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Indoor Dispersion of Volatile Radionuclides Following a Transportation Accident in a Radiochemical Laboratory

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An accident occurring during the handling or the transportation of volatile radioactive materials in a radiochemical laboratory can result in the dispersion of such radionuclides in the indoor atmosphere. Radionuclides might be transported away from the source based on the characteristics of the indoor airflows and the relative driving forces. Subsequent processes of deposition can contaminate a wide portion of the building and of its ventilation systems. Here a possible incidental event with the loss of containment of a I-131 source in one of our radiochemical laboratories in Rome, Italy, with the consequent indoor dispersion and the resulting exposition to the individuals, are considered. These results will be evaluated and analyzed by means of the multi-zone model CONTAM developed by the National Institute of Standards and Technology (NIST). CONTAM is a multi-zone indoor air quality and ventilation analysis model designed to determine airflows and pressures - infiltration, exfiltration, and room-to-room airflows, and pressure differences in building systems driven by mechanical means, wind pressures acting on the exterior of the building, buoyancy effects induced by temperature differences between the building and the outside, and evaluation of the trend of contaminant concentrations vs. time - the dispersal of airborne contaminants transported by these airflows and radio-chemical transformations, filtration, and deposition on the building surfaces; and/or personal exposure - prediction of exposure of building occupants to airborne contaminants for eventual risk assessment will be addressed. Since CONTAM can be useful in a variety of applications, the ability to calculate building airflows and relative mass exchange between different zones can be useful to assess the efficiency of the ventilation systems.
The example reported here will provide evidence that this modeling approach must be taken into account during an emergency response and, before this, in building emergency preparedness and planning mitigation efforts.