

ASN Position Statement

Tritium is a hydrogen isotope that is a low-energy beta emitter (mean energy 5.7 keV). The most commonly-found form in the biosphere is tritiated water and the dominant exposure route is ingestion. The radiotoxicity of tritium is low. The overall impact of tritium releases in France is also low, with an annual effective dose of roughly one μSv or less for the reference groups.

Radioactive releases in the environment around civilian nuclear facilities have significantly decreased over the last few decades, with the exception of tritium. Discharges of this element are forecast to increase due to expected changes in the fuel management methods used by the NPP, and also due to new tritium-emitting facilities, including new power plants that are to be built, and the ITER project.

In late 2007, papers published in the UK (RIFE 11 report, study by the HPA's Advisory Group on Ionising Radiation (AGIR)) raised questions as to the behaviour of tritium in the environment, in particular focusing on potential accumulation in organisms of organically bound tritium (OBT) from tritium released into the environment and on methods for assessing the biological impact of tritium in humans.

Given this context, ASN wanted to get a clear analysis of the existing studies into the issue and in early 2008 decided to establish two broad working groups, chaired by Dr Patrick Smeesters of the Belgian Federal Agency for Nuclear Control (AFCN) and Mr Roland Masse of the *Académie des technologies*. The groups were formed of experts (from the CEA, CNRS, GSIEN, Institut Curie, IRSN, universities and European Commission "Article 31" experts), representatives of operators (ANDRA, AREVA, CEA, EDF and ITER), associations (ANCCLI, ACRO and CLI) and safety authorities (ASN, DSND). Their findings and recommendations were submitted in early April 2010.

The ASN is pleased with the high quality of the work and the large bibliography provided, which have led to the recommendations issued at the end of each group's summary.

The studies highlight the small impact that tritium releases have in France. However, they do also show the need to carry out further study and research in order to supplement current data and knowledge on the behaviour of tritium in the environment.

The ASN has drawn up the following action plan on the basis of the recommendations made by the two working groups. It also hopes that research bodies take into account the requests made by the working groups, as described below.

1 ASN action plan

1.1 Measurements

There is currently no standardised measurement protocol for the various physico-chemical forms of tritium, in particular the various organic forms of tritium (exchangeable and non-exchangeable). The fact that there is no standardised method makes it difficult to interpret existing studies and data. The CEA's CETAMA (commission for the establishment of analysis methods) has started work to define shared and recognised measurement protocols. In the ASN's view, this work:

- must lead to the production of a guide to the measurement of organically bound tritium;
- is a vital first step prior to launching further studies.

1.2 Control of discharges

It is currently felt to be unrealistic to detritiate discharges from nuclear reactors and the La Hague fuel reprocessing plant at an acceptable cost using the best technologies currently available. In addition, detritiation would only have a limited effect on the radiological impact from these facilities. Given the increase observed in tritium discharges from civilian nuclear facilities and the absence of a detritiation method, the ASN, as part of the development of defence in depth, considers that:

- publishing the quantities discharged for each facility on an annual basis will ensure a long-term, reliable inventory of sources of tritium production. The public should be regularly and specifically informed of this inventory of tritium discharges by nuclear operators;
- accounting for discharges from all facilities should continue to be managed in all circumstances, as is the case today;
- a “technology watch” should be set up with respect to detritiation technologies.

1.3 Environmental monitoring

Tritium monitoring in the environment and throughout the food chain must be supplemented as follows:

- measurements performed must take into account the physico-chemical forms present. The ASN will consequently ask operators to characterise the physico-chemical forms of tritium in the discharges, particularly with regard to any possible organic precursors (small tritiated organic molecules);
- sampling plans in the different compartments of the environment must be undisputed and shared. In particular, the choice of animal and plant species to be measured must be reviewed in order to remove any species bias.

1.4 Impact assessment

Some studies mention the potential for underestimating the relative biological effectiveness (RBE) of tritium radiation. The ASN will ask the ICRP to review the value of the tritium weighting factor (w_R) used in calculating effective doses. Even before the ICRP’s response is known, the ASN will ask operators to supplement the radiological impact studies for their projects with a critical study in which a variant using a tritium weighting factor (w_R) of two is included.

2 Research themes

Current knowledge about the biological effects of tritium is in some areas rather fragmentary. The following topics should be investigated further by research bodies in order to answer all the questions:

- Harmonisation of dose assessment methods according to the physico-chemical form of the tritium, contamination pathway and length of exposure;
- Studies into the effects of tritium exposure on embryos and foetuses;
- Investigation of new approaches to the potential induction of hereditary effects.

In most cases, this research will require international cooperation.

Finally, the ASN believes that all stakeholders must continue to think about and discuss these issues and to this end suggests the establishment of a supervisory committee to oversee the actions undertaken following the recommendations of the working groups.