



Document: ISO/TC 85/SC 5/WG 8/ISO-11311:2011 Summary

## ***Nuclear criticality safety – Critical values for homogeneous plutonium-uranium oxide fuel mixtures outside of reactors***

This document provides a summary of the following:

**ISO-11311:2011 (First edition)** *Nuclear criticality safety – Critical values for homogeneous plutonium-uranium oxide fuel mixtures outside of reactors*

**ISO-11311:2011/Amd 1:2022 (First edition)** *Corrections and clarifications*

### **What is this standard?**

This international standard specifies common reference critical values (of which the effective neutron multiplication factor,  $k_{\text{eff}}$ , is equal to 1) for various systems of homogeneous water-moderated plutonium-uranium oxide mixtures (MOX) based on a comparison of calculated critical values from different computer methods and different nuclear data libraries. It gives a set of reference values defined as the lowest of those calculated and accepted as credible. It does not provide absolute critical values.

### **What does it cover?**

The MOX systems covered by ISO-11311 are:

- 3,5 g/cm<sup>3</sup> oxide mixtures, with a Pu content of 35%\*, optimally moderated by water or with a limited moderation
- 11,03 g/cm<sup>3</sup> oxide mixtures, with a Pu content of 12,5%\*, optimally moderated by water or with a limited moderation

In both cases, uranium is natural uranium and the <sup>240</sup>Pu content in total plutonium by weight is either 0%, 5% or 20%.

Two reflection conditions are considered: 2,5 cm of water and 30 cm of water.

The reference critical values specified for each of these systems are:

- Sphere radius (cm)
- Diameter of an infinite length cylinder (cm)
- Thickness of an infinite slab (cm)
- Mass of U+Pu (kg)
- Linear density of U+Pu (kg/cm)
- Surface density of U+Pu (kg/cm<sup>2</sup>)

### **Why is it useful?**

Significant discrepancies can be found between calculation methods for MOX systems, especially low moderated systems and slab systems. In addition, a classical validation approach for these systems is difficult because of the paucity of critical experiments for MOX systems. The critical values given in ISO-11311 provide a useful reference of calculated minimum critical values for the systems described above.

### **Who should use it?**

An individual or body who has responsibility in the design or maintenance of Nuclear Criticality Safety (NCS) for a process or facility involving MOX materials. These individuals would typically be NCS specialists with the responsibilities of assessment, calculation or peer review of NCS documentation. Also, individuals or bodies with responsibilities of oversight and regulation of facilities and processes that involve MOX materials.

### **Where can I find out more?**

The ISO-11311 and ISO-11311:Amd 1 standards webpages can be found at the ISO website:

<https://www.iso.org/standard/50381.html> and <https://www.iso.org/standard/83064.html>

\* by weight of total (Pu+U)