The Importance of Effective Communication of Radiological Protection Information to the Public and the Media

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The Communication Challenge

As elsewhere in the world, Great Britain is seeking to expand nuclear power generation in order to curtail its dependence on fossil fuels and so that it can meet its internationally agreed obligations on carbon emission reduction. But it does so in a world that is coming to terms with the consequences of the Fukushima nuclear accident and in a socio-political climate of disquiet about the safety performance of nuclear power generation.

The challenge for radiation protection professionals often lies in how to communicate technical issues to a public that doesn't know whether nuclear power is adequately safe and yet doesn't always trust operators or regulators.

UK Regulation of the Environmental Impact of Nuclear Operators

Nuclear operators have duties to ensure that public radiation exposures resulting from their operations are restricted, so far as is reasonably practicable, and kept below statutory limits. Their arrangements to do this include measurement of direct radiation dose rates at site perimeters and elsewhere (regulated by the Office for Nuclear Regulation - ONR) and environmental radioactivity monitoring (regulated by the environment agencies in England, Scotland and Northern Ireland). These agencies publish such data annually[1].

ONR regulates by means of a licensing process and other statutory instruments such as the Ionising Radiations Regulations 1999 (IRR99). In order to operate a nuclear facility, a licensee must comply with a number of licence conditions which, amongst other things, require an adequate nuclear safety case for its facility and processes. These include the licensee's need to control public radiation dose, so far as is reasonable practicable, a requirement which is further reinforced by the IRR99.

ONR and its predecessor organization, the Nuclear Installations Inspectorate, has for many years systematically collected and assessed the adequacy of annual data from nuclear operators on perimeter dose rates, and their estimates of the public exposures that might arise from them.

Annual dose limits for members of the public are set by IRR99 at 1 milli-sievert (mSv) effective dose but, additionally, the UK Health Protection Agency (HPA) recommends a dose constraint of 0.3 mSv per annum for any single source; the rationale here is that it should be possible for new nuclear plant to be operated to well within this constraint. ONR refers to both these values in its Safety Assessment Principles (SAPs), setting its Basic Safety Level (BSL) at the 1 mSv public exposure limit and an underlying Basic Safety Objective (BSO) of 20 micro-sieverts (μSv) per annum as a design-base objective.

The UK Approved Code of Practice (HSE publication L121) for IRR99 states:

> "*For the assessment of compliance with the dose limits relating to members of the public, realistic estimates should be made of the average effective dose (and where relevant equivalent dose) to representative members of the appropriate reference group for the expected pathways of exposure.*"

Nuclear operators comply with this guidance in ways that may differ in detail but, essentially, all conduct planned site perimeter dose measurements which together with population habit studies allow public doses to be estimated.

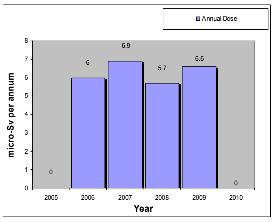
Typically, thermoluminescent dosemeters (TLDs) are exposed at locations around an installation's perimeter and off-site. These have the advantage of measuring integrated dose over the entire year and are capable of measuring small doses accurately. In some cases, regular surveys are made using radiation monitoring instruments which have the advantage of providing dose data along the entire perimeter. Habit surveys are used to identify the public reference group for which potential dose needs to be calculated, i.e. groups that are likely to receive the highest doses from direct radiation and from ingestion of locally-sourced food. These groups are often residents of nearby dwellings but can be others, for example, people exposed during recreational activities such as exercising dogs on ground near an installation.

Measurements of dose rates around nuclear installations, whether by instrument or dosemeter, necessarily include the natural background (terrestrial plus cosmic radiation) which, for the majority of UK nuclear installations, is the dominant component and must therefore be corrected for in public dose estimates; this correction often leads to a high degree of statistical uncertainty in the final calculated figure. Accordingly, measurement down to the ONR BSO of 20 μSv per year is not practicable in the UK where terrestrial and cosmic background levels are typically around 700 μSv per year and highly variable, even over short distances.

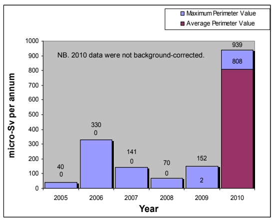
These measurement difficulties can lead to statistical variation year-on-year in operator declared public doses that may be mistaken for an unacceptable trend or at least one that needs explanation by the operator in order to allay public concern. Year-on-year step changes in public dose calculation also sometimes arise from plant operational change or from changes in dose modelling assumptions and these too have also to be explained if they are not to be misrepresented. When such problems occur, ONR's role in assessing the adequacy of licensee data returns is essential to the public interest being well-served.

The following charts illustrate some of the difficulties that exist in the presentation of environmental impact data to the public and other stakeholders.

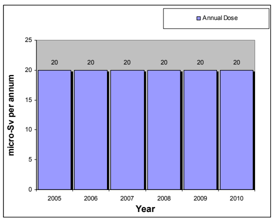
Calculated Public Dose

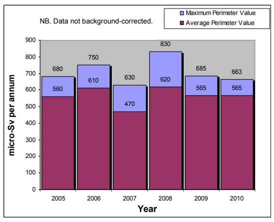


Site Boundary Dose Rates

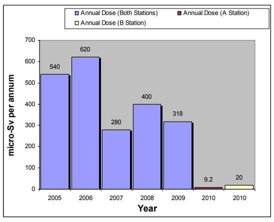


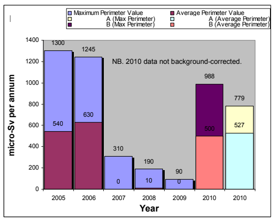
In the above example, the critical group public dose is apparently inconsistent with site boundary measurements made by the operator, for in 2005 and 2010, it did not declare a value. The site perimeter values for 2010 were also declared as being much higher than in previous years. The explanations though are simply that critical group dose calculation is significantly affected by statistical error in the measurement of radiation fields that are barely above background levels and that, in 2010, the operator did not report background-corrected site boundary measurements largely because of these difficulties.





In this next example, there are apparent inconsistencies in site boundary dose values compared to the public doses calculated to have arisen from them, for these appear to have remained constant even though site perimeter fields have varied somewhat. Again the explanation lies in the statistical uncertainty that arises when one is trying to assess radiation fields that are very small and significantly lower than the natural background field. In this case, the operator has elected simply to declare public doses to be below the applicable BSO, in effect using the BSO as its detection limit.





And in the above charts, the effect that plant operational change has on site boundary doses is evident for the nitrogen-16 radiation field disappeared when one of the two power stations on the site ceased operation. The operator also changed background-correction procedures and local population habit assumptions in 2010 which explain the apparent fall in calculated public dose.

Public and Media Presentation

These examples illustrate that such data need to be interpreted and presented carefully, with consistent approaches to statistical uncertainty and treatment of background radiation, to ensure that they are not misinterpreted by members of the public and other stakeholders.

Radiation protection professionals therefore need intelligent communications policies on how best to explain and disseminate these kinds of data. Regulators, such as ONR, have roles in this process.

References

1) Radioactivity in Food and the Environment, 2010 (RIFE-16), Environment Agency, Scottish Environment Protection Agency, Northern Ireland Environment Agency and Food Standards Agency, ISSN 1365-6414. www.cefas.defra.gov.uk/publications/rife/rife16.pdf

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