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Further to letter of 23 August 2018 from our Acting Chair Madeleine Havard, below is our response to the specific questions raised in your letter of 15 August 2018 and e-mail of 28 August 2018:

Responses to questions in your letter dated 15.08.18

L1. NRW informed the Assembly Petitions Committee that there is no in house expertise on nuclear power. Could you tell me what, if any steps you have taken as Board members to ensure that this gap in knowledge has been addressed?

We confirmed to the Petitions Committee in January 2018 that we have two employees who are dedicated to Nuclear/Radiological regulation and their roles are focussed on strategy and policy setting the direction for our work and providing advice and guidance. For matters relating to operational regulation, we procure the services of external experts which ensures efficient use of our resources.

L2. Could you outline what independent advice NRW took on the safety of the mud?

It is well documented that we procured the services of the Centre for Environment, Fisheries and Aquaculture Science (Cefas). We have also consulted with the Environment Agency and Public Health Wales (who also consulted with Public Health England).

L3. Could you give a reasonable explanation why you were unable to provide the raw data from the 2009 testing?

The raw data was obtained and managed by Cefas. The analytical methods they use are fully accredited to an International standard (ISO 17025). The UK's National Accreditation Body (UKAS) require that raw data is kept for 6 years and then can then be disposed of.

The raw data undergoes full quality control procedures to the UKAS standard (at the time of its production). The results of the analysis of the raw data are however kept on a computerised system as an historical record.

L4. How could you accept that just 5 samples taken beneath 5cm in 2009 constituted adequate testing?

The OSPAR (a name derived from the Oslo/Paris conventions regarding the disposal of waste) guidelines for the management of dredged material cover physical, chemical and biological characterisation of sediment to be dredged/disposed and the IAEA guidelines refer to radiological assessments.

The IAEA guidelines are based on expert knowledge. Many research programmes have been carried out for more than 40 years (and peer reviews published) to determine sources and behaviour of radioactivity below the surface sediment. The areas where radioactivity is known to have accumulated below the sediment surface is well known and documented in the scientific literature. There is no research (or monitoring) evidence to suggest that accumulation of radionuclides has occurred at any time around Hinkley. For these reasons, five sample stations, including surface and depth samples down to 4.8 metres was considered appropriate. The 2009 depth samples have continued to be valid due to the deep sediments not changing. In 2013, 17 surface samples were collected and analysed and in 2017, 12 surface samples were collected and analysed as the area to be dredged had reduced. The applications to dispose of dredged material to sea were for a total quantity of 304,885 tonnes (224,885 m³). The OSPAR guidelines suggest that 7-15 sampling stations are required for this volume of material, or that the number of stations are determined by the dredge area; which in the case of Hinkley was relatively small and in an open environment.

In 2013, the analysis of sediment from 12 surface sampling stations was requested by the regulator. Depth samples were not requested for this analysis as 14 core samples were collected from surface and depth from the area in 2009 by Fugro and analysed by Cefas. The results of the core sample analysis were provided with the Marine Licence application. As the material at depth will not have changed since this time, the supplied 2009 depth sampling results were used in conjunction with the 2013 surface samples to determine the dredge materials chemical and physical suitability for disposal at sea.

The combination of these core samples and the additional 2013 surface samples provide a good representation of the material to be dredged, and we are content that this is in line with the OSPAR guidelines. Similarly, with the 2017 sampling, twelve surface samples were collected and analysed and considered in conjunction with the 2009 depth sampling as the material at depth would not have changed. The combination of surface and depth samples were used to determine the materials suitability for disposal at sea.

As stated in paragraph 5.1 of the 2014 OSPAR guidelines, "Judgement and knowledge of local conditions will be essential when deciding what information is relevant to any particular operation"; And in paragraph 5.6 it states, "It may be possible, following assessment of the results of an initial full survey, to reduce either the number of sampling stations or the number of determinants and still provide sufficient information for permitting purposes".

Our judgement on the number of sampling stations required for the 2017 analysis was based on the OSPAR guidelines, knowledge of the 2009 and 2013 sampling results, and the assessment that was undertaken in determining the marine licence application. The aim of the sampling and analysis is to obtain representative results of the material to be dredged/disposed and we are content that this was obtained through the combination of the 2009, 2013 and 2017 sampling and analysis data.

L5. Licence Condition 9.5 requires satisfying NRW that the material is suitable for deposit at the site. How could this be established using 5 samples only below 5cm?

See detailed response to question L4.

L6. No question was listed in your letter.

L7. Why was mud in Kosovo tested using the 3 methods of gamma spectrometry, beta spectrometry and plasma mass spectrometry and yet the mud from outside Hinkley tested using only one of these methods?

For dredging applications, an assessment is used (as the starting point) which only requires gamma spectrometry, and produces a very conservative estimate of dose (i.e. the dose is likely to be lower, if a more detailed assessment was carried out). The other two methods would only be used if the dose limit was exceeded after undertaking the initial assessment. Further samples would also be taken under this scenario and the assessment would be repeated to give a more accurate dose. At Hinkley the dose limit was not exceeded in the initial assessment.

L8. It is alleged that it is impossible to identify hot radioactive particles of all kinds when using gamma testing only? What evidence can you provide to refute this allegation? If the scientific advice I am being given is false, please enlighten me.

Only radionuclides which decay via gamma decay can be identified via gamma testing. Some radionuclides have more than one decay mode- where they may primarily decay via alpha or beta they can also have an associated gamma decay. Additionally some radionuclides, although they cannot be detected from a gamma decay- their decay products can be and their presence inferred.

The radionuclides produced as a by-product of nuclear energy production are well documented and those of relevance are detailed in the sample reports. 'Hot particles' are not associated with normal effluent discharges from nuclear power station operations. The sampling undertaken has been for radionuclides expected and known from power station operations and have been independently verified by national experts.

Monitoring and sampling in the nuclear industry is extremely rigorous. The permits that regulate these sites include specific monitoring and sampling conditions, requirements and programmes intensively scrutinised by the regulators.

L9. Will you retract NRW's incorrect statement that there is no scientific evidence of higher radioactivity in deeper sediments in the Hinkley Point area, given the results contradict this? The numbers show 3 out of the 5 samples were significantly higher at depth (up to 3x for Radium - Ra).

Uranium-238 and radium-226 are both naturally occurring radionuclides. The concentrations at depth of EDF's measured data in sediments (collected in 2009), were also included in the most recent dose assessment (undertaken in 2018). Furthermore, hypothetically, if the maximum measured values of uranium-238 and radium-226 (at depth) were the only values used to re-run the 2009 assessment again (i.e. no uranium-238 and radium-226 surface data were used) the resultant dose would still be below the "de minimis" criteria. This is because the magnitude of activity concentrations is not directly proportional to the estimated dose.

Consequently, it is important that there is no inference from our statements that any of the sample results are above the *de minimis* criteria and therefore a risk to people or the environment.

L10. Why did NRW dispose of the raw data from the testing?

See our response to question L3 above.

L11. The de minimis criteria are for disposal at sea. The IAEA-TECDOC-1375 defines this to include well-mixed near-coastal waters. The disposal is assumed to take place a few kilometres off the coast so the actual shape of the coastline does not influence the dispersion significantly." The Severn Estuary site is not "sea", but estuarial water with distinct circulation and ecology, which does not satisfy the IAEA criterion. Could you point me to where this point was assessed and dismissed by NRW? I want to see the paper trail.

The IAEA-TECDOC-1375 also provides further clarification, after this statement; "Disposal in nearshore coastal areas with complex features might require an assessment based on site specific information". Site specific information would only need to be considered if the initial conservative generic radiological assessment to determine "*de minimis*" was exceeded. All sediments sampled from Hinkley dredged area were below this *de minimis* level and therefore identified as being within acceptable levels for disposal.

L12. Given that chemical contaminants, metal and organic contaminants were measured as above Action Level-1, what further assessment has been carried out? Could you provide the detailed methodology and results please?

There are two Action Levels that are used when determining if material can be disposed of to sea. Results below Action Level 1 are deemed to be 'natural levels' so no further consideration is required. Results above Action Level 2 are deemed to be unsuitable for disposal to sea, in most cases.

Results between these two levels require further consideration and does not immediately preclude the material from being disposed of to sea. Further evidence to inform the assessment includes any information of background levels of the determinands, the results of any other comparable analyses within the vicinity of the dredge and the results of any material that has been disposed of to the disposal site previously. There are differences around the UK coastline as many of the determinands come from both natural and anthropogenic sources.

As set out in the Cefas report on the 2017 sampling and analysis, contaminant levels measured during the chemical analysis were compared with Cefas Action Levels to determine the suitability of dredged material for disposal at sea. No contaminants were determined to be at or above Action Level 2 at any sampling station. Slight exceedances of Action Level 1 were detected for PCBs, zinc, nickel, lead and chromium at all sites. Slight exceedances of Action Level 1 were detected for cadmium and mercury at sampling station HPCD06 only.

Due to these exceedances of Action Level 1, Section 5 (Discussion) of the Cefas 2017 report goes on to investigate this i.e. it 'provides a more detailed assessment of the suitability'. The report compares the 2017 results to previous results collected from near Hinkley and further afield within the Severn Estuary. Following this detailed assessment, the report concludes that chemical analysis of the sediment samples indicates no reason that the material should not be disposed of to the designated disposal site.

L13. The Licence conditions 9.5, 9.11 require that the sediments are suitable for deposit and that dispersal via re-suspension should be avoided. What has NRW done to ensure that the mud is discharged avoiding re-suspension, such as via pipe to the sea bottom?

Condition 9.5 relates to additional sampling that was required to comply with OSPAR and this was undertaken in 2017.

It is for the operator to undertake best practice to minimise re-suspension. Compliance with operational conditions is a matter for Welsh Government Fisheries Office and not within NRW's jurisdiction.

L14. What advice was obtained from Public Health Wales? I ask that you share all correspondence on the matter.

The consultation response from Public Health Wales is attached for your assistance. We have also attached our assessment of the consultation responses.

L15. It is clear that there are uncertainties regarding the testing of the mud. As well as the points above, there was not a uniform methodology used. I am advised that NRW is obliged to gather evidence on uncertainties according to the Environment Wales Act 2016, Section 4. Has NRW sought legal advice on this? Will you?

We are not of the view that there are any uncertainties with the sampling and analysis of the sediment and are confident that all the requirements under current best practice and international guidelines have been met in our determination of this licence.

Responses to questions in your email of 28.08.18

E1. The applicant's sampling of the sediment with just 5 samples taken beneath 5cm in 2009 does not meet the OSPAR guidance for representative sampling and a minimum of 7 sampling stations for the permitted volume (300,000 tonnes). The samples were also discarded, contrary to OSPAR, so cannot be further tested. The company refused to comply with the Petitions Committee request to undertake further sampling at depth. The sea-bed surface sampling they did undertake of course sampled recent deposits which are unrepresentative of the decades of radioactively-contaminated mud.

Since Licence Condition 9.5 requires satisfying NRW that the material is suitable for deposit at the site, you surely have to conclude that the sampling is inadequate to satisfy the regulator to the international standard. OSPAR rule 6.2 says:

*6.2 If dredged material is so poorly characterised that proper assessment cannot be made of its potential impacts on human health and the environment, **it shall not be deposited at sea.***

Please see our response to question L4 above.

E2. Will NRW retract their incorrect statement that there is no scientific evidence of higher radioactivity in deeper sediments in the Hinkley Point area, given the results contradict this? The numbers in NRW's report to the Committee last March show 3 out of the 5 samples were significantly higher at depth (up to 3x for Radium - Ra) as in the reduced Table of results reproduced below.

Data for U238 and Radium in 2009 samples taken at depth

Table B.15 Uranium-238 and Radium-226 concentrations for Vibro core samples

FUGRO survey of five locations in vicinity of intake, outfall and jetty, on 9/11 and 15/11 2009

Sample	U: surface/deep	Ra: surface/deep	depth	Date
1230/1231	48.73 / 46.13	25.25 / 27.65	4.35-4.42m	9/11
1232/1233	43.98 / 71.23	24.46 / 71.25	3.0-3.08m	9/11
1234/1235	39.46 / 41.25	22.43 / 30.30	4.7-4.8m	15/11
1236.1237	30.83 / 50.9	15.56 / 29.10	1.94-2.16m	15/11 1238/1239
	50.65 / 68.56	25.29 / 73.57	3.0-4.12m	15/11

Please see our response to question L9 above.

E3. Radioactively "hot" particles of uranium or plutonium could not be detected by gamma ray spectrometry used by CEFAS. In view of the great concern for such "hot" micro-particles found near Dounreay and Sellafield nuclear sites, sources unknown, surely NRW should face the possibility of similar hot particles being released in mud due to be dispersed in the Severn estuary and require the company to assess this and the consequences?

Please see our response to question L8 above.

E4. Chemical contaminants (toxic heavy metals and organics) were measured as above the lower Action Level but below the upper Action Level. OSPAR prescribes that

"material below the upper level but exceeding the lower level, should require more detailed assessment before suitability for deposit at sea can be determined".

The applicant did not do this (their excuse was: "minor breach"), nor was CEFAS competent to assess it. To comply with international standards, NRW has still to ensure the "detailed assessment", especially including impacts on designated species in this European Conservation (SAC) site.

Please see our response to question L12 above. Additionally, we are firmly of the view that Cefas have the competency to undertake this assessment. A Habitats Regulations Assessment was also undertaken as part of the determination process and is attached for your assistance.

E5. The IAEA 2015 guidance requires assessment of radiological dose under 5 headings, as in their Table below. CEFAS considered only the first two (individual dose and collective dose). They wrongly assessed collective dose as if the mud reached shores of the Irish Sea after dumping there. They made no assessment of the last three dose rates in the IAEA Table. Will NRW ensure full compliance with the IAEA prescription, taking into account bio-concentration in the Severn Estuary biota?

The collective dose has been conservatively estimated (i.e. the dose is likely to be lower, if a more detailed assessment was carried out), using a generic radiological assessment procedure, on three separate occasions for samples collected in 2009, 2013 and 2017. The collective doses were 0.044, 0.035 and 0.035 manSv/year, respectively. These are all well within the *de minimis* criteria of 1 manSv/year, or approximately 4% of the limit (and mostly due to naturally occurring radionuclides).

Since the conservative generic radiological assessment procedure indicated that doses received were below recommended limits, a subsequent more detailed case specific assessment is not necessary – including an assessment of any potentially dispersed dredged material on the Irish Sea shores, post dumping. There is currently no scientific evidence, from the levels of radioactivity determined in the sediments, nor from concentrations predicted using appropriate dispersion models, to warrant a more complex assessment to marine flora and fauna.

The scientific expert advice provided by Cefas confirmed that the procedures followed are compliant with the IAEA guidance in undertaking “a stepwise evaluation procedure to determine whether candidate material can be designated as *de minimis*”

E6. The Licence conditions 9.5, 9.11 require that the sediments are 'suitable for deposit' and that dispersal via 're-suspension should be avoided'. NRW should surely not allow dumping from surface barges at all states of tidal currents as in the present license, but require piping to the seabed and deposit at times of low currents.

Part of the dredged material is bed-rock said to be 'clays'. The License includes a condition to avoid mounding of these heavy wastes, but OSPAR 10.3 prescribes

b. solid waste contained within the dredged material should be separated and managed on land.

Will you therefore modify the license accordingly?

Please see our response to question L13 above. Additionally, Paragraph 2.6 of the 2014 OSPAR guidelines states “In the context of these guidelines, dredged material is deemed to be sediments or rocks with associated water, organic matter etc. removed from areas that are normally or regularly covered by water, using dredging or other excavation equipment”. Clay material is mentioned several times throughout the guidance document and is considered to fall within this definition and is acceptable for disposal to sea.

Condition 9.1 of the licence also requires monitoring of the disposal site to avoid any shallowing.

E7. It is clear that there are major uncertainties regarding contaminants in the mud, effects on wildlife and transfer to humans. NRW is obliged to gather evidence on uncertainties according to the Environment Wales Act 2016, Section 4. The officers say uncertainties are included in the international standards, but that does not meet this EWA requirement to gather evidence on the uncertainties in applying the procedures. Will you require NRW staff to do this?

Please see our response to question L15 above.

I hope you find this information and attachments helpful.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Clare Pillman', with a horizontal line underneath.

Clare Pillman
CEO Natural Resources Wales