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# **Radiological Assessment of Dredging Application for Bradwell Nuclear Power Station, Essex (2013)**

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**Authors: A. Dewar, P. A. Smedley,  
S.M. Cogan and K. S. Leonard**

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## **RADIOLOGICAL ASSESSMENT OF DREDGING APPLICATION FOR BRADWELL NUCLEAR POWER STATION, ESSEX (2013)**

### **Summary**

In 2013, Magnox Limited lodged a MCAA licensing application for the removal of silt from the inlet and outlet of Bradwell Nuclear Power Station. The volume of material to be dredged and disposed of at sea is approximately 915 m<sup>3</sup> (1,400 tonnes).

In England, the MMO administers a range of statutory controls that apply to marine works on behalf of the Secretary of State for Environment, Food and Rural Affairs (Defra), this includes issuing licences under the Marine and Coastal Access Act (MCAA), 2009 (United Kingdom - Parliament, 2009) for the disposal of dredged material at sea. Licences for disposals made in Scottish waters and around the coast of Northern Ireland are the responsibility of the Scottish Government (Marine Scotland) and the Department of Environment (NIEA), respectively. As of 1 April 2010 licences for Welsh waters are the responsibility of the Welsh Government.

Using the conservative generic radiological assessment procedure developed by the IAEA, to convert radionuclide concentrations in dumped material into radiation doses due to dumping, the total derived total doses to individual members of the crew and public were 5.3 µSv/year and 1.8 µSv/year, respectively. The total collective dose was 0.033 manSv/year. The values for individual members of the crew and public, and the collective dose, were within the *de minimis* criteria of 10 µSv/year (individual doses) and 1 manSv/year (collective dose), respectively.

Since the conservative generic radiological assessment procedure indicated that doses received were below recommended limits, a subsequent more detailed case specific assessment was not necessary. Therefore, from radiological considerations, there is no objection to this material being dredged and dumped.

## Assessment details

In 2013, Magnox Limited lodged a MCAA licensing application for the removal of silt from the inlet and outlet of Bradwell Nuclear Power Station. The volume of material to be dredged and disposed of at sea is approximately 915 m<sup>3</sup> (1,400 tonnes). As part of the radiological assessment of the proposed operation, two sediment samples were taken on the 22<sup>nd</sup> August 2013 at:

- East Outlet Culvert (Sample 1) 51 44.7174N, 00 53.4457E
- West Inlet Culvert (Sample 2) 51 44.7308N, 00 53.4731 E

A location map is given in Figure 1, showing the dredging position.

Figure 1. Location Site (intakes and outfalls)



## Dredging area

Following freeze-drying and homogenisation, radionuclide assay at the Cefas Lowestoft Laboratory was achieved by  $\gamma$  counting samples on a high purity Ge detector. The results are summarised in Table 1.

**Table 1. Radioactivity in sediment dredged from Bradwell Nuclear Power Station, 2013**

Sample Identifier	Specific activity (Bq/kg, dry weight)					
	<sup>60</sup> Co	<sup>137</sup> Cs	<sup>226</sup> Ra (via <sup>214</sup> Pb)	<sup>232</sup> Th (via <sup>228</sup> Ac)	<sup>238</sup> U (via <sup>234</sup> Th)	<sup>241</sup> Am
East Outlet Culvert Sample 1	0.52	7.61	21.6	25.0	48.0	0.39
West Inlet Culvert Sample 2	<0.24	8.00	21.7	25.3	53.9	<0.71
<b>*Average</b>	<b>0.38</b>	<b>7.80</b>	<b>21.7</b>	<b>25.1</b>	<b>50.9</b>	<b>0.55</b>

\*Average determinations use < results as positively measured values to produce a conservative estimate

The specific activity of the artificial radionuclides (e.g. <sup>137</sup>Cs and <sup>241</sup>Am) in these samples was typical of sediments resulting from discharges from the Bradwell Nuclear Power Station and long distant effects (due to the long distance transfer of Sellafield derived activity and fallout from weapons testing). Apportionment of the effects of these sources is difficult because of the low levels detected.

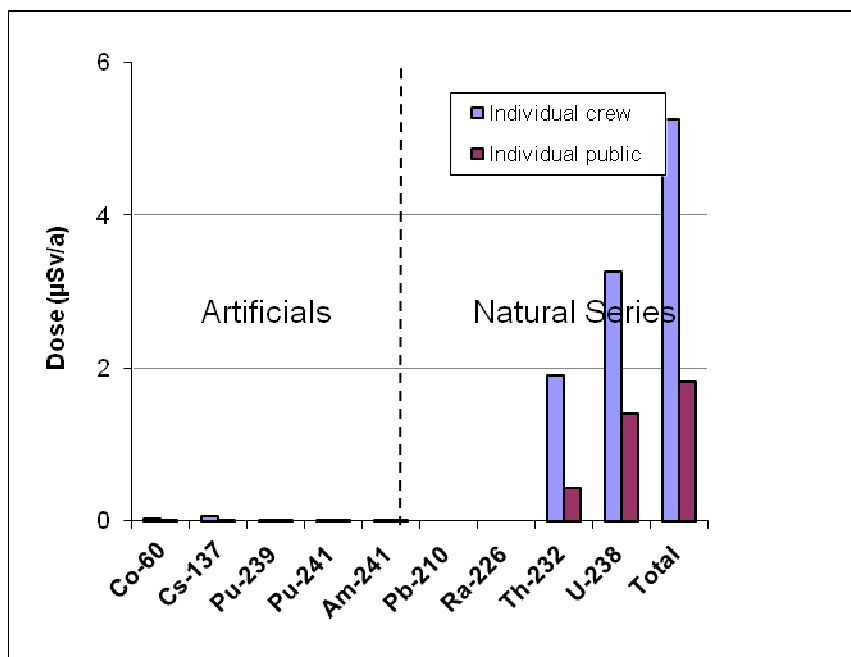
In addition to the nuclides detected by gamma spectrometry, sediments are also known to contain activities of Pu radionuclides. The <sup>241</sup>Am data were used to derive estimates for <sup>239,240</sup>Pu and <sup>241</sup>Pu, assuming their activity was proportional to the ratio in the time integrated Sellafield discharges. This approach is reasonable given that both radionuclides are highly particle-reactive, hence the fate following discharge is similar. The activity for <sup>210</sup>Pb was derived using data for <sup>226</sup>Ra and assuming secular equilibrium.

Under the London Convention, only materials with *de minimis* levels of radioactivity may be considered for dumping. Using the conservative generic radiological assessment procedure developed by the IAEA (IAEA, 2004), to convert radionuclide concentrations in dumped material into radiation doses due to dumping, the total derived total doses to individual members of the crew and public were 5.3 µSv/year and 1.8 µSv/year, respectively. The total collective dose was 0.033 manSv/year. The values for individual members of the crew and

public, and the collective dose, were within the *de minimis* criteria of 10  $\mu\text{Sv}/\text{year}$  (individual doses) and 1  $\text{manSv}/\text{year}$  (collective dose), respectively.

The dose estimates for individual crew/public (by nuclide), derived using the generic IAEA model, are shown in Figure 1.

**Figure 1. Assessment of dose to individual members of crew and the public arising from Bradwell Nuclear Power Station** a) Doses were derived using average activities listed in Table 1.



Since the conservative generic radiological assessment procedure indicated that doses received were well below recommended limits, a subsequent more detailed case specific assessment was not necessary. All the derived total dose values were less than the *de minimis* criteria of 10  $\mu\text{Sv}/\text{year}$  and 1  $\text{manSv}/\text{year}$  for individual and collective dose, respectively.

Therefore, from radiological considerations, there is no objection to this material being dredged and dumped.

## **References**

IAEA (2004). Sediment distribution coefficients and concentration factors for biota in the marine environment. Tech. Rep. Ser. No. 422, IAEA, Vienna.

United Kingdom - Parliament, 2009. Marine and Coastal Access Act, 2009. HMSO, London.

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### Head office

Centre for Environment, Fisheries & Aquaculture Science  
Pakefield Road, Lowestoft,  
Suffolk NR33 0HT UK

Tel +44 (0) 1502 56 2244

Fax +44 (0) 1502 51 3865

Web [www.cefas.defra.gov.uk](http://www.cefas.defra.gov.uk)

Centre for Environment, Fisheries & Aquaculture Science  
Barrack Road, The Nothe  
Weymouth, DT4 8UB

Tel +44 (0) 1305 206600

Fax +44 (0) 1305 206601

