ALARA from the decommissioning to the design stage in the nuclear field

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Abstract

The application of the ALARA principle is becoming nowadays a prerequisite for all operations and design of nuclear facilities. The regulatory authorities are requesting the demonstration of the application of the radioprotection optimization at all steps of the processes involved from the design phase until the end of life. As the philosophy behind the ALARA develops, more and more aspects, boundary conditions and side effects are taken into account.

The paper will show how this principle has been applied in actual decommissioning operations, where the conditions for the operators are quite difficult. One is dealing there with a changing environment, the simultaneous presence of industrial and radiological risks and the use of tools and operations which were not foreseen in the design of the installation. The large impact of the industrial ("classical") safety during the dismantling of a facility and the use of radioprotection optimization tools (decision aiding tool) will be highlighted through various practical examples, based mostly on the European pilot dismantling project of the PWR pilot plant BR3. The impact of combined approach has even lead to strive towards a more ASARA (As Safe As Reasonably Achievable) approach, combining the radiological and global safety optimization.

For the design of new installations, the regulators are asking for demonstration of the application of the ALARA throughout the design and on how the principle will be applied during the operation of the future facility. This aspect will be illustrated by the approach carried out for the design of fusion plant and fusion reactor. What is the impact of the ALARA on the design of the machine? How is the ALARA optimisation integrated in the maintenance and operation of the future installation? These aspects are very important in fusion plants as the presence of high energy neutrons (14 MeV) and the large size of the machines will lead to a rather large amount of highly active components. Moreover, the contamination aspect, due to the presence of tritium, has to be dealt with at the same time. And here also, the combined effects of industrial safety (including the effects of magnetic field and Beryllium handling e.g.) with the radiological one have to be taken into account.

After having browsed these two "ends" of nuclear facilities – design and decommissioning- , it will be shown that the application of the ALARA principle can be really beneficial, not only for the radiological safety only but also for the better preparation of the operations, for the need it brings to analyse in details the operation breakdown and for the systematic approach it imposes in the design of facilities and concept preparation of complex operations. Finally the limits of the application of the principle, when willing to cover the whole lifecycle of components and installations can be drawn.