Radiological impact assessment in the southeastern Mediterranean area

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Abstract

The consequences of a potential nuclear accident in a Nuclear Power Plant (NPP) as marine releases to the Eastern Mediterranean countries are considered. The types of accident considered span the range of accidents already indentified for existing NPP. The assessed consequences are compared with those of the accident at Chernobyl (Ukraine).

Two types of radionuclides can be found in the environment, those of anthropic origin. The natural radionuclides are essentially the cosmonuclides formed in the upper atmosphere by the interaction of cosmic ways with the elements present in the atmosphere, such as 14C. 3H, 10B, 7Be, 26Al, and the primordial radionuclides formed during nucleosynthesis, which have a half- life long enough to persist on earth; their radioactive decay gives rise to decay products with shorter half-lives; these are 238U, 232Th with their decay series. The marine environment has received man-made radionuclides from many sources: the detonation of nuclear weapons in the atmosphere, the controlled discharges of low- level liquid effluents from the nuclear power industry, and fallout arising from accidents such as the Chernobyl reactor accident, in 1986. These various sources have, collectively, introduced a wide range of nuclides both globally and locally.

The overall impact of the releases from the EU nuclear installations into the Mediterranean Sea (in the period 1980-1991) was assessed by calculating the collective dose truncated at 500 years and collective dose rates to the EU population. The impact of liquid effluents discharged into the Mediterranean Sea by EU nuclear plants was found to be close to that due to 137Cs present in the Chernobyl accident. The total collective dose was 1.96 man Sv, while the maximum collective dose rate was calculated to be around 0.18 man Sv y-1. The contribution of the nuclear bomb fallout and the Chernobyl accident to the collective dose was estimate to be 3.7 man Sv.

The main contributing plant to the collective dose was found to be the Marcoule reprocessing plant (95% of the total collective dose). Bugey (4.5%) is the next most important contributor. 106Ru is the main contributing radionuclide (39% of the total collective dose), while the predominant pathway was found to be ingestion of mollusks, which accounts for 60 % of the total collective dose. Finally, the Gulf of Lions is the main contributing sea area to the total collective dose (49%).

Present status of radioactivity in the Eastern Mediterranean Sea and bordering countries.

A description of the present status of the radioactive contamination in the Eastern Mediterranean Sea and bordering countries was obtained both from literature data and ad hoc measurements. No high level values were identified and the average concentration of 137Cs in soil and sediments is of the order of the Bq/kg and in sea water is of the order of ten Bq/m3.

The highest concentrations of 137Cs (within the same order of magnitude than elsewhere) have been detected in the Aegean waters due to the inflow from the Black Sea which is influenced by the discharge from the Chernobyl area.

Key-words: marine radioactivity, nuclear accident impact, Mediterranean sea, Black Sea

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