



**Webinar on
Recent Advances in Probabilistic Fault
Displacement Hazard Assessment for Nuclear
Installations in Light of Geological
Reconnaissance Findings**

**Organized by the
IAEA Division of Nuclear Installation Safety**

Tuesday, 30 May 2023

Scheduled at: 15:00 Vienna

(Austria) Time

Duration: 2.30 hours

Information Sheet

INTRODUCTION

[IAEA Safety Series No. SSR-1 \(Site Evaluation for Nuclear Installations\)](#) identifies fault capability as one of the potential challenges to the safety of nuclear installations that shall be assessed during site evaluations. Section 7 of [IAEA Safety Standards Series No. SSG-9 \(Rev.1\). Seismic Hazards in Site Evaluation for Nuclear Installations](#) is dedicated to the evaluation of the potential for fault displacement at the site, in order to implement the requirements given in SSR-1.

In the site selection and characterization stages of proposed new nuclear installation sites, sufficient geological, geophysical, geotechnical, and seismological data should be obtained to demonstrate the absence of capable faults at or near the site. In this respect, probabilistic fault displacement hazard assessment (PFDHA) is not explicitly included in the site evaluation for new nuclear installation sites, and best practices of using PFDHA for new nuclear installations is quite limited.

For sites with existing nuclear installations, new information about the existence of a capable fault within the site vicinity may come to light later, although the capable fault issue should be excluded as much as possible in the site evaluation stage. For these cases, SSG-9 (Rev.1) requires the assessment of the potential for fault displacement using probabilistic methods.

A recent IAEA publication – [TECDOC #1987, An Introduction to Probabilistic Fault Displacement Hazard Analysis in Site Evaluation for Nuclear Installations](#) - focuses on this issue, in order to provide the most relevant and up-to-date information to countries in PFDHA practice for nuclear sites.

This specific TECDOC includes case histories from the Yucca Mountain Geological Depository (Nevada, USA), Diablo Canyon Nuclear Power Plant (California, USA), and the Krsko 2 Nuclear Power Plant (Slovenia). These examples illustrated the large uncertainties in hazard estimates for fault displacement, especially due to lack of experience in assessing fault displacement hazards, limited data to constrain the fault parameters, and uncertainties in accurate locations of the faults.

The IAEA is finalising another TECDOC on this subject area that will be published this year on “*Benchmarking Study for Current Practices in Probabilistic Fault Displacement Hazard Assessment for Nuclear Installations*”, which provides the results for a specially designed benchmarking study for PFDHA for nuclear installations.

Three specific cases were selected and included for this study: the primary and distributed ruptures of the 2016 Kumamoto earthquake to represent strike-slip faults; the moderate-magnitude Le-Teil earthquake in 2019 to represent reverse faults; and the moderate-to-large magnitude 2016 Norcia earthquake associated with normal faulting. The seismic source characterization models for each case include a base case and some alternatives that affect the PFDHA results. Several PFDHA model developers and hazard analysts were invited to the benchmark study to provide their hazard results for primary and distributed displacements.

On 6 February 2023, at 04:17 (01:17 GMT) a devastating [earthquake sequence](#) occurred in Kahramanmaras - Türkiye that ruptured multiple strike-slip fault segments along East Anatolian Fault Zone (EAFZ). The first earthquake initiated on a secondary fault and ruptured

the main EAFZ segments bilaterally towards the NE and SW directions, forming a >300 km-long surface rupture with large left-lateral displacements.

Moment tensor analysis indicated almost pure left-lateral strike-slip motion on near vertical faults with a total moment magnitude (M_w) close to 7.9. Nine hours later at 13:24 (10:24 GMT), another large earthquake ($M_w=7.7$) was triggered, with a left-lateral strike-slip mechanism on an adjacent east-west trending fault that produced close to 160 km-long surface rupture. These complex large earthquakes provide a unique opportunity to study the co-seismic surface deformations and their detailed characteristics. Data from these events may shed light on uncertainties associated with fault mapping and factors promoting distributed surface deformations — two aspects of surface-fault ruptures that are critical for PFDHA.

This webinar will present the important geological reconnaissance findings after the 2023 Kahramanmaras-Turkiye earthquake sequence, including mapped principal and distributed fault ruptures and the consistency of their distribution with the active fault maps. The IAEA guidance for PFDHA, especially the upcoming TECDOC, will be introduced by presenting the benchmark cases and comparison of hazard assessment results. Finally, the possible contribution of the recent seismic events to the practice of fault displacement hazard assessment will also be discussed.

OBJECTIVES

The webinar aims to:

- Provide an overview of the contribution of collected field evidence for principal and distributed ruptures and measured fault displacements after large earthquakes to PFDHA models.
- To present the geological reconnaissance survey findings for the 6 February 2023, Turkiye earthquake sequence as an example case study where significant amount of field data is collected.
- Provide an overview of the IAEA activities regarding PFDHA.
- Provide information on the Case studies used to develop PFDHA benchmarking study and the initial analysis results. The presentations will cover important factors that contribute to the fault displacement hazard assessment results.
- Provide an opportunity to elaborate the current state-of-practice, lessons-learned, uncertainties and data needs for PFDHA for nuclear installation sites.

TARGET AUDIENCE

The event is targeted at professionals from nuclear regulatory authorities, design organisations, operating organisations, technical support organisations, and research and other institutions engaged in activities related to fault displacement hazard assessment.

WORKING LANGUAGE(S)

The webinar will be conducted in English.

WEBINAR PROGRAMME:

1. Opening Remarks

Mr. Paolo Contri – Section Head, External Events Safety Section, IAEA

2. Current Practices in Probabilistic Fault Displacement Hazard Assessment for Nuclear Installations

Presentation of the Draft IAEA TECDOC on Benchmarking Study for Current Practices in Probabilistic Fault Displacement Hazard Assessment for Nuclear Installations.

Ms. Zeynep Gulerce, Nuclear Safety Expert, External Events Safety Section, Division of Nuclear Installation Safety, IAEA

3. Panel Discussions on: “Contribution of geological field reconnaissance after large earthquakes to probabilistic fault displacement hazard assessment.”

Invited Panellists:

Mr. Erdin Bozkurt – Chairman of Geological Engineering Department, lead of Geological Field Reconnaissance Team of METU for the 6 February, 2023 Kahramanmaraş Earthquake Sequence, Middle East Technical University, Turkiye

Mr. A. Arda Ozacar, – Professor in Geological Engineering, Consultant for Geological Characterization of Akkuyu, Khor Duweihin and Umm Huwayd NPP Sites, Middle East Technical University, Turkiye

Mr. Toshiaki Sakai, Civil Engineer and Research Advisor, Central Research Institute of Electric Power Industry (CRIEPI), Japan

Mr. Stephen Thompson, Consultant, Principal Geologist, Member of the University of California's Fault Displacement Hazard Initiative, Lettis Consultants International, Inc., USA

Mr. Alessandro Valentini, Research fellow at National Institute of Geophysics and Volcanology (INGV), former consultant for External Event Safety Section of IAEA on fault displacement hazards, Italy.

4. Q&A and Conclusions

REGISTRATION

Please register for the webinar using the link on the website: [Webinar on Recent Advances in Probabilistic Fault Displacement Hazard Assessment for Nuclear Installations in Light of Geological Reconnaissance Findings | IAEA](#) not later than **15 May 2023**. After the registration and acceptance of your participation, you will receive an electronic mail containing information on how to access the webinar by following a hyperlink to join the WebEx meeting or by calling in by phone.

You can test your ability to connect to a WebEx meeting at the following link: <https://www.webex.com/test-meeting.html#>. Please contact your IT department if the test fails. For additional help regarding registration, please contact Ms Minitha Poikudiyil, External Events Safety Section (M.Poikudiyil@iaea.org).

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