

CLARIFYING THE PARADIGM ON RADIATION EFFECTS & SAFETY MANAGEMENT: UNSCEAR REPORT ON ATTRIBUTION OF EFFECTS AND INFERENCE OF RISKS

ABEL J. GONZÁLEZ

Representative at the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

Member of the Commission of Safety Standards (CSS) of the International Atomic Energy Agency (IAEA)

ex-Vice-Chairman of the International Commission on Radiological Protection (ICRP)

Autoridad Regulatoria Nuclear de Argentina (ARN)

[Argentine Nuclear Regulatory Authority]

Av. del Libertador 8250

(C1429 BNP) Ciudad de Buenos Aires

Argentina

E-mail : agonzalez@arn.gob.ar

Received July 03, 2014

The aim of this paper is to describe a relatively recent international agreement on the widely debated concepts of: (i) attributing effects to low dose radiation exposure situations that have occurred in the past and, (ii) inferring radiation risk to situations that are planned to occur in the future.

An important global consensus has been recently achieved on these fundamental issues at the level of the highest international intergovernmental body: the General Assembly of the United Nations. The General Assembly has welcomed with appreciation a scientific report on attributing health effects to radiation exposure and inferring risks that had been prepared the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) following a formal request by the General Assembly.

KEYWORDS : Radiation Effects, Radiation Risks, Effect Attribution, Risk Inference, Safety Management, UNSCEAR, Radiation Paradigm

1. EPISTEMOLOGICAL BACKGROUND

Before the political consensus described in this paper was achieved, the epistemology on radiation risks and effects of low radiation dose exposure situations had been amply discussed in the peer reviewed literature (González, 2011). Such epistemology relates to the theories of knowledge applied for attributing the effects to and inferring the risks from radiation exposure situations, especially with regard to the methods, validity and scope of such theories. The attribution of radiation effects is a retrospective notion based on the concept of *provability*, which involves demonstrability, counterfactuality, and finally, the attestability that effects have actually been incurred in past exposure situations. The inference of radiation risk as a prospective notion is associated with the concept of probability, usually a Bayesian probability that quantifies risk in prospective exposure situations on the bases of radiobiological knowledge and epidemiological experience at high doses, usually expressed as a frequentistic probability. I had concluded that under present knowledge, radiation risks are inferable for prospective low-dose radiation exposure situations, however small the expected doses may be, and, therefore, that ascribing nominal radiation risks to planned exposure situations for radiation protection purposes is required for reasons of

duty, responsibility, prudence and precaution. However, it was also concluded that the prospective attribution of radiation risk does not imply that actual effects can be automatically attributed retrospectively to low-dose exposure situations.

In fact *attribution* refers to the knowledge required for assigning health outcomes to past radiation exposure situations, namely for connecting radiation effects to precedent radiation exposure situations (and therefore assigning them unequivocally to the situation). This is different than the aptitude for inferring radiation risks to planned prospective radiation exposure situations. In this respect, the epistemology of attribution is associated, respectively, with the subtly distinct concepts of *probability* and *provability*, expressed with these quasi-homonymous terms that cause much misunderstanding. They derive from a common root, the Latin *probare*, which means both 'to test' and 'to demonstrate'. This akin terminology is a recipe for confusion, and therefore requires an adequate semantics for conveying the concepts associated with radiation hazards.

Probability describes how plausible it would be that a planned radiation exposure be hazardous; quantitatively, it can measure *risk*. In fact, probability is the mean for quantifying the prospective inference of radiation risks. If previous statistical information on the effect occurrence is available, such probability can be derived frequentistically,

namely as the limit of the relative frequency of the effect occurrence in a large number of cases. If only indirect information on the plausibility of effect occurrence is available, evidential probability can still be estimated as a 'Bayesian' inference through experts' judgement. This is usually the case for prospective planned exposure situations at low doses, for which frequentistic data does not exist.

Distinctly, provability describes the capability to demonstrate retrospectively and by evidence the actual occurrence of radiation effects. While probability is restricted to quantifying the prospective plausibility of hazardous outcomes, provability aims at demonstrating the genuineness and validity of the causality of radiation effects, and therefore it is a precondition for attesting the existence of such effects unequivocally and unambiguously. Namely, if radiation effects are retrospectively provable, and their occurrence has been proved, then actual effects can be attributed to the past radiation exposure situation. Provability is the means for retrospectively revealing the occurrence of radiation effects.

It should be noted, however surprising it may be, that provability has not the quantifiable qualities of probability. Paraphrasing previous thinking in this area of epistemology (Gödel 1931), neither provable should be taken as a synonym of true, nor non-improvable as a synonym of false; rather, provability should be taken as a means for allowing qualified professionals to attest revealed effects with a high degree of confidence.

A final (and important clarification): Attribution should not be considered as a synonym of the legal term *imputation*, which is mainly linked to the concept of causation and its analogue causality. While attributing means regarding something (e.g. health effects) as being caused by something else (e.g. radiation exposure), diversely, imputing means ascribing *someone* (e.g., a nuclear employer) to be the cause of something bad (e.g., causing by imprudence radiation effects to an occupationally exposed worker). Imputation is mainly related to occupational compensation claims, for example, as part of a multi-stage test for legal liability associated with the causal relationship between the conduct of employers of occupationally exposed workers and the occupational harm that those workers may have experienced. These legal issues will not be discussed in this paper, but they have been internationally considered recently (ILO, 2010).

The UNSCEAR reported consensus on the above described concepts should have an enormous influence on the way that regulatory authorities consider radiation effects and their consequent safety management in the future.

2. RELEVANT RESOLUTIONS OF THE GENERAL ASSEMBLY OF THE UNITED NATIONS

In resolution 62/100 of 17 December 2007, the General Assembly had already encouraged UNSCEAR to submit a

report to further clarify the assessment of potential harm owing to chronic low-level exposures among large populations and also the attributability of health effects at its earliest convenience (UN, 2007a)

Furthermore, the General Assembly, in resolution 63/89, endorsed UNSCEAR's strategy during the period 2009-2013 to increase awareness and deepen understanding among authorities, the scientific community and civil society with regard to levels of ionizing radiation and the related health and environmental effects as a sound basis for informed decision-making on radiation-related issues. Such a strategic objective 'highlighted the need for UNSCEAR to provide information on the strengths and limitations of its evaluations, which are often not fully appreciated. This involves avoiding unjustified causal associations (false positives) as well as unjustified dismissal of real health effects (false negatives). Specifically, there was a need to clarify the degree to which health effects could be attributed to radiation exposure' (UN, 2010).

In resolution 66/70, the General Assembly called upon UNSCEAR to submit, at its sixty-seventh session, the report requested by it on the attributability of health effects from radiation exposure (UN, 2011).

As a result of these developments, on 18 December 2012, the General Assembly of the United Nations, during its sixty-seventh session and under Agenda item 50, adopted its Resolution 67/112 on *Effects of Atomic Radiation* (UN, 2012). In this Resolution, the General Assembly *inter alia* 'is concerned about the potentially harmful effects on present and future generations resulting from the levels of radiation to which mankind and the environment are exposed'; 'commends the United Nations Scientific Committee on the Effects of Atomic Radiation for the valuable contribution it has been making since its inception to wider knowledge and understanding of the levels, effects and risks of ionizing radiation, and for fulfilling its original mandate with scientific authority and independence of judgment' and; significantly and importantly, '**welcomes with appreciation the scientific report on attributing health effects to radiation exposure and inferring risks**' that had been requested by the General Assembly in its resolution 62/100 of 17 December 2007 (UN, 2007b).

3. REPORTING FROM THE UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION

In its fifty-ninth session on 21-25 May 2012 UNSCEAR approved its customary report to the General Assembly (UNSCEAR, 2012). In this report, UNSCEAR informs the General Assembly that it discussed substantive documents on the attribution of health effects to different levels of exposure to ionizing radiation and on uncertainties in risk estimates for cancer due to exposure to ionizing radiation, and summarizes its findings with the support

Download English Version:

<https://daneshyari.com/en/article/1740027>

Download Persian Version:

<https://daneshyari.com/article/1740027>

[Daneshyari.com](https://daneshyari.com)