Paper 7-02

NATIONAL DOSE ASSESSMENT WORKING GROUP

PAPER 7-02: LOCALISED CHARTS TO SHOW DOSES BY COUNTY

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The National Dose Assessment Working Group (NDAWG) recognised the need to make estimates of the total radiation dose received by members of the public which include all sources such as that due to natural background. This needed to be in a form that could be easily presented to the public and which was not just for the country as a whole. For many years the National Radiological Protection Board (now part of the Health Protection Agency) has compiled information on the exposure of the UK population from all sources of radiation[2]. This review includes a pie chart that shows the average annual dose to the UK population and gives the breakdown by different sources of ionising radiation. This pie chart was felt to be a useful way of explaining radiation exposure to the public. It was agreed that it would be useful to have such charts for different counties in the UK taking account of the variation in natural background exposure as well as local sources, such as due to discharges from nuclear sites.

This note describes two sets of charts that have been developed to show the variation in dose from the main sources of exposure in two counties. The counties selected for this discussion note are Cornwall and Cumbria. Cornwall was selected as there is little exposure of the population to environmental artificial radioactivity, and because the levels of natural exposure are significantly higher than the average for the UK. The elevated indoor radon concentrations in this county are partly due to the geology of the area. Cumbria was selected because the population is affected by the authorised discharges of radionuclides from two major sources: Sellafield and Rhodia. The natural radiation levels within the county are similar to the average for the UK.

Natural gamma comes from naturally occurring radionuclides in building materials, rocks and soils. Data on levels of exposure to this source were obtained as part of an NRPB national survey of indoor and outdoor levels of natural radiation that were published in the early 1980s.

The levels of indoor radon were also measured as part of the NRPB national survey, and the results were used to derive an average dose per county. The exposure to radon is very dependent on the ground above which buildings have been constructed and other factors such as the weather, and as such is the most widely varying natural source of exposure.

Exposure from **cosmic radiation** has been taken from information in UNSCEAR. There is some variability of this dose with both latitude and elevation; however the value selected

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[1] Formerly the National Radiological Protection Board.

[2] The last review was published as: Hughes J S, Ionising radiation exposure review of the UK population: 1999 review. NRPB-R311, NRPB Chilton (1999). The latest review will be published in 2005.

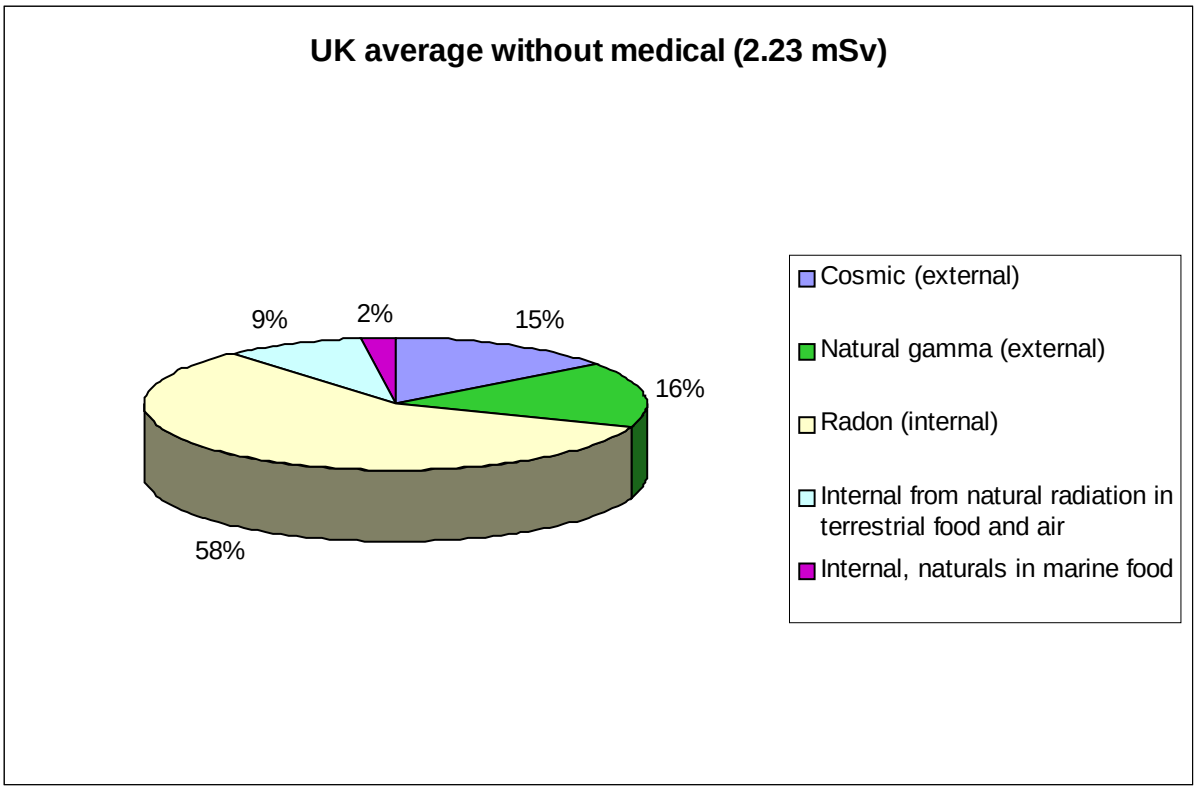
represents an average of the range quoted for the UK, as described in the latest population review report from the NRPB. Account has been made of time spent inside buildings, including the use of a factor for the shielding effect of a typical house in the UK.

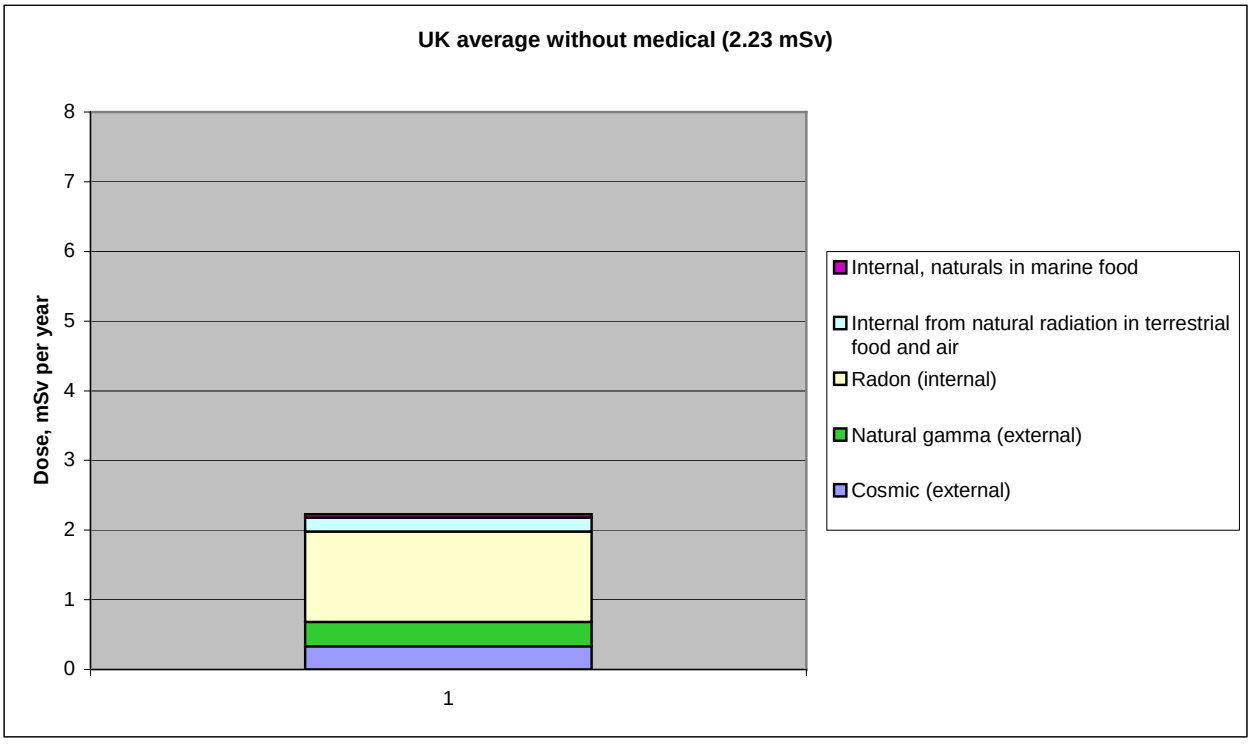
Internal exposures from **ingestion and inhalation of natural radionuclides** have been calculated as an average for the UK, using average activity concentrations of those radionuclides in water, air and foodstuffs.

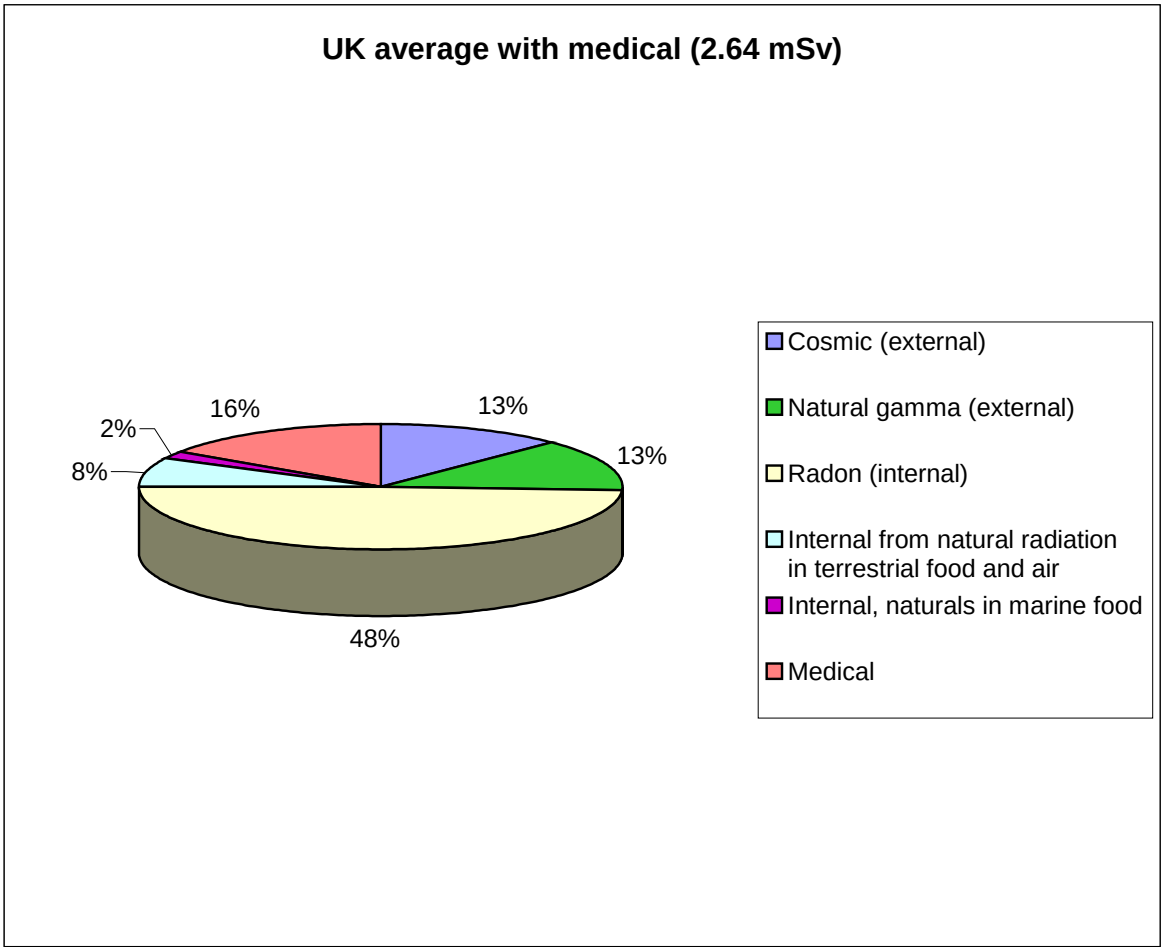
Medical exposure is shown in the charts as both included and excluded as this exposure may not be applicable to everyone. Data for medical exposure has been obtained from published NRPB surveys and included as part of the UK population exposure review. The contribution shown indicates the average annual medical exposure received by the UK population.

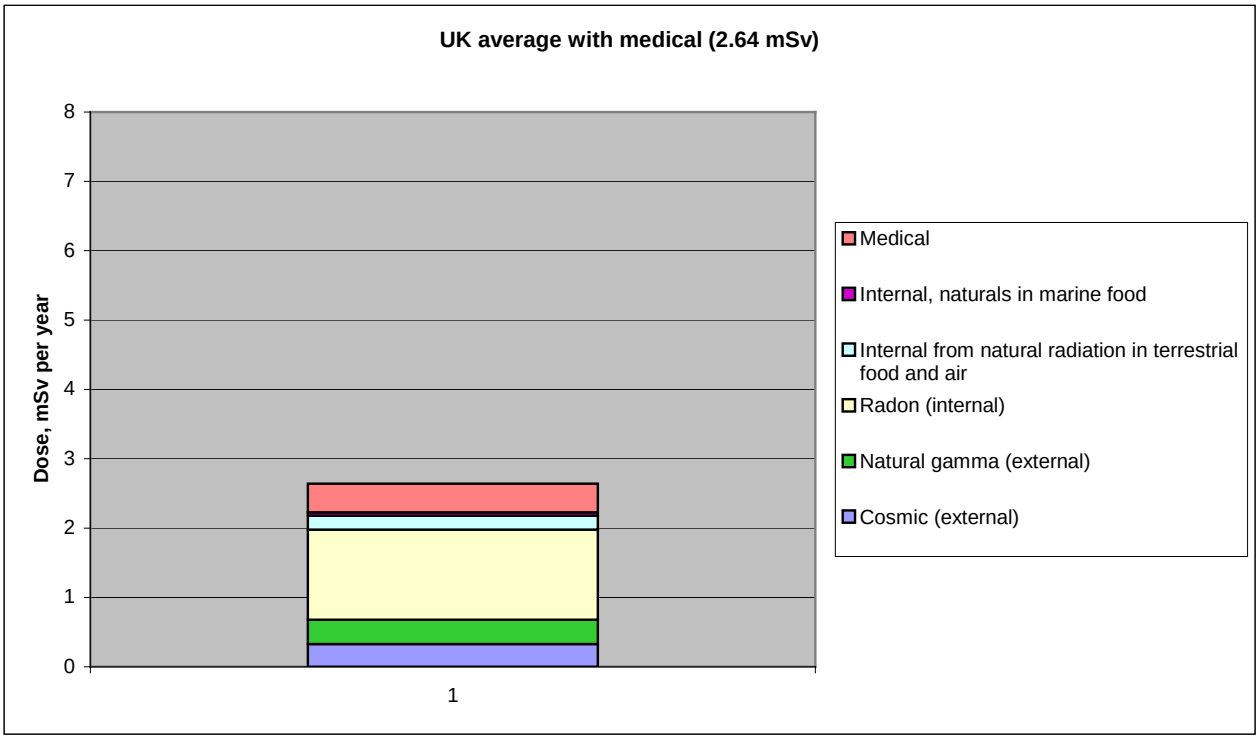
Marine exposure has been included for Cumbria due to the discharges at Sellafield and Rhodia. The charts for the Cumbrian critical group show the dose from critical group consumption of marine foods using the present activity concentrations of radionuclides in the area (this includes contributions from both current and historical discharges). The critical group doses from marine discharges have been taken from the RIFE-9 report. The 'Cumbria average group' charts show the estimated doses based on normal eating habits of the Cumbrian population, thus the contribution from marine food ingestion is less in these charts compared with the critical group charts. It should be noted that the doses from natural radioactivity in marine foods are also higher for the critical group due to their greater consumption of such food than the average group.

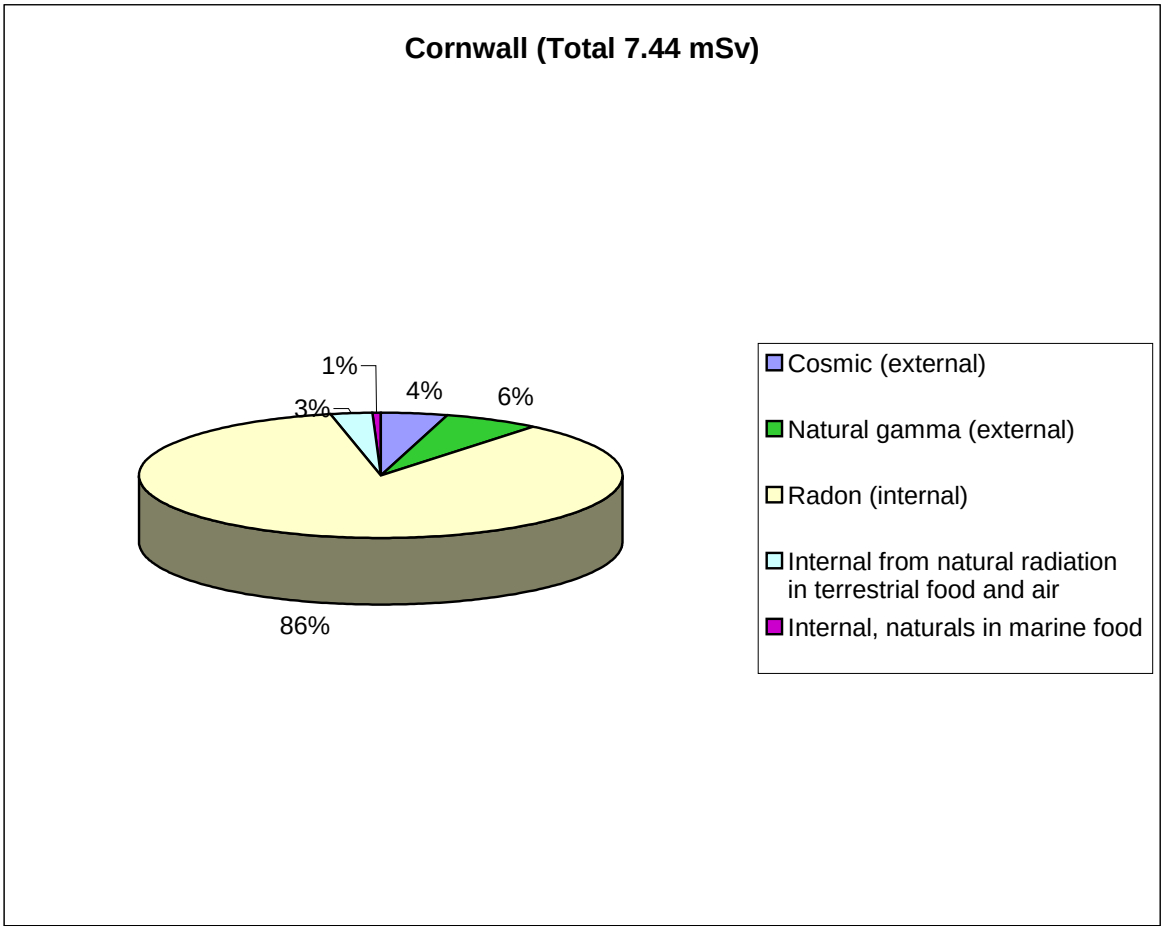
Charts are presented below for the UK average (with and without medical exposure), Cornwall, Cumbria and for the critical group of seafood consumers in Cumbria. Two types of chart are presented for each, the traditional pie chart and a bar chart. The bar chart enables the relative size of the doses for different cases to be seen easily. If agreed by NDAWG members the intention is to produce similar charts for each county in the UK. The information would then be displayed on the NDAWG and HPA websites in such a way that people can easily find the dose for the area where they live.

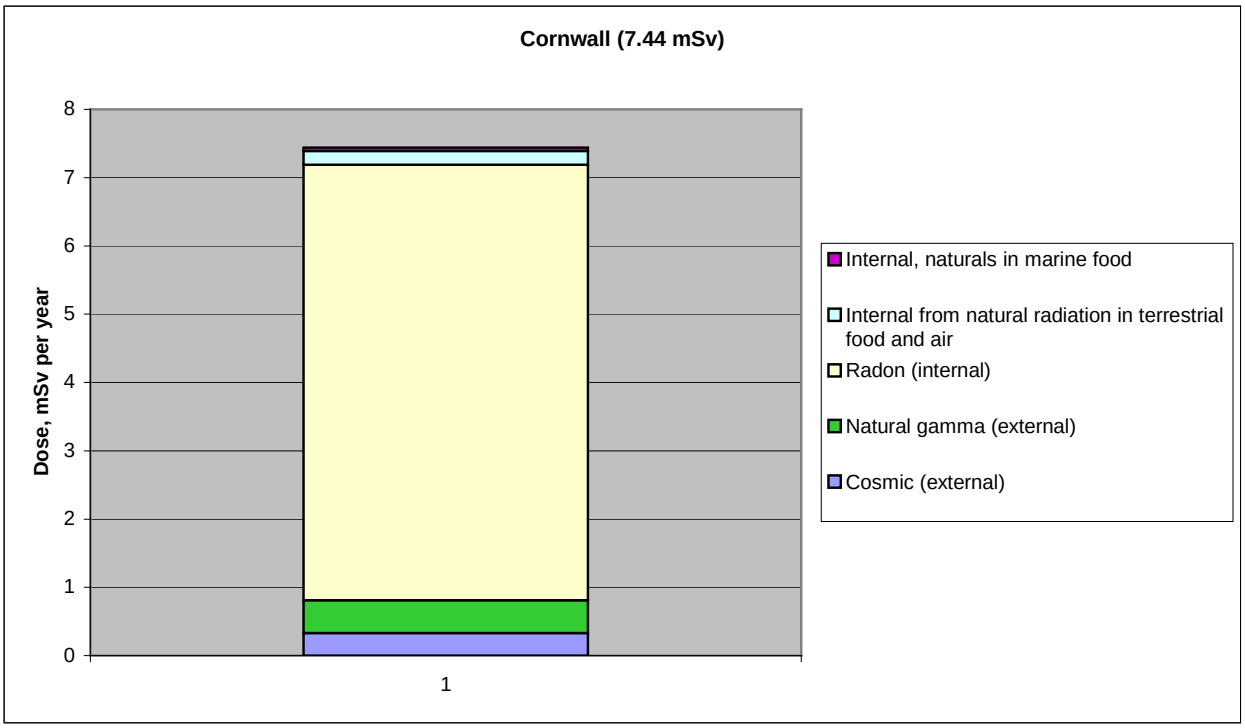

UK average without medical (2.23 mSv)
9%
2%
15%
16%
58%
Cosmic (external)
Natural gamma (external)
Radon (internal)
Internal from natural radiation in terrestrial food and air
Internal, naturals in marine food

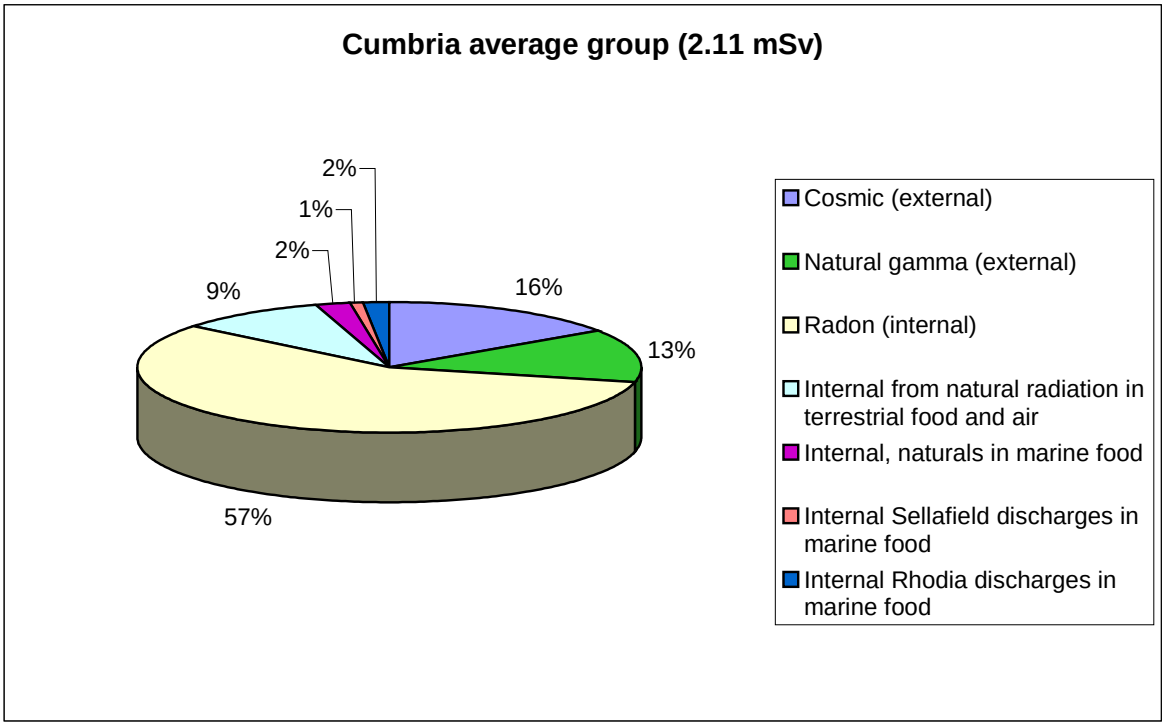

UK average without medical (2.23 mSv)
Dose, mSv per year
8
7
6
5
4
3
2
1
0
1
Internal, naturals in marine food
Internal from natural radiation in terrestrial food and air
Radon (internal)
Natural gamma (external)
Cosmic (external)

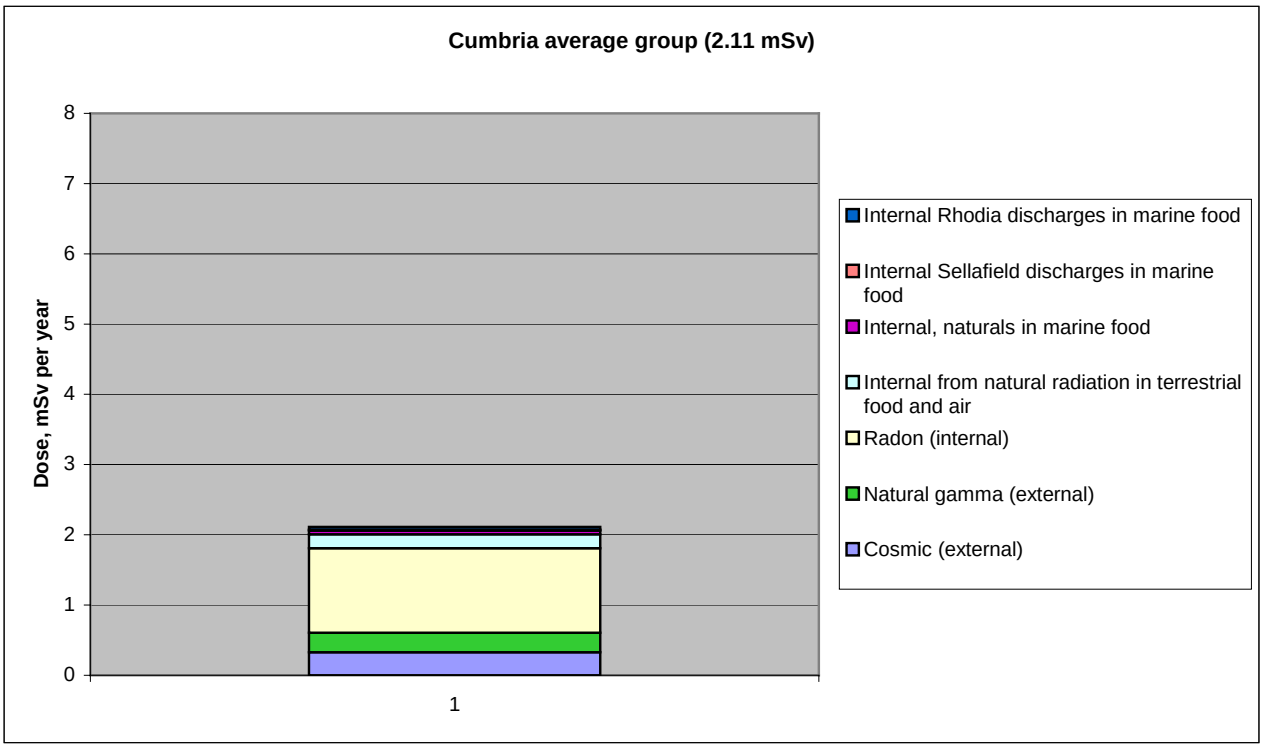

UK average with medical (2.64 mSv)
16%
13%
2%
13%
8%
48%
Cosmic (external)
Natural gamma (external)
Radon (internal)
Internal from natural radiation in terrestrial food and air
Internal, naturals in marine food
Medical

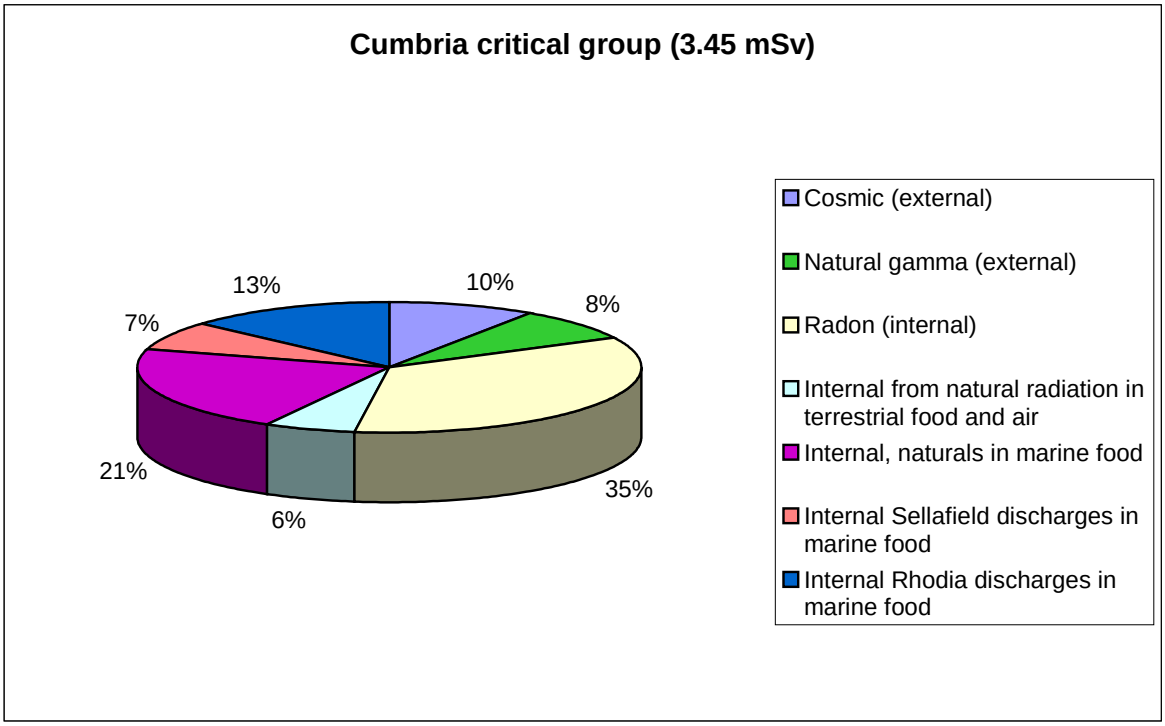

UK average with medical (2.64 mSv)
Dose, mSv per year
0
1
2
3
4
5
6
7
8
1
Medical
Internal, naturals in marine food
Internal from natural radiation in terrestrial food and air
Radon (internal)
Natural gamma (external)
Cosmic (external)

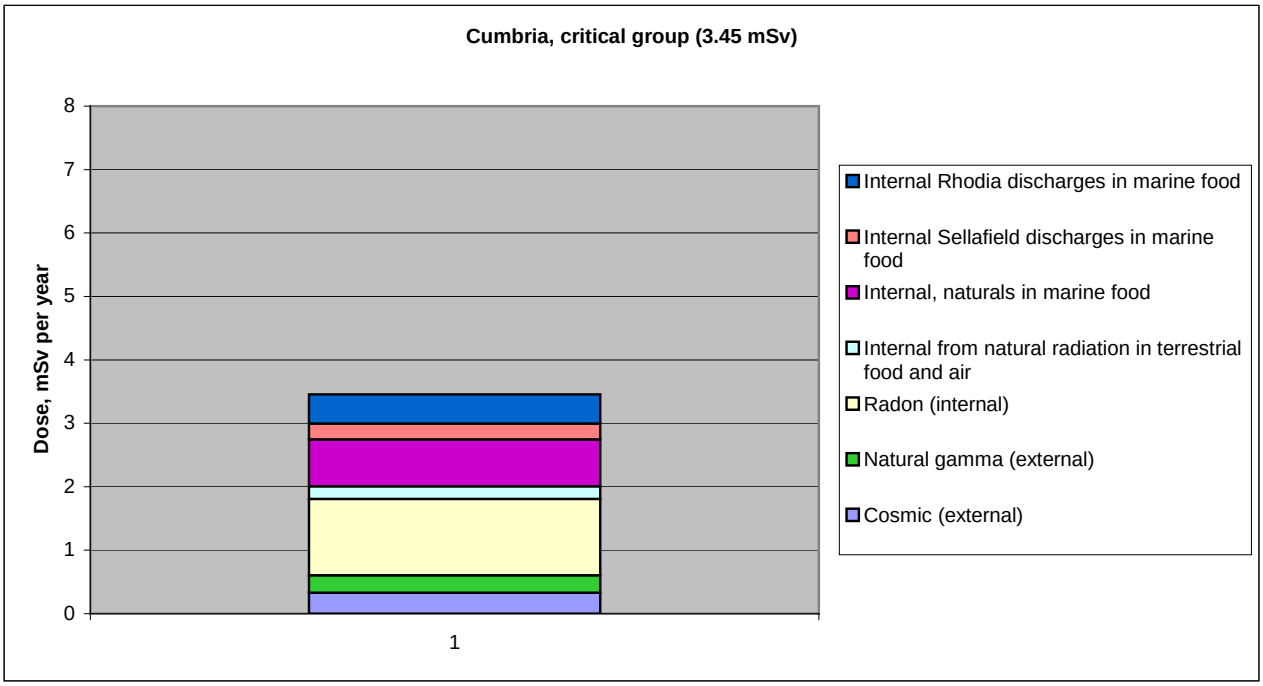

Cornwall (Total 7.44 mSv)
1%
4%
6%
3%
86%
Cosmic (external)
Natural gamma (external)
Radon (internal)
Internal from natural radiation in terrestrial food and air
Internal, naturals in marine food


Cornwall (7.44 mSv)
Dose, mSv per year
0
1
2
3
4
5
6
7
8
1
Internal, naturals in marine food
Internal from natural radiation in terrestrial food and air
Radon (internal)
Natural gamma (external)
Cosmic (external)


Cumbria average group (2.11 mSv)
2%
1%
2%
9%
16%
13%
57%
Cosmic (external)
Natural gamma (external)
Radon (internal)
Internal from natural radiation in terrestrial food and air
Internal, naturals in marine food
Internal Sellafield discharges in marine food
Internal Rhodia discharges in marine food


Cumbria average group (2.11 mSv)
Dose, mSv per year
0
1
2
3
4
5
6
7
8
1
Internal Rhodia discharges in marine food
Internal Sellafield discharges in marine food
Internal, naturals in marine food
Internal from natural radiation in terrestrial food and air
Radon (internal)
Natural gamma (external)
Cosmic (external)


Cumbria critical group (3.45 mSv)
13%
10%
8%
7%
21%
35%
6%
Cosmic (external)
Natural gamma (external)
Radon (internal)
Internal from natural radiation in terrestrial food and air
Internal, naturals in marine food
Internal Sellafield discharges in marine food
Internal Rhodia discharges in marine food


Cumbria, critical group (3.45 mSv)
Dose, mSv per year
8
7
6
5
4
3
2
1
0
1
Internal Rhodia discharges in marine food
Internal Sellafield discharges in marine food
Internal, naturals in marine food
Internal from natural radiation in terrestrial food and air
Radon (internal)
Natural gamma (external)
Cosmic (external)