Nuclear Free Local Authorities
RADIOACTIVE WASTE POLICY
Briefing No.69 – Cardiff Bay & Hinkley C new build mud

Prepared for NFLA member authorities, October 2017

The potential radiological consequences of the marine disposal of 300,000 tonnes of radioactively contaminated dredged sediments from the proposed Bridgewater Bay/Hinkley Point C new nuclear reactor at the "Cardiff Bay Grounds" marine disposal site (Welsh Assembly Government jurisdiction)

i. Preamble

This edition of the NFLA Radioactive Waste Policy Briefing gives members information of concern from an investigation by independent marine radioactivity consultant Tim Deere-Jones, who has worked with the NFLA for a number of years. He has uncovered serious issues over the potential consequences of dumping as much as 300,000 tonnes of radioactive dredged sediments from the proposed Hinkley Point C new nuclear reactor site into Cardiff Bay. The issue has received interest in the Welsh media and the Welsh Assembly following questions from Neil McEvoy AM. An online petition has received so many signatures that the issue will be shortly discussed in the Assembly.

Tim Deere-Jones will be talking to members of the Vale of Glamorgan Council on the findings of this report on Thursday 12th October and again at the NFLA Welsh Forum seminar in Cardiff County Hall on Friday 13th October. Places are available to attend the NFLA Welsh Forum seminar by emailing the NFLA Secretary as follows – s.morris4@manchester.gov.uk. NFLA publishes this report by kind permission from Tim Deere-Jones, given the real concern over the local issues raised and the potential for similar issues at other new nuclear facilities. It is also considering sending this report to the OSPAR Commission Radiation Substances Committee after discussion with its partner organisation on marine environment issues, KIMO International.

1. Introduction

As a consequence of the proposal to construct the Hinkley Point C (HPC) nuclear power station on the north Somerset coast a range of offshore construction activities have been deemed necessary in the adjacent offshore environment of Bridgwater bay.

The most radiologically significant of these activities is the EDF NNB proposal to undertake dredging of surface sediments, in order to expose the seabed bedrock at 2 sites in Bridgwater Bay. It is proposed that the dredged material, estimated to consist of up to approximately 300,000 tonnes of sediment, will be transported by sea and disposed of at the 'Cardiff Bay Grounds' licenced dump site, off the south Wales coast.

Both dredging activity and dredge waste disposal activity are known to generate relatively long lived plumes of suspended material. Considerable quantities of the plume suspended material may be carried out of the activity/disposal site and may eventually become deposited elsewhere. It is also known that material deposited (and settled on the seabed) within the disposal site, may later be re-suspended and transported away from the disposal site by a variety of natural phenomenon, including storms, super tide/tidal surge activity, tsunamis etc.

Bridgwater Bay sediments have been in receipt of anthropogenic radioactive discharges since the 1967 commissioning of the Hinkley A station. It is known that concentrations of radioactivity in historical discharges from both the Hinkley A station and Hinkley B were markedly higher than contemporary levels of discharges. It is also know that a number of potentially severe, but

regrettably very poorly quantified “leaks” and “accidental discharges” to sea have occurred at the Hinkley site and that much of this leaked material was incorporated into Bridgwater Bay sediments.

Thus, it is inevitable that the Bridgwater Bay sediments to be dredged under this proposal will contain measurable concentrations of radioactive waste from both the Hinkley A and B stations and that the radio-nuclides contained therein will consist of the full range of 50 to 60 radio-nuclides discharged from the stations (including alpha, beta and gamma emitters).

However, the available data sets report on surface sample radioactivity along the shoreline fringes of the Bay and there appears to very little work on the more “offshore” and “sub-sea” sedimentary environments.

It may well be the case that such sub-surface sediments will be sequestering much higher concentrations of long lived radionuclides than contemporary surface sediment samples.

Permission for the disposal of this radiologically contaminated waste has been sought from the Welsh Assembly Government (WAG). Natural Resources Wales is acting on behalf of the WAG in this respect and Tim Deere-Jones has been informed by Natural Resources Wales (NRW) that the proposal was permitted/licensed in July 2014, subject to the fulfilment of a range of conditions.

2. Briefing detail: information known to date

2.1 The Welsh Assembly Government has granted a license for the disposal of up to 300,000 cubic metres (304,885 tonnes) of sediments dredged from Bridgwater Bay (contaminated with radioactive wastes discharged from the Hinkley Point nuclear power station) into Welsh coastal waters, at the ‘Cardiff Bay Grounds’ marine dump site. The sediments in question will be dredged from 2 discrete areas of the Bridgwater Bay and the River Parrett estuary.

2.2 The major dredge volume will be taken from an area adjacent to, and offshore of, the Hinkley Point nuclear site on the north Somerset coast in order to facilitate the construction of cooling water intakes and radioactive liquid waste discharge pipes for the proposed Hinkley C nuclear power station. The lesser volume will be dredged from the nearby River Parrett estuary in order to facilitate the construction of a new jetty as part of the ongoing development of the proposed Hinkley C Nuclear Power Station (NPS).

2.3 The areas to be dredged have been the receiving environment of liquid nuclear wastes discharged from the existing nuclear stations (Hinkley A and Hinkley B) for the last 51 years. The area to be dredged for the construction of Hinkley C water intake and radioactive waste disposal pipes is in the immediate vicinity of the existing long term waste discharge pipes, while the estuarine area is some miles distant, but located in an estuarine fine sediment environment demonstrated by official annual monitoring/analytical work to hold re-concentrated levels of Hinkley derived radioactivity.

2.4 At the request of NNB Genco (a division of EDF), the UK’s Marine Management Organisation (MMO) which is attached to DEFRA, licensed the dredge proposal in 2013.

2.5 Following the MMO decision, the NNB then requested that the WAG license the disposal of the dredge waste arisings into the ‘Cardiff Bay Grounds’ marine dumpsite which lies off the Glamorgan coast of south Wales.

2.6 Communications by Tim Deere-Jones with Natural Resources Wales (NRW) indicate that the License application was passed to them on “vesting day” (when NRW formally commenced work). At this stage the WAG had already come to the opinion that the “disposal” did not require any form of Environmental Impact Assessment (EIA). Thus it can be deduced that the current Welsh environmental safeguarding body (NRW) ***DID NOT*** have any input into the decision making process and were forced to “rubber stamp” a decision made elsewhere and by others.

2.7 On that basis, the NRW considered it "appropriate to determine the NNB's Marine Licensing Application accordingly": i.e. to license and permit the disposal of the radioactively contaminated sediments into the Cardiff Bay Grounds marine dump site environment.

2.8 Tim Deere-Jones has accessed data sets reporting on the pollutants recorded by analysis of the sediments to be dredged.

2.9 Non-radioactive contaminants:
A range of non-radioactive pollutants have been identified recording positive results for PAH, PCB, OH & BDE and toxic metals in "surface sediments" taken from the proposed dredge areas. It is reported that, in many samples, the concentrations of PAHs, PCBs and toxic metals exceeded Action level 1.

Contaminant levels in dredged materials below Action Level 1 are generally assumed to be "of no concern" and "unlikely to influence the licensing decision". Contaminant levels between Action Level 1 and 2 "generally trigger further investigations of the material proposed for disposal at sea".

However, in the case of the Cardiff Bay Grounds disposal, such "further investigations" appear NOT to have been taken. It is stated that, because the contaminant levels are similar to those previously disposed of at the Cardiff Bay Grounds site (port maintenance dredge spoil) there were no grounds to refuse the License Application.

2.10 Radioactive contaminants:
The available evidence indicates that analysis of surface sediments, taken from the proposed dredge areas, was also carried out (by CEFAS) in 2013, for a limited range of anthropogenic radioactivity. During the course of the analysis 15 samples were analysed for 3 man-made radio-nuclides Cobalt (Co) 60, Caesium (Cs) 137 and Americium (Am) 241.

Based on the analysis results, the CEFAS radiological assessment concluded that the "average" radio activity contents of the Bridgwater Bay sediments to be dredged, would be as follows:

- Cobalt 60 = 0.43 Bqs/Kg
- Cs 137=21 Bqs /Kg
- Am 241= 1.59 Bqs/Kg

The three radio-nuclides (Co60, Cs 137 and Am 241) are present in the "contents" list of radio-nuclides to be discharged in the liquid wastes of both the existing Hinkley A & B Stations and the proposed Hinkley C station. However, the other 50+ radio-nuclides present on the contents lists for radioactive waste discharges to sea all three stations have not been analysed for.

From the published results of the analysis it can be seen that some of the offshore surface sediments hold higher concentrations of Cs 137 and Am 241 than the shore line surface sediments analysed during the normal "annual radiological monitoring regime" in place for the Hinkley site as reported in the annual RIFE reports.

3. Issues arising from this information

Both the dredge proposal and the disposal proposal may give rise to a number of potential environmental and public health issues as follows:

3.1 The available evidence indicates that extent survey and analytical work on radioactive and non-radioactive pollutants in Bridgwater Bay sediments consists of surface sample analysis. Such a monitoring protocol, although widely practiced and the favoured "official"

method, is deeply flawed and inadequate because it fails to investigate the amount of pollutants sequestered at depth in such sedimentary deposits.

3.2 Depth core sample studies of pollutants in sediments in the Bristol Channel/Irish Sea region are uncommon, however a 2004 (Irish Sea) core sample study of radioactivity in seabed sediments confirmed that "surface samples" (from 0cms down to 5cms deep) held the lowest concentrations of man-made radioactivity and that all samples between 5cms and 50cms (maximum depth of the core sample) held higher concentrations than the "surface sediments".

3.3 The study demonstrated that peak concentrations occurred at 15 to 25cms depths. In the case of the study's measured radio-nuclides (Americium 241, Plutonium 239/240, Plutonium 241 and Caesium 137) it was found that these depth maxima exceeded the surface sample concentrations by around five times.

3.4 Broadly similar outcomes have been recorded by other core sampling studies investigating hydrocarbon, PCB, and metals.

3.5 The available evidence proves that the surface sample analysis cannot possibly provide a truly representative data suite describing the concentrations of man-made radioactivity and other non-radioactive pollutants in the totality (seabed surface to bedrock) of the sediments proposed for disposal at the Cardiff Grounds site. Thus, in that context it may be stated that the environmental and human health (dose) risks of the proposed disposal remain inadequately investigated and that any conclusions made, on the basis of the current inadequate and flawed data, are similarly flawed and inadequate.

3.6 Thus the decision (by the WAG) not to initiate an EIA of the potential impacts of the disposal of pollutant contaminated Bridgwater Bay sediments has been taken without the benefit of appropriate baseline research and data.

4. Re-mobilisation of pollutants: Bridgwater Bay

4.1 There is a strong scientific consensus that Bridgwater Bay is one of the major sediment "sinks" in the Bristol Channel. There is a similarly strong consensus that Bridgwater Bay sediment deposits also accumulate and sequester sediment associated pollutants such as the hydrocarbons, metals and radio-nuclides reported and referenced above.

4.2 There is a similar consensus that dredging activity will disturb and re-mobilise sediments being dredged and that any pollutants associated with those sediments will be similarly re-mobilised into the water column and may be transported out of the dredge site to be deposited elsewhere into alternative deposition sites (mudflats etc).

4.3 In EDF Energy's opinion numerical modelling of the sediment plume would be disproportionate given the small area of dredging pocket and the existing high suspended solid concentrations that are a baseline characteristic of the inner Bristol Channel. It is expected, given the relatively strong tidal currents, that material within the plume would be relatively quickly dispersed and either form part of the fine sediment suspension load or be transported as bedload and deposited in various locations. Again, given the volumes involved it is not considered likely that the local or wider deposition of sediment from the plume would have any effect on existing bathymetry, transport processes or depositional bed-forms. (See Hinkley Point C Preliminary Works Environmental Statement: Temporary Jetty Development 12-1, November 2010)

NB: It is regrettable that no attempt has been made to assess the potential radiological exposure outcomes for regional populations of the re-mobilisation of historical concentrations of radioactive waste disposal from both the Jetty development and the offshore works.

4.4 River Parrett estuary and fluvial corridor pollutants - As a result of recent research work, initiated by Tim Deere-Jones and the Stop Hinkley group, it can now be confirmed that radioactivity (discharged to sea from the Hinkley site into Bridgwater Bay) enters the tidal corridor of the R. Parrett and penetrates deep inland (at least as far as Burrowbridge).

4.5 All studies of both dredging activity and dredge waste disposal demonstrate that such activity generates highly visible and relatively long lasting "plumes" of suspended (fine) sedimentary material which are transported out of the immediate vicinity of the activity by water column movements generated by residual currents, tidal (ebb and flood) movements, prolonged winds from any one direction etc.

4.6 Any sediment associated pollution (radioactivity, hydrocarbons, metals, PCBs etc) disturbed by the proposed dredging may be expected to behave in a similar way. The proposed dredging activity will plainly re-mobilise the range of sediment associated pollutants known to be "sequestered" in the Bridgwater Bay sediments and free them for transport via the regional water column.

4.7 The available evidence implies that these sediment associated pollutants, mobilised by the proposed dredges, will penetrate the Parrett's tidal corridor, suspended in the water column and deposit out in the fluvial inter-tidal (river channel sand banks and mud flats and the riverside tidal sediments) and the sub-tidal fluvial sediments. (This river corridor is regularly dredged, in the interests of flood control, and the recovered sediments are commonly spread onto agricultural land).

4.8 These dredge mobilized sediments will also be available for transport along the Bristol Channel and re-deposition into other regional sedimentary deposits along both the English and Welsh coasts.

4.9 It should be noted that the radioactivity mobilized by the proposed dredges will be in addition to the ongoing liquid radioactive waste discharges from the Hinkley, Berkeley, Oldbury and Cardiff nuclear sites.

5. Injection of pollutants to Cardiff Bay Grounds marine dump site

5.1 There is a similar consensus that sedimentary material deposited at designated marine dump sites such as Cardiff Grounds will be similarly mobilized into regional water columns. Thus it may be expected that the proposed disposal of Bridgwater Bay dredged sediments into the Cardiff grounds site will generate the transport of associated pollutants out of the dump site (see Para 4.4 above).

5.2 Thus it should be expected that, during and following the dumping of Bridgwater Bay sediments at the Cardiff Bay grounds site, a pulse of sediment associated pollutants will be rapidly re-distributed into the south Wales coastal water column and subsequently, into the extensive south Wales coastal sub-tidal and inter-tidal sedimentary deposits (mud flats, estuarine sediments etc) and the water column

5.3 Any injection of radioactive and non-radioactive pollutants into the south Wales coastal aquatic and sedimentary environments will expose the south Wales coastal zone environments and populations to increased doses of such pollutants.

Human doses of radioactivity will be received by way of:

- seafood dietary doses, external contact doses to fishermen, water sports etc
- coastal zone terrestrial dietary doses, contact doses and inhalation doses received as a result of the sea to land transfer of such pollutants in sea spray and marine aerosols (as demonstrated by several studies completed in the Welsh coastal zone).

5.4 Aggregated radioactivity - from the details provided by the MMO, NRW and CEFAS (see paras 2.1 & 2.10 above) it can be calculated that the total aggregated radioactivity content

(Co60+ Am 241+Cs 137) of the sediments proposed for disposal at the "Cardiff Bay Grounds" would be approximately 7 Billion Bqs.

NB: However, as stated above (Section 3), the available evidence from "core" sampling studies strongly implies that the analysis of surface sediments only may significantly under estimate (by as much as five times) the amount of radioactivity in the total dredge arisings.

Additionally, as also stated above, the surface sediments discussed herein have been analysed for only 3 of the 50+ radio nuclides routinely discharged to sea as liquid wastes from nuclear power stations. This is plainly another factor which will lead to a significant under estimate of the aggregated radioactivity in the total dredge arisings.

5.5 From the available research outcomes of the few studies which have investigated the nature of discharges of radioactive wastes to sea, from UK nuclear sites, via pipelines, it is evident that the radioactive waste discharges take multiple forms including:

- soluble radioactivity dissolved in water and/or other liquids,
- solid environmental organic or sedimentary particles contaminated by the soluble material by "adsorption",
- "radioactive particles" which may consist of (generally small) irradiated pieces of bitumen from pipeline linings, pieces of nuclear fuel, pieces of irradiated metal from the engineering infrastructure interior of the reactor and it's cooling/ heat exchange system.

5.6 In the context of the conclusions set out in the above preceding paragraphs the proposed "derived dose values" for dredger crew members and members of the public (based on the under estimates of radio-activity in the dredge arisings) are as flawed and incomplete as the data sets obtained by the flawed and incomplete analytical surveys work.

6. Conclusions:

- The Welsh Assembly Government (WAG) has decided that no Environmental Impact Assessment (EIA) is needed for the Cardiff grounds disposal of the dredge waste.
- This WAG decision is based on inadequate and flawed data, because the sampling/analytical work has been very poorly scoped and cannot possibly have identified the peak concentrations of both radioactive and non-radioactive pollutants found in the Bridgwater Bay sediments
- Radiological and non-radiological analysis of the sediments to be dredged from Bridgwater Bay and disposed of at the Cardiff grounds dump site are incomplete and inadequate and under-estimate the radioactivity contents of the Bridgwater Bay sediments because:
  a: all samples were "surface samples" (0-5cms depth) and the available evidence from other studies shows that "surface samples" have the lowest concentrations of both radioactivity and non-radioactive pollutants,
  b: concentrations increase with depth with all samples below 5cms having higher concentrations than surface samples,
  c: concentrations are at their maxima (5X surface concentrations) in samples from the 15 to 25cms band.
- The dose estimates for dredger crews and members of the public, based on the analytical results for surface samples only are not based on full, complete or adequate data.
- It is calculated, based on the figures provided by the flawed analysis, that the aggregated radioactivity of the dredge arisings to be dumped into Welsh coastal waters is at least approximately 7 Billion (7,000,000,000) Bqs.
- The 7 billion Bqs figure may be a very significant underestimate of the true figure.
- The WAG decision was taken without the advice of the current Welsh environmental watchdog/regulator.
- Permission to dispose of the radioactively and non-radioactively contaminated Bridgwater Bay sediments into Welsh coastal waters will increase the potential for elevated doses of radioactivity to Welsh marine users and inhabitants of the Welsh coastal zone via multiple pathways. (NB these populations will already have been in receipt of low doses of such radioactivity for 50 + years)

- It is an established fact that Welsh coastal zone populations are exposed to a range of radio-nuclides (including Caesium, Plutonium and Americium) which have transferred from the sea to the land in sea spray and marine aerosols, driven by the prevailing winds. The evidence also demonstrates that dietary doses of marine radioactivity are routinely received by terrestrial populations via their consumption of agricultural / horticultural produce contaminated by deposited airborne radioactivity originating from the sea. Although no studies have been carried out to assess the inhalation doses of airborne marine radioactivity, received by Welsh coastal zone dwellers, the receipt of such doses is a logical assumption.
- Sea to Land transfer has been occurring along the south and west Wales coastal zone for over 50 years, as a result of liquid radioactive waste discharges from multiple reactors and other nuclear sites to the Bristol Channel. Despite this, there is no regular annual monitoring of coastal radioactivity between Cardiff and Wylfa on the north coast of Wales.
- Over recent years the concentration of radioactivity in the annual liquid waste discharges to the Bristol Channel has been reducing due to the progressing de-commissioning of those reactors. However, the current proposal to dispose of Bridgwater Bay dredge arisings into the Cardiff Bay Grounds site will release radioactivity sequestered into those sediments during periods when the radioactivity concentrations being discharged were much higher. It is inevitable the concentrations of radioactivity in south Wales' coastal waters will increase as result of the proposed disposal.
- This is in opposition to the Precautionary Principle, namely that the redistribution/diffusion of radioactivity into the environment is contra-indicated.
- The 'Cardiff Bay Grounds' disposal proposal will generate a "pulse" of radioactivity (an 'injection' of 7 billion + Bqs of radioactivity) derived from historical discharges.
- The available current evidence implies that it is likely that this pulse will generate regional water column and sedimentary deposit concentrations of radioactivity which exceed the current environmental concentrations and human doses
- In the context of the above summary review it is relevant to call for a suspension of the license to dump Hinkley Point C derived radioactive waste contaminated sediments into the south Wales coastal/marine environment in order to carry out an inquiry/review of the licensing decision within the context of the contra-indicating evidence and data outlined above.
- Such research also puts under question similar works that may take place at other nuclear new build sites in England and Wales.

Tim Deere-Jones, September 2017