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INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE
Faire avancer la sûreté nucléaire

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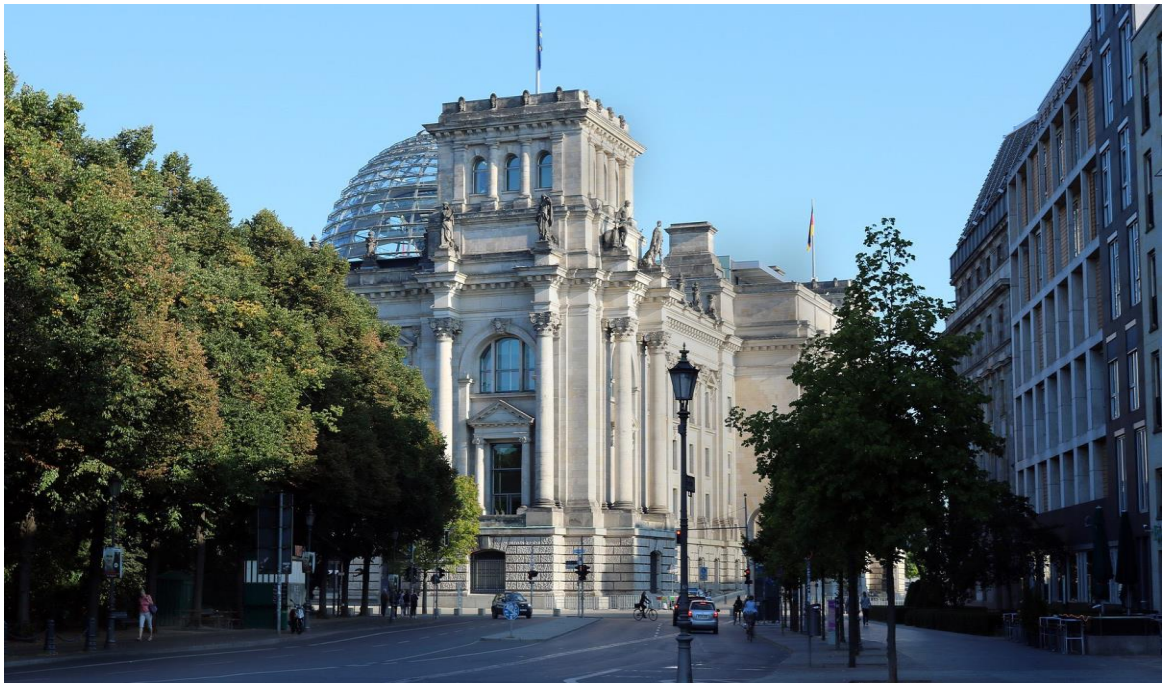

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P3-01
Local factors to make risk maps, for potential nuclear accident affected farming areas, to be applied in the decision-making process

B. Garcia Puerta *, C. Trueba Alonso, M. Montero Prieto

CIEMAT - Madrid (Spain)

*Corresponding author, email address: blanca.garciapuerta@ciemat.es

Introduction

In a post-accident situation, the decision-making process for the recovery of an affected farming area is especially relevant and needs a wide range of factors to be taken into account. On one hand those related to environmental aspects, such as climate, soil type and the processes that are developed on it. On the other hand, additional elements which have to do with social or cultural aspects, as agricultural practices and land use and other socio-economical factors such as population density and nutritional habits, should be considered. The more specific and local those factors are, the less uncertainties will be in the decision-making process and the more effective and precise will be the response.

Risk maps as planning tools can help to identify those areas which are more vulnerable to high levels of soil-to-plant transfer and where the application of remediation techniques to mitigate the consequences could be feasible and effective. The ultimate objective is to analyse the response mechanism of the affected ecosystem and thus, provide decision-makers enough information and as clear, comprehensive and accurate, locally oriented, as possible, to optimise the recovery. This paper presents a methodology design to elaborate risk maps, considering local factors, to be used by the decision-makers in the management of a nuclear post-accident exposure situation. The methodology is expected to be reproducible in any spot in Europe, and scalable for different territorial levels. Here, an approach to the Spanish case is presented.

Materials and Methods

Data regarding the factors above mentioned have been collected in Spain. Geographic Information Systems (GISs) have been used to manage and represent all of them, by using diverse geoprocessing methods. The final results are presented in a graphical and comprehensible manner improving their representativeness.

The methodology comprises several steps, being the first one the elaboration of the soil radiological vulnerability maps. Those are elaborated starting from a wide representative Spanish soil profile database and using the Soil Geographical Data Base of Europe as a base map. They show the soil-to-plant transfer capacity of Cs-137 and Sr-90, according to the soil properties.

The next step is to incorporate the food chain exposure into the methodology. Therefore, it is necessary to know the agricultural and livestock distribution. Thus, a Spanish products database has been created, which has been combined with the Corine Land Cover (CLC) European map, which has been used as a base map.

By using transfer factors, yields and dietary habits, a proper radiological impact assessment can be done. Through diverse geoprocessing technics, combining all those factors and the deposit probability in a certain area, a categorisation of the risk areas can be developed. That categorisation will help in the priorisation of the recovery strategies.

Results and Discussion

A hypothetical accident scenario in a Spanish Nuclear Power Plant has been modelled with JRODOS, in order to assay this methodology.

By combining the most vulnerable soils and the most sensitive foodstuffs in the affected area (with a local scale point of view), risk zoning is defined and, for instance, restriction zones or areas where corrective actions should be applied, can be identified. The risk maps are useful to determine when a foodstuff could be consumed by the population. Socio-economic effects of the event can be also evaluated to be considered by the correspondent authorities.

Conclusions

Risk maps for the decision-making process are the result of the combination of the soil vulnerability, the food chain impact and the deposit probability of a released radionuclide, after a nuclear accident.

Those maps can be used to determine the foodstuff and feedstuff restriction areas, or to stablish where remediation and recovery measures are to be applied. All this could also allow to assess derived socio-economic implications of concern to the authorities.

The developed methodology combines improvements in the decision-making process to reduce uncertainties since it considers the local specificities, and its applicability at any European spot.

How to integrate all the aspects that should be taken into account within a methodology is a huge challenge. If in addition it is easy to apply by the decision-makers and useful for the whole society, it is a confidence.