

Document Preparation Profile (DPP)

1. IDENTIFICATION

Document Category	Safety Guide
Working ID:	DS 417
Proposed Title:	Hydrological and Meteorological Hazards in Site Evaluation for Nuclear Installations
Proposed Action:	To revise and combine NS-G-3.4 and NS-G-3.5 Safety Guides
Published Title/Date	Meteorological Events in Site Evaluation for Nuclear Power Plants NS-G-3.4 (2003) and Flood Hazard for Nuclear Power Plants on Coastal and River Sites NS-G-3.5 (2003)
Safety Series No.:	NS-G-3.4 and NS-G-3.5
SS Committee(s):	NUSSC
Technical Officer(s):	A. Godoy

2. OBJECTIVE

- *The primary objective is to take account of the recently gained flood-related knowledge and experiences of Member States and to provide up-to-date guidance for site evaluation on hydrological and meteorological external hazards. This update will utilize the insights gained by feedback from Member States, from other Organisations, and from the lessons learned from the IAEA engineering safety review services.*
- *The second objective is to update guidance to include recent findings and knowledge related to climate change.*
- *The third objective is to merge Safety Guides NS-G-3.4 and NS-G-3.5 in order to streamline agency guidelines.*
- *The fourth objective of the new Safety Guide will be to include hazard effects that were not included in the current version, such as the lowering of water levels.*
- *The fifth objective is to expand the scope of the Safety Guidance to nuclear installations, other than nuclear power plants, in order to provide coherent and comprehensive guidance.*

3. BACKGROUND

Over the last few years, significant new knowledge and experience has been gained in hydrological and meteorological topics included in the Safety Guides NS-G-3.4 and NS-G-3.5. This knowledge and experience has come in a number of areas, including the following:

- Occurrences of external events (e.g. the 2004 Indian Ocean tsunami and other flooding events)
- Development or improvement of new assessment techniques (e.g. for tsunami hazards)
- Recent Member States experience in the application of the related Safety Guides (e.g. NS-G-3.4 and NS-G-3.5)
- Upgrading of nuclear power plants with new equipment

The current publication was issued in the year 2003, and according to the policy of the Agency to periodically review all the safety standards, activities have been carried out to collect the feed back from Member States on the use and application of NS-G-3.4 and NS-G-3.5. In addition to the several safety review services conducted by the Agency since NS-G-3.4 and NS-G-3.5 were published, a series of international workshops and expert meetings have been held in response to the 2004 Indian Ocean tsunami. These were held in August 2005 in Kalpakkam, India, and in May 2006 and May 2007 in Trieste, Italy. Other flood-related occurrences were discussed during these workshops, in addition to tsunami. During the 2006 workshop in Trieste, a panel of international experts concluded that more comprehensive and detailed guidance for characterization and assessment of potential tsunami events is needed. The results of these activities will be considered for the preparation of the revised version of NS-G-3.4 and NS-G-3.5.

Although information on climate change was included in the existing publication, it is appropriate to update the guidance at this time. New information includes recent findings by the United Nations' Intergovernmental Panel on Climate Change, in addition to a large body of new scientific research. Furthermore, there has been greater public perception and concern related to the impact of climate change.

As part of the "Beyond Action Plan" for the new structure of the Safety Standard series, the two Safety Guides, NS-G-3.4 and NS-G-3.5, need to be merged to link guidance on the closely related phenomenological effects. For example, storm surge and high wind effects combined to produce safety concerns for an installation. Also, drought can be combined with very high temperature events, which exacerbates the need for cooling.

Although some sites had been previously designed for tsunami-induced drawdown effects, recent re-evaluation has been undertaken by some Member States. The re-evaluation identified a risk of loss of intake water for safety related cooling, thus identifying a need for update. The existing Safety Guide does not provide guidance on the assessment of low water conditions. The new Safety Guide will cover this effect.

There is a need to integrate the safety evaluation approach for hydrological and meteorological hazards for all nuclear installations, not just nuclear power plants. Some Member States are already developing such an integrated approach.

This Safety Guide will be developed with participation from other organizations, such as the United Nations Intergovernmental Panel on Climate Change (UN-IPCC), the World Meteorological Organization (WMO) and the United Nations Intergovernmental Oceanographic Commission (UNESCO IOC). The DPP was prepared with participation from an expert and past Chairman of UNESCO IOC.

4. INTERFACES

The review will cover other relevant IAEA publications. The new guidance should be consistent with the Fundamental Safety Principles NS-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-3.3: Evaluation of Seismic Hazards for NPPs,

- Safety Guide NS-G-1.5: External Events Excluding Earthquakes in the Design of Nuclear Power Plants
- Various Safety Guides related to Nuclear Power Plants: Operation.
- Draft Safety Requirements on Safety Assessment for Facilities and Activities, DS348, (GS-R-4-Draft).

5. OVERVIEW

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

6. PRODUCTION:

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

Approval of DPP by the Steering Committee:	July 2007
Approval of DPP by the NUSSC:	October 2007
Approval of DPP by the CSS:	November 2007
Development of revised document:	
First CSs to prepare 1st draft:	February 2008
Second CSs to prepare final draft:	May 2008
Approval of draft by the Steering Committee:	July 2008
Approval by the NUSSC for submission to MS:	October 2008
Comments received from MS:	April 2009
Third CSs to incorporate MS comments	May 2009
Approval by the NUSSC for submission to the CSS:	October 2009
Endorsement by the CSS:	November 2009
Editing and Submission to the Publications Committee:	December 2009
Target publication date:	February 2010

7. DOCUMENT CONTENTS

The table of contents will be as follows:

CONTENTS

1. INTRODUCTION

- 1.1 Background
- 1.2 Objective
- 1.3 Scope
- 1.4 Structure

2. GENERAL RECOMMENDATIONS FOR APPROACH TO HYDROLOGICAL AND METEOROLOGICAL HAZARD ASSESSMENTS

2.1 Hazard scenarios

2.1.1 Flood scenarios

2.1.1.1 Storm Surge

2.1.1.2 Waves

2.1.1.3 Tsunami

2.1.1.4 Seiches

2.1.1.5 Run-off

2.1.1.6 Sudden releases of water from natural or artificial storage

2.1.1.7 Other natural causes

2.1.2 Low water scenarios

2.1.2.1 Drought

2.1.2.2 Tsunami

2.1.2.3 Drawdown

2.1.3 Meteorological scenarios

2.1.3.1 Hurricane effects

2.1.3.2 Extreme snow pack

2.1.3.3 Extreme temperatures

2.1.3.4 Tornado effects

2.1.3.5 Lightening

2.1.4 Combined events

2.1.4.1 Initial and ambient conditions

2.1.4.2 Simultaneous events

2.1.4.3 Postulated internal events

2.2 Expected main effects of hazards on nuclear power plant sites

2.3 Methods for evaluation of the hazards

2.4 Hazard assessment tools

2.4.1. Meteorological models

2.4.2. Hydraulic and hydrodynamic models

2.4.3. geographic information systems and remotely sensed data

3. INFORMATION AND INVESTIGATIONS NECESSARY (DATABASE)

3.1 Preliminary Investigations

3.1.1 General

3.1.2 Major attributes for preliminary hazard investigations for siting

3.1.2.1 High water effects

3.1.2.2 Low water effects

3.1.2.3 Other extreme events and conditions

3.1.3 Stability of the shoreline and riverbank

3.1.4 Other potential causes of flooding

3.2 Detailed Data Collection and Observations

3.2.1 General

3.2.2 Meteorological data

3.2.3 Hydrological data

3.2.4 Geophysical, geochemical and geological data related to site hazard

3.2.5 Site morphology data

3.2.6 Seismological, seismotectonics, and tsunami data

3.2.7 Topographic and bathymetric data

3.3 Long-Term Data Collection and Monitoring

4. FLOODING HAZARDS

4.1 Flooding By Storm Surges

4.1.1 General

4.1.2 Deterministic evaluation of probable maximum storm surge

4.1.3 Stochastic evaluation of probable maximum storm surge

4.1.4 Probable maximum storms

4.2 Waves

- 4.2.1 General
- 4.2.2 Wind field
- 4.2.3 Generation of offshore waves
- 4.2.4 Transformation of offshore waves
- 4.2.5 Near-shore waves
- 4.2.6 Local modifications of waves
- 4.2.7 Wave forces

4.3 Tsunami Flooding

- 4.3.1 General
 - 4.3.1.1 Tsunami phenomena
 - 4.3.1.2 Description and effects
- 4.3.2 Tsunami Generating Sources
 - 4.3.2.1 Tsunamis from nearby (local) earthquakes
 - 4.3.2.2 Tsunamis from distant earthquakes
 - 4.3.2.3 Tsunamis from landslides (aerial and submarine)
 - 4.3.2.4 Other tsunamis
- 4.3.3 Probable Maximum Tsunami (PMT)
 - 4.3.3.1 Definition of PMT and all its parameters.
- 4.3.4 Hazard Assessment
 - 4.3.4.1 Earthquake Tsunami - Generation, Propagation and Inundation
 - 4.3.4.1.1 Fault parameters
 - 4.3.4.1.2 Earthquake tsunami generation, propagation and inundation modeling
 - 4.3.4.1.3 Propagation Numerical simulation (basic equations etc)
 - 4.3.4.1.4 Effects on the coast
 - 4.3.4.2 Landslide Tsunami - Generation, Propagation and Inundation
 - 4.3.4.2.1 Landslide parameters
 - 4.3.4.2.2 Landslide tsunami generation, propagation and inundation modeling
 - 4.3.4.2.3 Effects on the coast
 - 4.3.4.3 Special Topics on Tsunami Modeling
 - 4.3.4.3.1 Deterministic and Probabilistic approaches
 - 4.3.4.3.2 Parametric studies
 - 4.3.4.3.3 Disaggregate PTHA

4.4 Flooding By Seiches

- 4.4.1 General
- 4.4.2 Meteorologically-induced seiches
- 4.4.3 Seismically-induced seiches
- 4.4.4 Effects of sediment deposition and erosion processes

4.5 Flooding Due To Runoff

- 4.5.1 General
- 4.5.2 Deterministic method
- 4.5.3 Probabilistic methods

4.6 Flooding Due To Sudden Releases Of Water From Natural Or Artificial Storage

- 4.6.1 General
- 4.6.2 Hydrological dam failures
- 4.6.3 Seismic dam failures
- 4.6.4 Dam and reservoirs failures resulting from causes other than hydrological and seismic
- 4.6.5 Faulty operation of dams
- 4.6.6 On-site dams, reservoirs, and equipment failures and faulty operation

4.7 Other Natural Causes

- 4.7.1 General
- 4.7.2 Change in groundwater level
- 4.7.3 Changes in natural channel
- 4.7.4 Direct rainfall on the site

4.7.5 Waterspouts

4.7.6 Natural and mechanically-induced hydraulic jumps

5. LOW WATER CONDITIONS AND ASSOCIATED HAZARDS

5.1 Drought

5.2 Tsunami

5.3 Drawdown

6. METEOROLOGICAL HAZARDS

6.1 Hurricane effects

6.2 Extreme snow pack

6.3 Ice formation

6.4 Extreme temperatures

6.5 Tornado effects

6.6 Extreme winds

6.7 Lightning

7. COMBINED EVENTS

7.1 General

7.2 Initial and ambient conditions

7.3 Simultaneous events

7.4 Postulated internal events

8. ASPECTS OF HYDROLOGICAL AND METEOROLOGICAL HAZARD PROTECTION

8.1 General

8.2 Types of protection

8.3 Analysis of the protection

8.4 Stability of the shoreline

8.5 Site drainage

8.6 Transport and communication routes

9. MODIFICATION OF THE HAZARD WITH TIME

9.1 General

9.2 Changes due to climatic evolution

9.3 Other changes

10. MONITORING AND WARNING FOR PLANT PROTECTION

10.1 General

10.2 Tsunami

10.3 Meteorological

10.4 Dams and reservoirs

10.5 Lakes and Rivers

10.6 Other

11. MANAGEMENT SYSTEM FOR HAZARD ASSESSMENTS

11.1 Application of a Management System

11.2 Verification of data sufficiency and completeness

11.3 Documentation and records

REFERENCES