

NERIS Workshop 2017

17-19 May 2017

Lisbon, Portugal

Abstract Template

Please select one or more topics for your abstract

☒	RADIOLOGICAL IMPACT ASSESSMENTS
☐	COUNTERMEASURES AND COUNTERMEASURE STRATEGIES IN EMERGENCY & RECOVERY, DECISION SUPPORT & DISASTER INFORMATICS
☒	SETTING-UP A HOLISTIC FRAMEWORK FOR PREPAREDNESS FOR EMERGENCY RESPONSE & RECOVERY
☐	STAKEHOLDER INVOLVEMENT AND ENGAGEMENT IN EMERGENCY AND RECOVERY
☐	UNCERTAINTY HANDLING ISSUES FOR EMERGENCY AND RECOVERY

Title

European nuclear Risk Mapping by Kernel Density Estimation applied to air mass trajectories

Authors – Please underline corresponding author

Miguel Angel Hernández Ceballos, Luca De Felice, Marc De Cort

Address: Joint Research Centre, Nuclear Safety and Security Directorate, Knowledge for Nuclear Security and Safety Unit, Radioactivity Environmental Monitoring Group

Text

Currently, based on the information provided by the International Atomic Energy Agency (IAEA), 168 nuclear reactors are in operation in Europe. As a consequence of the Fukushima accident, countries have reviewed and improved their Emergency Preparedness and Response (EP&R) arrangements and capabilities and many are implementing improvements in the policies that may affect the management of a future nuclear release accident.

One of the issues that have received particular attention concerns the estimation of the spatial impact probability of a NPP release. A well prepared nuclear risk map facilitates to evaluate nuclear problems and make decisions on solution methods. Inherent to the nature of this type of incident, one of the key factors in the elaboration of these maps is the meteorological conditions. Within the set of meteorological parameters that influence the radioactive plume dispersion, the analysis of the wind field in each NPP provides useful information about the displacement of the plume in the first stage of the emergency situation for the decision makers to face and mitigate the impact of the release, without taking into account the amount and the properties of the release material (source term).

The purpose of the present work is to estimate the probability of an area to be affected following a hypothetical release from each EU NPP by the analysis of the wind dynamic in each one.

One of the main tools to describe the wind dynamic in a specific area is the calculation of forward trajectories, which represent, by a sequence of points (latitude/longitude), the path followed by the air parcel with time from a starting location. Considering this, the methodology used in this work is the elaboration of a density map for each EU NPP based on the collection of trajectory points for each NPP, obtained by calculating four trajectories per day with a temporal coverage of 96 hours during the period 2011-2015 (701184 total number of trajectory points = 7304 trajectories*96 points). Among the techniques to convert data from point to continuous fields and therefore to make more readable this information, the nonparametric kernel density estimation (KDE) method has been used in this work.

Figure 1 displays the density maps of three NPPs in Europe, such as Almaraz in Spain, Paks in Hungary and Heysham in the United Kingdom during 2011-2015. More than the logical maximum number of hits reached in the surroundings of each NPP, as it was expected, the spatial coverage and the distribution of the affected areas are quite different for each NPP: this is associated with the combination of different meteorological conditions and geographical conditions.

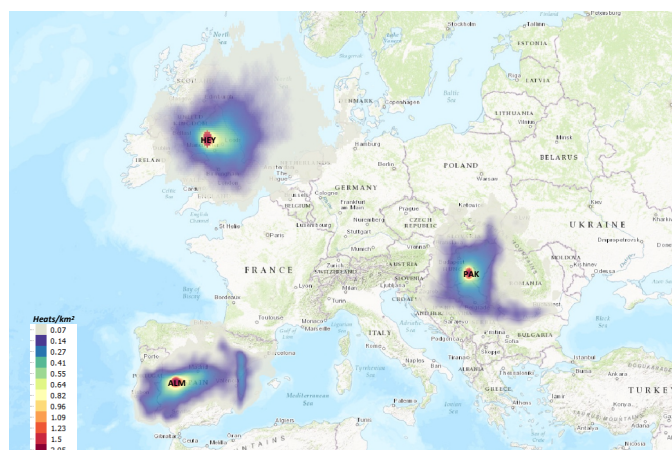


Figure 1. Example of heat map in three EU NPP

This analysis and related results may provide useful statistical information for the civil protection authorities in planning the actions to be taken, and more than this, it may constitute a strategic operational advantage to develop a proper system in which the necessary actions can be taken according to their spatial and temporal priorities inside the high risk zones. In addition, the combination of the risk maps would allow for the identification of the most affected areas in Europe.