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## **RISK ASSESSMENT IN THE TRANSPORTATION OF RADIOACTIVE MATERIAL IN THE AREA OF BOLOGNA**

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### **BACKGROUND-AIM**

Every day thousands of packages of radioactive materials are transported within, into or out of EU Member States: more than 90% of these packages are for medical use. Albeit national and international regulations on transportation of radioactive materials can be found in literature, no specific guidelines about intervention procedures in case of accident have been approved by any international organism and published. The aim of this work is to collect statistical information on transportation of radioactive materials in the area of Bologna (Italy) and to evaluate the potential radiological risk for the population in case of accident; data were used to create a model for risk assessment as a support for the definition of an emergency protocol.

### **METHODS**

An investigation of the transportation of radioactive materials in the area of Bologna was conducted collecting data on authorized carriers, consignees, itineraries, type of package transported (excepted package, type A package, type B package), radioactive content of each package (radionuclide, physical form, activity), population density, vehicle density and accident rate. Risk was assessed using RADTRAN, a code developed at the Sandia National Laboratories, with the help of two graphical user interfaces and input file generators, RadCat0.6 and INTERTRAN2. An event tree analysis was conducted to identify the most representative cases to be simulated by RADTRAN. To take into account the different levels of danger of an accident, severity categories were defined; the probability that an accident belonged to a defined severity category was assessed and, for each severity category, the package response was defined in terms of the release of radioactive material.

### **RESULTS**

As an example of a typical situation, we evaluated an accident involving a vehicle carrying 4 packages of <sup>99</sup>Mo (activity per package (a.p.p) 2.25E+11 Bq), 4 packages of <sup>131</sup>I (a.p.p. 2.92E+10 Bq), 3 packages of <sup>111</sup>In (a.p.p. 5.78E+08 Bq), 1 package of <sup>90</sup>Y (a.p.p. 7.90E+10 Bq) and 2 packages of <sup>125</sup>I (a.p.p. 4.00E+06 Bq). The evaluated population risk in terms of collective dose was 3.06E-11 person\*Sv, while the maximum individual risk for a person in proximity of the accident was 8.43E-11 Sv. Other cases, including rare events, were analyzed and all the results obtained were consistent.

### **CONCLUSION**

As a general result, risk assessment analysis of radionuclide sources in the area of Bologna showed a negligible risk for the population in case of accident, even considering the worst case. All information collected and results led to the implementation of a database to conduct risk assessment in the transportation of radioactive material with reasonable and realistic assumptions.