RADIOECOLOGICAL SENSITIVITY PROJECT ON THE FRENCH MEDITERRANEAN COASTAL ENVIRONMENT

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Abstract
The radioecological sensitivity of Mediterranean French coasts is evaluated in order to propose a forecasting system usable as decision support in case of accidental nuclear release in the marine environment. Radioecological sensitivity is defined as the result of the combination of physical, biological, socio-economical and radioecological parameters (related to radionuclide specificities). A resulting sensitivity index is then attributed for a given zone.
Keywords : Coastal Management, Radionuclides.

Introduction
The impact of an hypothetical marine radioactive pollution on man and his environment depends on the extent and type of pollution, but also on the polluted environment itself. The economical, toxicological or health repercussions will vary according to the characteristics of the polluted environment and its human use. The marine stage of the Radioecological Sensitivity project (SENSIB project), brought by the French Institute for Radioprotection and Nuclear Safety with funding of the French Agency Environment and Energy Management [1], aims to create standardized tools which make it possible to represent and to compare with the same scale the sensitivity of various coastal environments. This concept will be first dedicated to the French Mediterranean coasts.

Method
The marine radioecological sensitivity is defined as the sensitivity of a coastal environment subject to a radioactive contamination. Sensibility refers to the capacity of a given environment to exhibit significant changes concerning various possible indicators: activity concentration, radionuclide stock or flux. This sensitivity is determined by the relationship between the ecosystem intrinsic characteristics (physical or biological), the radioecological parameters (dependant of the concerned radionuclide) and the socio-economical resources.
These three natures of criteria produce several sensitivity factors, which are studied in the project. The ecosystem characteristics concern geomorphic data, sedimentary type, biological resources and eventually the presence of rare species. The radioecological parameters include dilution coefficient, concentration factors expressing the transfer to biological species, partitioning coefficients (Kd), sedimentary migration rate. The socio-economical criteria refer to professional or recreational activities (fisheries, beaches), resource extraction locations (water intake, aquaculture, etc.) and management areas like ecological reserves.
Values are attributed to these factors regarding their efficiency to increase or decrease the final sensibility indicator. The attributed values can be binary (0/1) or entire values comprised between 0 and 10. Their combination results in a sensitivity index, comparable to the ESI (Environmental Sensitivity Index) previously developed in the United States [2]. This indexation requires the attribution of a weight relative to each factor as regards to the others. This weighting depends both on involved radionuclide and on sensitivity chosen indicator. It is evaluated by sensitivity analysis and by expert judgement.
Hence, environmental sensitivity will be calculated by adding the value of each factor weighted by its contribution. The higher is the number, the more sensitive is the environment.
Finally, resulting sensitivity maps are set up using a management subsystem based on geographical information system (GIS). Similar kind of results, i.e. environmental sensitivity mapping, are often used to characterize oil-spill coastal impact [3] and for coastal integrated management [4] [5] [6]. Such maps allow comparisons of environments as regards their sensitivity. The working scale (country, local...) is important as it determines the level of knowledge that is required when assessing ecosystem and human-use data.

Conclusion
In post-accidental situation, the coupling of sensitivity maps with risk maps (based on radionuclides source term knowledge and marine dispersion modelling) might give localisation of vulnerable coastal areas (Figure 1).

A first application of the radioecological marine sensitivity concept will be carried out on Toulon bay area. This area has already been partially studied from ecological, economical and radioecological points of view. Local sediments have been partially characterized [7]. This area is biologically rich with important beds of *Posidonia oceanica*, shellfish fields, spawning grounds, and different protected areas. Human-uses and economic pressure are also important: fishery, aquaculture and tourism especially. These data are still to be completed and updated, and will be used to characterize and evaluate the global radioecological sensitivity of this area.

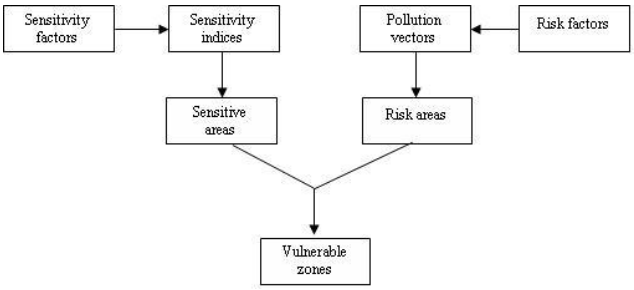

Fig. 1. The vulnerability assessment process [4]

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