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Cefas Environment Report RL 21/2008

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Cefas Contract SLBA1 Marine material disposal – Part II FEPA

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# RADIOLOGICAL ASSESSMENT OF DREDGING APPLICATION FOR THE PORT OF LANCASTER (2008)

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**Cefas Contract** SLBA1 Marine material disposal – Part II FEPA

**RADIOLOGICAL ASSESSMENT OF DREDGING APPLICATION FOR THE PORT OF LANCASTER (2008)**

## Summary

In 2008, Lancaster Port Commission lodged a FEPA licensing application to carry out a 3 year dredging program involving the disposal at sea of up to 9999 tonnes per annum of sediment in the vicinity of the Port of Lancaster. 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 dose to individual members of the crew and public was ~5.0 µSv/year and ~1.0 µSv/year, respectively. The total collective dose was 0.032 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 well 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 2008, Lancaster Port Commission lodged a FEPA licensing application to carry out a dredging program (23 December 2008 – 23 December 2011) involving the disposal at sea of up to 29997 tonnes of sediment (9999 tonnes per annum) from the Glasson Dock, at the port of Lancaster. As part of the radiological assessment of the proposed operation, six sediment samples were collected from Glasson Dock in November 2007. Sampling locations (1-6) are given in Figure 1 (insert).

**Figure 1. Study Area (Lancaster Port) and Sampling Locations (insert)**

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

**Table 1. Radioactivity in sediment dredged from the Port of Lancaster, November 2008**

| Sample Location | Specific activity (Bq/kg, dry weight) | | | | | |
|---|---|---|---|---|---|---|
| | $^{60}$Co | $^{137}$Cs | $^{226}$Ra (via $^{214}$Pb) | $^{232}$Th (via $^{228}$Ac) | $^{238}$U (via $^{234}$Th) | $^{241}$Am |
| 1 | < 1.5 | 77 | 22 | 23 | 27 | 62 |
| 2 | < 1.1 | 105 | 19 | 22 | 28 | 91 |
| 3 | < 1.1 | 74 | 17 | 16 | 18 | 66 |
| 4 | < 1.0 | 88 | 17 | 23 | 37 | 68 |
| 5 | < 1.7 | 203 | 21 | 27 | 29 | 164 |
| 6 | < 1.1 | 115 | 22 | 21 | 23 | 94 |
| ***Average** | **1.2** | **110** | **20** | **22** | **27** | **91** |

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

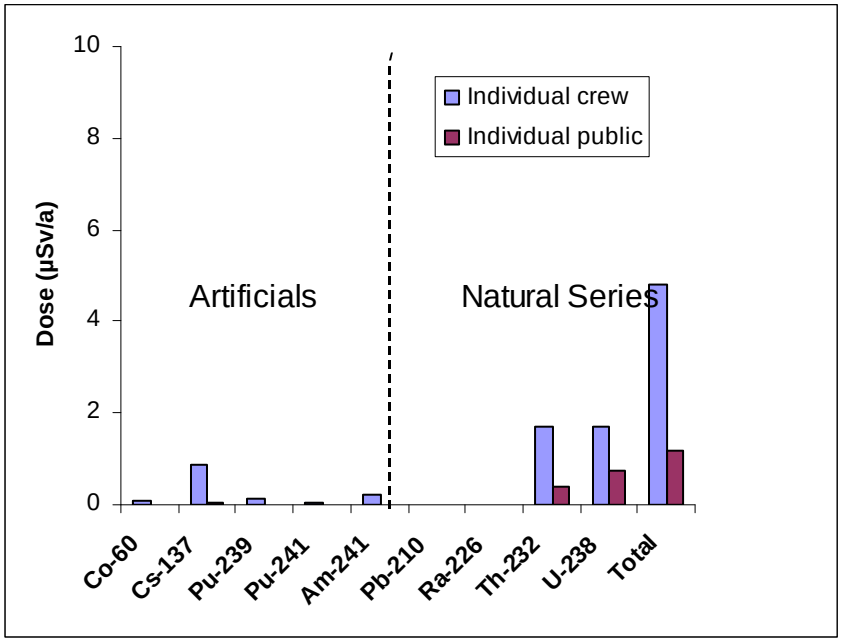
The specific activity of the artificial radionuclides (e.g. $^{137}$Cs and $^{241}$Am) in these samples was typical of muddy sediments along the north-east coastline of England, being significantly enhanced above background levels outside the Irish Sea. The contamination is a legacy of large discharges from the Sellafield Limited reprocessing plant (formally British Nuclear Fuels) at Sellafield in the 1970s.

In addition to the nuclides detected by gamma spectrometry, sediment in Lancaster is known to contain activities of Pu radionuclides. The $^{241}$Am data were used to derive estimates for $^{239,240}$Pu and $^{241}$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 $^{210}$Pb was derived using data for $^{226}$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 dose to individual members of the crew and public was ~5.0 µSv/year and ~1.0 µSv/year, respectively. The total collective dose was 0.032 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.

The dose estimates for individual crew/public (by nuclide), derived using the generic IAEA model, are shown in Figure 2.

**Figure 2. Assessment of dose to individual members of crew and the public arising from at Lancaster** 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 µSv/a and 1 manSv/a 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.

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