World Nuclear Association Position Statement:

Risks of Low-Dose Ionising Radiation

The World Nuclear Association (WNA) recognises the need to address concerns among policymakers and the public about the potential health impact of low levels of exposure to ionising radiation. In this effort, it is a valuable asset that risks of cancer associated with radiation are much better documented than similar risks arising from other hazardous material such as chemicals.

The current state of scientific knowledge leaves open to debate and further research the issue of a theoretical hazard from very low amounts of radiation. Uncertainty is rooted in the fact that, if any such risks exist, they are extremely small and extremely difficult to detect. Consequently, a prudent approach to controlling radiation sources should combine a high degree of caution with the avoidance of undue restrictions that discriminate against nuclear applications in a way that could deprive our societies of the many benefits of nuclear technologies, especially in the fields of energy and medicine.

Exposure to ionising radiation comes mainly in the form of natural background radiation from the earth, cosmic rays and the radioactivity naturally contained in the human body. The biological impact of radiation is measured in terms of millisieverts (mSv), a unit that expresses both the amount of exposure and its potential damage to human health. Worldwide, the annual radiation exposure per individual averages between two and three mSv. The amount can vary widely, mainly because the principal source of exposure – natural background radiation – ranges from one to 100 mSv a year depending on a person's geographical location.

Medical applications, including both diagnosis and treatment, are the second biggest source of human exposure to ionising radiation. In comparison with radiation from natural background sources and medical applications, any additional exposure to the public resulting from man-made sources, including the normal operations associated with the production of nuclear power, is extremely small. This is true both for the general population and for any individual. (When calculating risk to human health from radiation exposure, as expressed in millisieverts, there is no difference between radiation from natural sources and radiation from man-made sources.)

Cancer risks are demonstrably increased by exposure to exceptionally high radiation doses (typically greater than about 100 mSv). At low doses, a theoretical risk is often hypothesised by using a mathematical model that extrapolates downwards from data about high doses. Models of this sort are often based on the "linear-no-threshold" (LNT) hypothesis, which postulates that radiation risk is proportional to dose. Under the LNT hypothesis, even doses typical of people's average routine exposures (i.e., a few mSv per year) are assumed to carry a small but finite degree of health risk to humans.

As a matter of scientific evidence, cancer or other adverse health effects have not been clearly and consistently discerned in connection with low doses of radiation (below approximately 100 mSv). In fact, the risk, even theoretical, is so low that it cannot be unambiguously detected by the methods currently available to epidemiology, the branch of medicine that studies the causes, distribution and control of disease in populations.

However, since it is impossible to exclude the possibility of risk, the leading international radiological-protection bodies (UNSCEAR[1], ICRP[2] and IAEA[3]) have adopted what they deem a "prudent" approach for low doses of radiation that is based on the LNT hypothesis. An alternative would be a model that identifies a threshold level of radiation exposure below which there are no valid health concerns. These organisations note that, for all practical purposes, the area of theoretical concern about low doses begins at a level of a few mSv per year because any exposure to additional sources of radiation must be counted on top of natural background radiation.

Based on this cautious approach, the leading international radiation-protection bodies have recommended the adoption of individual dose limits for the amount of additional radiation (on top of background radiation) to which people are exposed:

- Dose limit for members of the public: one mSv per year.
- Dose limit for practitioners working with radiation sources: 20 mSv per year averaged over five years (i.e., 100 mSv over a five-year period), with a ceiling of 50 mSv in a single year.

The WNA recognises the necessity of setting exposure levels with practical relevance for legislation, regulatory guidance and protection doctrines concerning radiation, and accepts the current approach, based on the LNT hypothesis, as prudent and precautionary – pending further scientific clarification. But the WNA emphasises that the LNT philosophy may significantly over-estimate the risks of low doses of radiation. LNT is not a scientific fact but rather a theory used as a modelling assumption.

Until further scientific research establishes more conclusively the nature of risk – or the absence of risk – associated with low-level radiation doses, balanced judgment must be applied in developing policies and allocating resources for radiation protection so as to combine suitable caution with a practical recognition of the large and diverse benefits of nuclear technology.

The nuclear industry has, over many years:

- Consistently pursued prudent, pro-active policies aimed at limiting radiation exposure of the public and of people working with radioactive materials;
- Achieved an exemplary record in reducing exposure to radiation.

In so doing, the nuclear industry has consistently supported the ALARA Principle of seeking levels "as low as reasonably achievable, all social and economic factors considered." We believe that this principle naturally puts a prime focus on the higher end of the spectrum of radiation exposure where the gains in protection clearly provide the greatest potential benefits to people's health.

[1] UNSCEAR: United Nation Scientific Committee on the Effects of Atomic Radiation
[2] ICRP: International Commission on Radiological Protection
[3] IAEA: International Atomic Energy Agency

WNA believes that the ALARA Principle would be misapplied if interpreted as necessitating efforts to eliminate the alleged individual risk arising from extremely low doses of radiation. Because doses in this range fall well within the normal variability in levels of natural background radiation, extreme efforts to prevent even tiny doses would violate the essence of the principle, which is to achieve a reasonable balance of risks and benefits.

Also controversial is the concept of a "collective dose" of radiation that aggregates possible tiny doses of exposure over long periods of time and across wide areas to postulate a potential health risk to a wide public. Application of the "collective dose" concept carries both dose assessment and health-risk assessment far beyond their ranges of proven scientific validity and cannot provide a legitimate basis for public policy.

Because very low levels of radiation pose, at worst, an insignificant health risk, the WNA sees the need to establish a consistent international approach to defining a level of dose below which it is widely deemed legitimate to maintain that an individual is adequately protected from ionising radiation, whether natural or man-made. At such a low level – below which there would be an agreed absence of valid health concerns – it would be unjustified to allocate more resources to controlling sources of small radiation exposure because any such effort could only impair the many peaceful uses of nuclear technology, from which much human benefit is attained.