Radiological assessments of the public: the challenge of assessing changes to the 'Critical Group' at Sellafield

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Summary
A review of doses to the public since the operation of Sellafield has shown that the highest doses reported were for the laverbread (Porphyra, seaweed) consumers. Since the 1970s, locally consumed seafood has been the most important pathway but it has not been possible to determine life-time doses.

Introduction
The International Commission for Radiological Protection (ICRP) provides advice on protection of the public from sources of radioactivity. The annual publications in the Aquatic Environmental Monitoring Report (AEMR) and Radioactivity in Food and the Environment (RIFE) series (Refs 1 & 2) provide information about discharges from nuclear operations, environmental sampling and thus, to dose assessments of the public for each site. Identification of those people who are potentially the most exposed, the so called 'Critical Group' or 'Representative Group' can be guided by undertaking surveys of local residents to determine their habits. Examples of the way such studies are conducted are briefly described using the people living near Sellafield as an example.

Habit Surveys
Surveys of the public may include face to face interviews, use of logging sheets to compile diary records, and silicone models to determine portion size. Such methodology relies on the willingness of individuals to co-operate. In the case of commercial fishermen, due respect needs to be paid to commercially sensitive information such as fishing locations and maintaining goodwill with their customers. Other commercial interests may include e.g. turf cutting, fish meal manufacturers and fish farm operators. Local residents may live in close proximity to a nuclear site and wish to be involved with supplying environmental samples or contributing to radiological assessments, such as giving access to their garden produce, farm land or fishing gear from which doses can be determined. Over a period of many years, such a relationship should provide scientifically robust information, aided by additional research such as by using whole body monitoring to determine caesium levels and the use of thermoluminsecent dosimeters to aid assessment of whole body exposure. (Refs. 3 & 4).
A range of methods have been used to estimate individual exposure and this includes children. Almost 600 observations were made e.g. during 1981 and 1982. (Ref. 5). and the methods for the combination of data to calculate doses kept under review (Ref. 6). Sellafield habits surveys have included the need to consider consumption trends over a number of years (Ref.7).

Analysis of Publications
There have been changes in the personnel constituting the so called 'Representative Group' In the period 1962 to 1967, estimated doses to the laverbread consumers in South Wales could have ranged from 4 to 7 $mSvy^{-1}$ because of the collection of seaweed, Porphyra. This pathway ceased to be of importance when the collectors retired and the railway line was closed. Thus in the 1970s, commercial fishermen and local residents consuming locally caught seafood were deemed to be receiving the highest doses in the order of 1 – 2 mSv^{-1} . The economic recession in 1980 meant that consumption of molluscs, especially winkles increased and this has remained the dominant pathway through to 2010. The highest dose for these seafood consumers occurred in 1981 of 3.5mSv, which utilised an enhanced dose for plutonium. The installation at Sellafield of the Site Ion Exchange Effluent Plant, SIXEP, Thermal Oxide Reprocessing Plant THORP and the Enhanced Actinide Removal Plant EARP, significantly reduced discharges from the mid 1990s. Current discharges e.g. in the last ten years only contribute 10 – 15% of the total dose, with most of the dose being due to historical discharges made in the 1970s. Both the AEMR and RIFE reports have considered additivity of pathways to individuals and this has included external exposure e.g. from seashore occupancy, as well as atom bomb fallout and exposure to the Chernobyl nuclear accident. Apportionment is often difficult and further work with changes to EU legislation has included the need to consider technologically enhanced naturally occurring radioactive material, e.g. Po-210 in seafood, especially in crustaceans and molluscs. Inclusion of these doses may be similar or greater than Sellafield discharges. The AEMR and RIFE reports show that dose limits for the public have been met under ICRP guidance available at the time.

Conclusions & the Way Forward?
Due to historical and current discharges from Sellafield, annual surveys are merited of those people potentially the most exposed i.e. the 'Representative Group'. Such work may include the need for duplicate sampling of foodstuffs and additional radiological research to check the appropriateness of the way doses are assessed. People will change their habits and thus judgement needs to be made of the risk to either significantly overestimating or underestimating exposure. Meetings with local councillors and representatives provide credibility that pathways are kept under review and an opportunity to discuss the merits of additional work.
From the data already published, it is not possible to determine life time doses. Further analysis of the AEMR and RIFE reports in conjunction with analysis of individual observations might include a review of potentially radiologically important habits as well as providing additional reassurance to the public.

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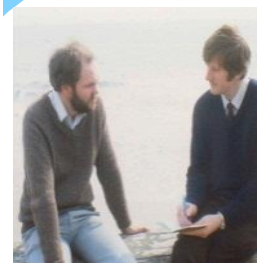

Personal interviews

Diary recording

Whole body monitoring