Environment Agency

Evidence

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Measurement and assessment of external radiation dose rates to people on houseboats and using riverbanks - Ribble Estuary case study

Project summary SC060080/S4

The Ribble estuary near Preston receives radioactive substances from liquid effluent, discharged directly from the nearby Springfields Fuels Ltd site, and also transported down the coast from the Sellafield Ltd site via the Irish Sea. Estuaries are complex environments, influenced by both the marine tidal processes and the freshwater input from rivers. Some of the radioactive substances eventually become deposited in sediment in the estuary and on the nearby salt marsh.

We at the Environment Agency have a duty to ensure that the dose received by members of the public from man-made radioactivity does not exceed the public dose limit of one millisievert per year. We regularly analyse the amount of radioactivity in sediments and foodstuffs to calculate the dose that a member of the public may receive - results are published in the annual RIFE report. Many people spend time in or near to the Ribble estuary, from living in houseboats to recreational angling or wildfowling. All will receive a dose from the radioactive substances in the sediment.

In this project we studied the factors that influence the external dose a person may receive from beta and gamma radiation from Ribble sediments. We looked at the conditions which may change the dose received including: the effects of high and low, spring and neap tides; whether boat hulls or clothing materials provide shielding from the radioactivity in the sediment; the effect of the position of boats relative to the banks; and the different habits of people using the estuary, for example wildfowlers laying flat on the sediment, or anglers sitting next to a channel filled with water.

We completed a detailed monitoring survey at different sites in the Ribble estuary, including around and within three boats at Becconsall Boatyard, over salt marsh at Longton Marsh, and at Savick Brook; a small tidal tributary just upstream of the Springfields Fuels Ltd site's discharge point. As well as measuring external dose rates, at each we did spectrometry analysis to identify which radioactive substances were present and which were contributing most to the dose rate.

We also collected samples of the surface sediment and two sediment cores for laboratory analysis.

The results of this work found that of the people using the Ribble estuary, those living on houseboats received the highest dose from radioactivity in the sediments, but this was less than ten percent of the public dose limit. The dose to anglers and wildfowlers was less than one percent of the public dose limit.

About half of the dose received was from naturally occurring radioactive substances. Most of the dose received from man-made radioactive substances was from those discharged from the Sellafield Ltd site. At Savick Brook, radioactive substances discharged from the Springfields Fuels Ltd site contributed to the dose received, but this was negligible at the other sites.

The presence of water in the estuary reduces the external dose rate from the sediments. People living on boats that rest on sediment for most of the tidal cycle (further inland) will receive a higher dose than those where the tide floods twice daily. Boat occupants receive a dose from the sides of a channel as well as the from the underlying sediment.

The amount of shielding provided by boat hulls varied from almost none in a small pleasure boat, to 50 percent in a medium sized houseboat. Thick, dense clothing materials like rubber boots reduced the dose received from beta radiation by around 80 percent, wax jacket by 20 to 40 percent, while thin, less dense materials like woollen jumpers did not provide any protection.

A site-specific value is provided to correct instrument readings for cosmic radiation (from space) and for naturally occurring radiation in sediments. Comparing this site-specific value with the generic value which had been used in the annual RIFE reports shows that the generic value is reasonable, but perhaps slightly conservative.

This report addresses previous criticism of the methods we use in our dose assessments. The results from this work can be used to improve how measurements are made, and to ensure that vital information about the state of the tide and the location of measurements are recorded. This means that our dose assessments will be better, and that we can defend our public dose assessments for people using estuaries with confidence.

This summary relates to information from project SC060080, reported in detail in the following output(s):

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