
Comment

Radiobiology and Gray Science: Flaws in Landmark New Radiation Protections

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ABSTRACT: *The International Commission on Radiological Protection – whose regularly updated recommendations are routinely adopted as law throughout the globe – recently issued the first-ever ICRP protections for the environment. These draft 2005 proposals are significant both because they offer the commission’s first radiation protections for any non-human parts of the planet and because they will influence both the quality of radiation risk assessment and environmental protection, as well as the global costs of nuclear-weapons cleanup, reactor decommissioning and radioactive waste management. This piece argues that the 2005 recommendations are scientifically and ethically flawed, or gray, in at least three respects: first, in largely ignoring scientific journals while employing mainly “gray literature”; second, in relying on non-transparent dose estimates and models, rather than on actual radiation measurements; and third, in ignoring classical ethical constraints on acceptable radiation risk.*

The International Commission on Radiological Protection (ICRP) recently issued landmark 2005 proposals – its first-ever environmental recommendations.¹ Because the commission’s regularly updated recommendations are routinely adopted as law throughout the globe, the new proposals are certain to influence radiation risk assessment, environmental regulations and global costs such as reactor decommissioning, radioactive waste management and nuclear-weapons cleanup. Under existing regulations and just in the United States, government estimates that nuclear-weapons cleanup alone will cost a trillion dollars.

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Given this context, one would think the commission's new environmental proposals would deserve both scientific and ethical acclaim. Unfortunately, this is not the case.

Although their uniqueness makes the 2005 recommendations a milestone, they are flawed in at least three respects. First, they largely ignore refereed scientific journals while employing mainly "gray literature" (non-journal reports that do not undergo traditional scientific peer review). Second, they rely on non-transparent dose estimates and models, rather than on actual radiation measurements. Third, they ignore classical ethical constraints on acceptable radiation risk.

The first problem – the commission's reliance on gray literature, often written by special interests – is especially troubling because it emphasizes the fact that the commission has no new scientific data and no journal- and consensus-based scientific data to support its environmental proposals. Of the 52 items in the reference list for the 2005 recommendations, only 4 items – or 8 percent – are from refereed scientific journals; 92 percent are from gray literature. Perhaps this is because (as commission Chair Roger Clarke says) costs of radioactive waste cleanup and reactor decommissioning drove the new proposals.² Science deserves better.

The second problem – the commission's recommending reliance on non-transparent dose estimates and models, not on actual radiation measurements – effectively turns empirical radiobiology into what might be called "theological radiobiology." Although air and water concentrations are easily and reliably measured, the 2005 recommendations ignore all direct and abiotic measures of radiation. Instead the commission proposes using only estimates of "effective dose" to a few reference species – then estimating doses to other organisms, based on these "reference species." Yet the commission admits both that internal doses, often the dominant part of exposure, cannot be measured and that they are uncertain, hypothetical and unverifiable.

Effective dose to reference organisms also is a poor choice for the sole measure of environmental radiological protection because, by ignoring air and water concentrations, the commission foregoes a simple "early warning system" for later doses to plants and animals. Another problem is the absence of any scientifically accepted definition of "reference species." An undefined, purely qualitative neologism without clear biological significance, "reference species" is a term of convenience, introduced by the commission. Yet best practice in radiobiology requires using well defined concepts like "keystone," "umbrella," or "sentinel" species. Trying to explain "reference species," the 2005 document says they are "typical" of major environments and have "political resonance." Yet the document gives no list of such species or environments. Nor does it explain why having political resonance makes some organisms scientifically appropriate for estimating doses to millions of other species, each having quite different radiobiological sensitivities. A third problem is that, in relying solely on doses to reference species, the commission completely ignores ecosystem risk assessment; instead focuses only on toxicological risk assessment – dose estimates for a few species; and thus proposes performing only half of standard ecological risk assessment.

Another gray area includes the commission's many proposals to weaken long-standing human-health protections. The commission admits – following scientific consensus – that all non-zero doses of ionizing radiation are risky and all exposures should be kept “as low as reasonably achievable” (ALARA).³ Yet without requiring any risk disclosures, assessments or informed consent regarding affected humans, the 2005 recommendations propose deregulating all low-dose radiation. While low-dose deregulation may make sense, it is not ethical – at least not without explanation – for the commission to achieve deregulation by jettisoning half a century of informed-consent requirements and thereby ignoring ethics.⁴ It also is not consistent – at least not without explanation – to propose deregulating low-dose radiation but continuing the ALARA requirement. Equally inconsistent, the commission admits all non-zero radiation doses are cumulative and additive, yet endorses trimming dose data. By proposing to count and to regulate only radiation doses within the single highest human-exposure class (given workplace, public and medical exposure-classes), the commission seems not to realize that its proposals are at odds with ALARA and the scientific consensus that radiation doses are cumulative. The new recommendations also provide no explanation for their suddenly reversing decades of protections for sensitive human populations. Instead they propose 2005 regulations based on average doses to “Reference Man.”

What explains such flawed science and ethics? If Roger Clarke is right,² the 2005 proposals may have been influenced by special interests. By using and proposing gray, rather than transparent, science, the 2005 commission recommendations may be exchanging empirical law – measured regularities – for easily manipulated, nonempirical radiation estimates. If most scientists want unbiased governments “based on law, not on men,” should they not also want unbiased radiation science “based on law not on men”?

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