Abstract submission form

Speaker or corresponding author

First name	Olivier
Name	SAUNIER
Organisation	IRSN
Country	FRANCE
Email address	Olivier.saunier@irsn.fr

Abstract information

Presentation type **[1]**	Oral
Select one or more topic **[2]**	Operational aspects: from theory to practice
Subject of the presentation	Inverse modeling method for source identification: Application to the selenium detection event in May 2019
Participation NERIS Young Scientist Award **[3]**	No
Proceedings of the Workshop 2020 **[4]**	maybe

[1] Copy paste:
Oral
Poster
Both (The programme committee will choose oral or poster)

[2] Copy paste one or more subject(s):
Operational aspects: from theory to practice
Disaster management and resilience in communities
Preparedness for a sustainable recovery: including non radiological consequences and effects
Updating handbooks, guidelines and recommendations to support decision making
Future research needs
Other

[3] To promote young researchers, the NERIS platform awards a free participation to the 7th NERIS Workshop (2021) and diploma to the winner of the prize. To participate you must be under 35 years old in May 2020. **Answer: yes / no.**

[4] You can publish a full paper in the proceedings of the Workshop 2020 to be published by the end of 2020. The full paper deadline in 31st July 2020. If you're not sure yet, tell us and we'll come back at you on this after the Workshop. **Answer: yes / no / maybe.**

⚠ The abstract submission must respect the following template and must not exceed 1 page. The completed abstract submission form has to be sent by email to the NERIS secretariat (sec@eu-neris.net) by **January 31st, 2020**. Please name your file with an easily identifiable prefix: FirstName_NAME_subject_... etc.

Inverse modeling method for source identification: Application to the selenium detection event in May 2019

Olivier SAUNIER[1], *Joffrey DUMONT LE BRAZIDEC*[1,2], *Damien DIDIER*[1], *Olivier MASSSON*[1]

[1] *IRSN – Institut for Radiation Protection and Nuclear Safety, 31 avenue de la Division Leclerc, 92260 Fontenay aux Roses, FRANCE*
[2] *CEREA, joint laboratory École des Ponts Paris Tech and EDF R&D, Université Paris-Est, Champs-sur-Marne, France*

Abstract
In the past few years, several unusual detections events of radionuclides in the atmosphere have been reported in Europe (^{131}I in 2017 and 2018, ^{137}Cs in 2013 and 2015, ^{106}Ru in 2017) while the origin was unknown. These situations usually involved small amounts of radionuclides released in the environment and the concentrations levels measured were too low to have any impact on human health and environment. For such situations, the Institute for Radiological Protection and Nuclear Safety (IRSN) uses modeling techniques to analyze the event in more detail. The aim is, in particular, to locate the origin, to assess the duration and the magnitude of the releases.
Inverse modeling methods which combine field measurements with atmospheric dispersion modeling have proven to be appropriate for source identification. Deterministic (variational) methods are suitable in operational use since they are able to quickly provide an optimal solution (Saunier et al. 2019). However, the quantification of the uncertainties associated to the reconstructed source is usually not easily accessible. Bayesian methods are more powerful since they are developed in order to efficiently sample the distributions of the parameters of the source, allowing to get a complete characterization of its parameters. Very popular Bayesian techniques are random search algorithms such as Markov Chain Monte Carlo (MCMC) methods. However, the control of the convergence speed of MCMC methods remains a key issue and their use in real–time can result in prohibitive computational costs. Deterministic and Bayesian approaches are therefore complementary. In May 2019, an incident at the SCK-CEN facility in Mol, Belgium led to the release of selenium 75 (^{75}Se) in the atmosphere. It was detected at very low concentrations by several air monitoring stations of France. In this presentation, we consider that the origin of ^{75}Se detections is unknown in order to measure the ability of our inverse modeling tools to identify the source location using field observations. Deterministic and advanced Bayesian MCMC methods (Dumont et al. 2019) were applied to identify the source location and total quantity of ^{75}Se released into the environment. The results obtained using the two approaches are compared and discussed. Finally, the relevance of results is assessed by comparing the model results with the observations (Figure 1).

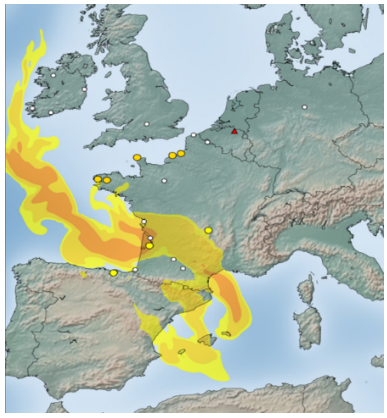

Figure 1: Dispersion of the selenium plume using reconstructed source term by inverse modeling