

## **Document Preparation Profile (DPP)**

### **1. IDENTIFICATION**

**Document Category** Safety Guide

**Working ID:** DS405

**Proposed Title:** Volcanic Hazards in Site Evaluation for Nuclear Installations

**Proposed Action:** New document – Review, revision and upgrading of Provisional Safety Standards Series No 1, July 1997.

**Published Title/Date**

**Safety Series No.:**

**SS Committee(s):** NUSSC and WASSC

**Technical Officer(s):** Antonio Godoy/ISSC (former NSNI/ESS)

### **2. BACKGROUND**

The safety standard on requirements for site evaluation (NS-R-3) states that volcanic hazards at nuclear installations sites shall be assessed. Volcanic events are, at best, a parenthesis in current regulations and guidelines for determining site suitability and for licensing decisions for most nuclear installations worldwide. This situation is understandable as volcanic eruptions are comparatively rare geologic phenomena and have not yet created a condition adverse to safety at an operating nuclear installation.

Nevertheless, approximately 25% of Member States have active volcanoes within their borders and many types of volcanic phenomena have regional effects, extending beyond international borders. These types of volcanic phenomena include lava flows and pyroclastic density currents that generally constitute site exclusion criteria, and widespread phenomena, such as tephra falls (volcanic ash) for which facility design or operational planning may practically mitigate potential hazards.

Worldwide, volcanic hazard assessments are now being performed for existing or planned nuclear facilities (e.g., Armenia NPP site; proposed Yucca Mountain geologic repository, USA; etc.).

An important step in the process of establishing a safety guide is to provide recommendations on how to satisfy the requirements of NS-R-3 was the development of the Provisional Safety Standard Series No 1 on “*Volcanoes and associated topics in relation to nuclear power plant siting*” published by IAEA in July 1997.

In these circumstances, the time has come for IAEA to develop formal guidance, i.e. a safety guide, as decided by NUSSC in its 19<sup>th</sup> Meeting (May 2005) for revising and upgrading that publication. A presentation was provided to NUSSC 26<sup>th</sup> Meeting in 2008 on the development status of the guide and it was decided by NUSSC to look forward to see the draft in the 27<sup>th</sup> Meeting in June 2009.

Therefore, the Draft was already prepared without the corresponding DPP considering the decision made in 2005 and the actions decided and comments provided in previous NUSSC meeting. The present DPP has the only objective to formalize the process according to current

requirements assuming that this is an exceptional case for resolving the status of the only Provisional Safety Standard Series document that exists, through the development of a safety guide.

### **3. OBJECTIVE AND JUSTIFICATION**

The objective of this Safety Guide is to provide a systematic approach for evaluation of volcanic hazards at a nuclear installation site.

The scope of this Safety Guide addresses an extended range of nuclear installations as defined in the IAEA Nuclear Safety Glossary, i.e. land based stationary nuclear power plants, research reactors, nuclear fuel fabrication plants, enrichment plants, reprocessing facilities and independent spent fuel storage facilities. It will not apply to repositories. This scope may be extended in future revision of the guide (2015 long term structure of safety standards) to nuclear facilities other than nuclear installations, when more available practice and consensus on this subject are reached in relation to geologic repositories. Therefore, in its first version under development, the safety guide will cover nuclear installations.

This Safety Guide is intended for use by regulatory bodies responsible for establishing regulatory requirements and by operating organizations directly responsible for the execution of volcanic hazards assessments. A successful outcome of a volcanic hazards assessment conducted using this guidance is a transparent and traceable basis for making decisions about site suitability and design. Consequently, this Safety Guide provides a basis to meet that requirement – as other IAEA Safety Guides do for other natural and human induced external events- through a comprehensive consideration of all potential volcanic hazards. Such consideration should not be interpreted as a way to encourage the location of nuclear installations in highly active volcanic regions.

Such guidance is essential because volcanic processes are complex and varied, and volcanic hazard assessment requires expertise and specialist knowledge. The Safety Guide provides a staged approach to assessment of these complex volcanic hazards. A staged approach will allow the hazard assessment to focus on phenomena that represent credible hazards to the site, rather than require an equivalent level of investigation and support for all types of volcanic phenomena and their hazards. This staged approach recognizes the need for increasing levels of information for increasing levels of potential hazard. This approach recognizes that sites located far from potentially active volcanoes may need to consider only a limited subset of potential volcanic hazards, whereas sites located closer to potentially active volcanoes may need to consider a full range of potential hazards. Thus, the Safety Guide is intended to clarify procedures and focus investigations on assessment of credible external volcanic hazards.

The first guidance developed by the IAEA on this topic led to release of Provisional Safety Standards Series No. 1, Volcanoes and Associated Topics in Relation to Nuclear Power Plant Siting, in July, 1997. This provisional document was seminal in the sense that it was the first to provide any guidance on volcanic hazard assessment using the state-of-the-science at that time. Since its publication, several developments have made significant revision of this document necessary. First, the science of volcanology has been transformed by significant advances in numerical modelling of volcanic processes and hazard assessment based on stochastic models of these processes. Second, the volcanology community has increased experience in applying these models in national hazard assessments and in national hazard mitigation programmes. For example, during the last decade hazard mitigation strategies have been successfully implemented during volcano crises in Sakurajima (1985-86), Unzen (1990-

95) and Miyakejima (2000) volcanoes, in Japan, Soufrière Hills volcano, in the Lesser Antilles, Colima volcano, in Mexico, etc. Numerous national exercises in volcanic response, based on probabilistic methods, have been run in Italy, New Zealand, and the USA. Third, probabilistic volcanic hazards assessments for nuclear installations and radioactive waste management facilities (e.g. in the USA) have been conducted with tremendous practical experience gained as a result. These factors have made significant refinement of information contained in the provisional guide both possible and necessary.

#### **4. POSITION IN THE OVERALL STRUCTURE OF THE RELEVANT SERIES AND INTERFACES WITH EXISTING AND/OR PLANNED PUBLICATIONS**

The new guidance should be consistent with the Fundamental Safety Principles S-F-1, with Safety Requirements for Site Evaluation for Nuclear Installations, NS-R-3, with Safety Requirements NS-R-1: Safety of Nuclear Power Plants: Design (under review process), and with NS-R-2: Safety of Nuclear Power Plants: Operation (under review process). Safety Requirements related to Nuclear Installations, other than NPPs, should also be considered.

The new Safety Guide will have interfaces with and should be consistent with:

- Safety Guide NS-G-1.6 Seismic Design and Qualification of NPPs
- Safety Guide NS-G-2.13 “Evaluation of Seismic Safety of existing nuclear installations” (former DS 383, during development phase)
- Meteorological Events in Site Evaluation for Nuclear Power Plants (NS-G-3.4), now DS417.
- Flood Hazard for Nuclear Power Plants on Coastal and River Sites (NS-G-3.5), now DS417.
- Safety Guide on Level 1 PSA (DSG 394)
- DS284 – Safety Assessment for predisposal of radioactive waste management facilities.

#### **5. OVERVIEW**

The content of the new Safety Guide will, to the extent possible, retain the existing structure, modifying them where necessary to enable clear interpretation of the relevant associated Safety Requirements as applicable to NPPs and other nuclear installations. Care will be taken to ensure full consistency and coordination with other relevant safety standards.

The Safety Guide will provide information on the volcanic phenomena that give rise to hazards and information on whether these hazards generally constitute an exclusionary condition or may be addressed by design basis or operational procedures. The Safety Guide provides a four stage approach to hazard assessment in order to clarify and focus assessments. Procedures are further clarified through the use of Tables and Flow charts.

Because volcanological terms may not be familiar to some users of the Safety Guide, a glossary of terms used in the Safety Guide will be included.

The Contents of the document are as follows:

##### **1. INTRODUCTION**

2. OVERVIEW OF VOLCANIC HAZARD ASSESSMENT
  3. GENERAL CONSIDERATIONS
  4. NECESSARY INFORMATION AND INVESTIGATIONS (DATABASE)
  5. SCREENING VOLCANIC HAZARDS
  6. SITE SPECIFIC VOLCANIC HAZARD ASSESSMENT
  7. NUCLEAR INSTALLATIONS OTHER THAN POWER PLANTS
  8. MONITORING AND PREPARATION FOR PLANT RESPONSE
  9. MANAGEMENT OF VOLCANIC HAZARDS EVALUATION
- REFERENCES
- APPENDIX 1-DESCRIPTION OF TYPES OF VOLCANIC PHENOMENA
- ANNEX 1 – VOLCANIC HAZARD SCENARIOS
- ANNEX 2 – WORLDWIDE SOURCES OF INFORMATION
- GLOSSARY OF VOLCANOLOGICAL TERMS

## 6. PRODUCTION:

Provisional schedule for preparation of the document, outlining expected dates for:

|  |                |
|--|----------------|
| Approval on DPP and SG Draft by the Coordination Committee:          | April 2009     |
| Approval on DPP by NUSSC :   | June 2009      |
| Approval on DPP by WASSC :   | November 2009  |
| Approval on DPP by the CSS : with consideration of WASSC comments    | Oct 2009       |
| Approval of draft by NUSSC/WASSC for submission to MSs for comments: | Nov 2009       |
| Comments from MSs:   | April 2010     |
| Review by Technical Editors:   | May 2010       |
| Approval by NUSSC/WASSC for submission to the CSS:                   | June/July 2010 |
| Endorsement by the CSS:  | October 2010   |
| Submission to Publications Committee:                                | December 2010  |
| Approval by the Board of Governors, as appropriate                   | February 2011  |
| Target publication date  | April 2011     |