Agenda Item W 2.4
Draft Safety Guide DS507: Seismic Hazards in Site Evaluation for Nuclear Installations (Revision of SSG-9) – For approval for submission to Member States –

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SSG-9 (2010) respected the lessons learned from Kashiwazaki Kariwa NPP during the 2007 Niigata-ken Chuetsu Oki, Japan earthquake.

The 2011 Tohoku earthquake and tsunami occurred in Japan on March 11. The Fukushima Daiichi Accident* highlighted again issues of seismic hazards in site evaluation.

This guide is consistent with the Safety Requirements for Site Evaluation of Nuclear Installations (NS-R-3 Full-revision in progress, as DS484)

Status of the Document

New Safety Guide timely, to keep up with the pace of scientific and technological progress, which is evolving quickly in response to new observed data

- Nov. 1-3, 2017: DPP of the DS507 has been approved 42 CSS,
- Jan. 29-31, 2018: CS for draft (Participants: Argentina, France, Italy, Japan, Russia, Switzerland, Turkey, USA)
- Aug. 23, 2018: NS-CC approved to post in WASSC/NUSSC
Scope

• All nuclear installations
• Pre-operational / operational / temporary or permanent shutdown stages
• Vibratory ground motions and permanent ground displacement
• The site selection and/or site evaluation stages
Comments and Resolutions

• Received 58 comments from: France, Germany, India, Japan, Korea, Pakistan and USA.

• All comments were addressed. There are no unresolved comments.
Action Requested

Approval by WASSC for submission of DS507 to MS for comments
Thank you!
## Comments and Resolutions

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<tr>
<th>Country</th>
<th>Number Of Comments</th>
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<th>Rejected</th>
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If during the selection and evaluation stages of a new site for a nuclear installation, reliable evidence is collected demonstrating the existence within the site vicinity and site areas of a capable fault with potential for seismogenic (i.e. primary) fault displacement phenomena, the feasibility of design, construction and safe operation of nuclear installations at this site should be evaluated. If its effects cannot be compensated by design/engineering protective measures, this issue should be treated as an exclusionary attribute* and an alternative site should be considered.

*Ref: para. 3.8 of IAEA Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations
Reason for rejection

- This document is not the safety requirements (SR – DS484) but a safety guide providing an interpretation of these requirements. Every MS shall follow the SR, therefore the last sentence of para. 5.4 in DS484 has a broader scope than provided in this guidance. This SG at para. 7.10 is a more restricted interpretation than the SR, because this is providing a preferred interpretation in line with current accepted international practice. Therefore, this SG does not consider the potential for capable faults as anything but an exclusionary attribute.

- In this Para, fault displacement hazard is discussed, but the MS(Japan) discusses vibratory ground motion hazards only.

- It is noted that uncertainty in the location of capable faults is high, and primary faults within the site vicinity may influence the potential for displacement on secondary faults within the site area, and therefore directly under the NPP.
A proposed new site shall be considered unsuitable when reliable evidence shows the existence of a capable fault that has the potential to affect the safety of the nuclear installation and which cannot be compensated for by means of a combination of measures for site protection and design features of the nuclear installation. If a capable fault is identified in the site vicinity of an existing nuclear installation, the site shall be deemed unsuitable if the nuclear installation safety cannot be demonstrated.
Recommendation to NUSSC & WASSC

• At present time - no known way of ensuring site safety for capable fault displacement.
• DS507 provides guidance based on current accepted technical practice.
  – Therefore a new site should be considered unsuitable when reliable evidence shows the existence of a capable fault that has the potential to affect the safety of the site.
• Safety Requirement in DS484 allows MS to develop methodology to demonstrate site safety for capable fault displacement.
• If MS wants to take advantage of this – MS (or site operator) should develop methodology first.
• DS507 should not be changed in response to MS(Japan) comment at this time.
FIG. 5. Seismic landscape of the 1915 Fucino Italy Earthquake. (IAEA TecDoc-1769)

Surface rupture location is quite uncertain.
Capable Faults

Site vicinity ~5km
Site area ~1km
Discretion
Exclusion
Primary
Secondary
Can we predict fault geometry?

箭头 No

2009 Prediction (National Hazard Map)  2016 Kumamoto Japan earthquake
Can we survive fault displacement?

→ No

Waterfall made by the fault displacement during 1999 Chi-chi earthquake
During the selection and evaluation stages of a proposed new site for a nuclear installation, if reliable evidence is collected demonstrating the existence of a capable fault with potential for seismogenic (i.e. primary) fault displacement within the site vicinity but without any feasible way of compensating for such displacement, or within the site area in any case, this issue should be treated as an exclusionary attribute (see para. 3.8 of IAEA Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations [9]) and an alternative site should be considered.

In an exceptional case, where it is necessary for the site to be considered, in order to comply with Requirement 15 and para. 5.4 of DS484, site safety must still be demonstrated. To do this:

a) It should be demonstrated that there is negligible potential for capable faults in the site vicinity to influence secondary faults in the site area. Or, if this is not possible;

b) It should be demonstrated that a feasible engineering solution is available to compensate for potential fault displacement in the site area.

It should be noted that although a) and b) are identified as possible ways of justifying site safety if there is the potential for capable faulting in the site vicinity, neither option is considered credible with the current state of both technology and reliable site specific database.
IAEA Safety Report Series No.89 Fig.12
Proposed Structure

1. INTRODUCTION
2. GENERAL RECOMMENDATIONS
3. DATABASE OF INFORMATION AND INVESTIGATIONS
4. CONSTRUCTION OF SEISMIC SOURCE MODELS
5. VIBRATORY GROUND MOTION ESTIMATION METHODS
6. VIBRATORY GROUND MOTION SEISMIC HAZARD ANALYSIS
7. EVALUATION OF THE POTENTIAL FOR FAULT DISPLACEMENT AT THE SITE
8. PARAMETERS FROM THE VIBRATORY GROUND MOTION ANALYSIS, FAULT DISPLACEMENT AND OTHER ASSOCIATED SEISMIC HAZARDS
9. EVALUATION OF SEISMIC HAZARDS FOR NUCLEAR INSTALLATIONS OTHER THAN NUCLEAR POWER PLANTS
10. PROJECT MANAGEMENT SYSTEM
REFERENCES
ANNEX-TYPICAL OUTPUT OF PROBABILISTIC SEISMIC HAZARD ANALYSES
Scope

• **Interface with other documents:**

  - Site Evaluation for Nuclear Installations - Safety Requirements, NS-R-3 Rev. 1 (2016)
  - Site Evaluation for Nuclear Installations – Specific Safety Requirements (DS484 → SSR-1)