) and Rt Hon Jeremy Hunt D. of Health. It was about evidence submitted to the Justification Application Centre (JAC) at BEIS, COMARE, ICRP, and Radioactive Waste Management (RWM) in 2016. The evidence consisted of:

- a review [18] of genetic effects following exposure to radioactivity released to the environment;
- a letter in which at that time was about to be published in *Genetics*,[19] responding to a opinion piece by Bertrand Jordan.[20]

The LLRC letter analysed shortcomings in official responses to the evidence. It is Appendix 9 of the present letter to Natural Resources Wales (21st June 2018).

RWM replied that evaluating the information is a matter for PHE and COMARE.
The Welsh Government expressed an interest in the outcome of discussions between COMARE and NGOs and agreed that the issues need consideration in the development of a GDF.
List of Appendices on next page with links:
Appendix 0 the application to JAC (not included here to reduce clutter)

Appendix 1 letter from Pete Wilkinson to Environment Agency (not included here)

Appendix 2 ICRP's reply (ICRP Ref.: 4834-8080-1606 not included here but available from LLRC on request)

[18] 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
[19] *Genetics* December 1, 2016 vol. 204 no. 4 1627-1629
[20] *Genetics*, Vol. 203, 1505–1512 August 2016

Appendix 3 COMARE's reply

Appendix 4 BEIS's reply

Appendix 5 advice note from PHE to BEIS (the basis of BEIS's reply App.4)

Appendix 6 LLRC reply to BEIS

Appendix 7 Environment Agency reply to Wilkinson (i.e. App.1)

Appendices 8, 9, 10 are later letters:

Appendix 8 BEIS's reply to App. 6

Appendix 9 letter (17th July 2017) from LLRC to Secretaries of State BEIS and Health which included Appendices 0 - 7.

Appendix 10 letter from Energy Minister to Richard Bramhall

Appendix 11 extracts from Robin Whyte 1996 letter to Richard Bramhall

Appendix 12 Extracts from the CERRIE majority report (2004) relating to alpha particles.