

Document Preparation Profile (DPP)

1. IDENTIFICATION

Document Category	Safety Guide
Working ID:	DS 441
Proposed Title:	Construction of Nuclear Installations
Proposed Action:	New document
Review Committee(s) or Group:	<u>NUSSC</u> (Leading Committee), WASSC
Technical Officer(s):	Yuichiro Inoue

2. BACKGROUND

With the recent world wide trend of increasing demand for nuclear energy, there exist high expectations of stake holders for a safe and sound construction of nuclear installations, ensuring safety as the top priority. The status of safety and quality of newly built nuclear installations in countries embarking on a nuclear energy programme or countries with no recent construction for many years has been a global concern, as relevant parties involved in nuclear construction processes may lack experience or resources, while cost reduction by higher efficiency and strict schedule adherence are always emphasized.

NS-R-1 requires that systems, structures and components (SSCs) be constructed such that their quality and reliability are commensurate with their safety significance. Ensuring that SSCs are constructed with the required quality and reliability involves the application of management systems and technical processes. Management system requirements and guidance are provided by GS-R-3, “The Management System for Facilities and Activities”, GS-G-3.5, “The Management System for Nuclear Installations”, and GS-G-3.1, “Application of the Management Systems for Facilities and Activities”. However, an additional guidance is needed to designate the technical processes and complement the existing guidance on management systems necessary to ensure that the NPP is constructed in accordance with the approved design and safety commitments as stipulated by NS-R-1.

Such guidance is particularly important in today’s environment of global supply chains. Recent construction experience has emphasized the importance of the management and supervision of contractors and also the issues related to risk management, safety culture, leadership, oversight and management for the design process, experience feedback and handling of non-conformances during construction.

3. OBJECTIVE

The objective of this Safety Guide is to make recommendations based on international good practices in construction of nuclear installations, as currently followed in Member States, which will enable construction to implement the design so that safety requirements are met and the systems, structures and components (SSC) important to safety are produced with a high quality, consistent with applicable codes and standards. It will also provide the necessary assurance that nuclear installations as constructed can be commissioned and operated safely.

This safety guide is neither a technical guide describing how to construct a nuclear installation nor does it provide any technical specifications related to the construction. It identifies safety significant construction activities which construction organisation should ensure to be planned, specified, checked and reviewed in preparation for and during construction in the areas of civil, architectural, mechanical, electrical, I&C and software for ensuring safety and quality.

4. JUSTIFICATION

The IAEA Safety Guides on site evaluation (NS-G-3.1 to 3.6), design (NS-G-1.1 to 1.13), commissioning, operation and maintenance (NS-G-2.1 to 2.15) provide guidance on how each respective Safety Requirements can be met to ensure nuclear safety in each respective phases of the nuclear installations. However, a similar Safety Guide for providing guidance on what safety significant construction activities should be considered during fabrication, installation and pre-commissioning tests to ensure NS-R-1 requirement on construction is not yet covered by any safety standard.

To address this, the proposed Safety Guide will provide practical guidance on what needs to be considered in preparation for and during construction with regards to proper fabrication and assembly of the SSCs; the civil works; the installation of components and equipment; tests; inspections; and verifications as per authorized design.

To respond to the rapid development of the construction projects, this new Safety Guide also supplements and elaborates the guidance provided by GS-G-3.1 and GS-G-3.5 on preparation for and implementation of construction activities via management system to incorporate latest construction experience. It may be used to assist any organization in oversight and evaluation of the specific activities; to assist in providing construction management guidance to a vendor; and to assist in the understanding of the construction management aspects that should be considered when assessing vendors' qualifications and performance.

This guide is needed to take into account the changes in the global nature of the construction industry where, in addition to importing design from other countries, skilled workers, construction materials and modular parts may also be imported across international boundaries.

The recommendations will embody best practices derived from internationally recognized standards using the latest construction experience and the insights of technical experts in disciplines including civil, mechanical, electrical, I&C and computer related software.

5. PLACE IN THE OVERALL STRUCTURE OF THE RELEVANT SERIES AND INTERFACES WITH EXISTING AND/OR PLANNED PUBLICATIONS

This safety guide will provide recommendations with regards to NS-R-1 (DS414) related to construction. For ensuring the newly constructed plant to be commissioned and operated safely after the construction is complete, this safety guide can be valid only with the fulfilment of the requirements of DS414 "Safety of Nuclear Power Plants: Design" and NS-R-2 (DS413) "Safety of Nuclear Power Plants: Commissioning and Operation." In addition, the regulatory authorization described in GS-R-1 "Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety" must be granted according to each country's regulatory framework. It is recognized that even if the design is fully compliant with NS-R-1 and the commissioning is compliant with NS-R-2, the high level of safety can only be achieved if all the details of the construction are carried out with high quality and care, since commissioning can not test all aspects.

The publication will not supersede any existing IAEA document. This will be the first guide providing more detailed recommendations for the construction management of nuclear installations in the areas of

civil, architectural, mechanical, electrical, I&C and software. The general management system guidance for facilities and activities during construction are presented by GS-R-3, GS-G-3.1 and GS-G-3.5. This guide closely interfaces with Appendix III to GS-G-3.1 and Appendix V to GS-G-3.5. It provides more practical guidance on project and site management on recent construction experience from Member States which will ensure that the construction is in accordance with approved design.

In terms of nuclear installation life phases from siting to decommissioning, the proposed safety guide will be positioned between safety guides on the design and the commissioning of nuclear installations.

For any construction work which utilizes radiation and radioactive materials such as nondestructive testing of welding, the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources will be referenced.

The new guide must also consider new and revised IAEA safety standards and other guides that are currently under development. The proposed Safety Guide must be consistent with the following IAEA publications:

NS-R-1(DS-414): Safety of Nuclear Power Plant: Design

DS424: Establishing Safety Infrastructure for Nuclear Power Programme

GSR Part 1: Governmental, Legal and Regulatory Framework for Safety

NS-R-2(DS413): Safety of Nuclear Power Plant: Commissioning and Operation

NS-G-1.1 to 1.13 (All design related Safety Guides)

NS-G-2.9: Commissioning for Nuclear Power Plants

GS-G-1.3: Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body

DS416: Licensing Process for Nuclear Installations

6. OVERVIEW

Summary of proposed scope

This Safety Guide will provide recommendations for the construction of high quality nuclear installations as intended by design. The guidance will be broadly applicable to nuclear installations and is intended for application to both the construction of new and the modification of existing nuclear installations. The recommendations of this Safety Guide are general and applicable to all types of nuclear installations.

Nuclear Installations vary greatly in type, size, utilization and other characteristics so that judgement has to be exercised on the measure of applicability of particular requirements to a specific installation. In this safety guide it is considered that all relevant safety requirements must be complied with, in all applications of the graded approach. The graded approach should be used to determine the appropriate manner to comply with a requirement; it is not used to provide relief from meeting the requirement.

Draft Outline

(Topics shown in italics represent proposed ideas or concepts to be discussed under respective sections, and exact names of these topics are subject to change as draft guide is developed)

1. INTRODUCTION

- Background
- Objective
- Scope
- Structure

2. PREREQUISITES FOR THE CONSTRUCTION OF NUCLEAR INSTALLATION

3. THE GENERAL CONSIDERATIONS

- The Management System during Construction
 - Safety Culture
 - Project Management
- Grading Application of Construction Requirements
- Responsibilities and Organizational Structure
 - Authorizations, Licenses and Permits
 - Regulatory Body Involvement
 - Contractual Approaches
 - Control and Supervision of Contractors
 - Transfer of Ownership and Responsibility
 - Change and Configuration Control
 - Confirmation of Construction Activities
 - Non-Conformance and Corrective Actions
 - Security
- Construction Resources
 - Training and Qualification
 - Control of Apparatus and Tools
 - Receipt, Storage and Preservation
- Construction Processes
 - Work and Environmental Conditions
 - Procurement Specifications
 - Vendor Qualification
 - Fabrication Shop Qualification
 - Site Management
 - Construction Records
 - Construction Experience Feedback
 - Risk Management

4. CONSTRUCTION MANAGEMENT PROGRAMMES FOR STRUCTURES, SYSTEMS AND COMPONENTS

- Civil and Architectural Works
 - Scope
 - Site Preparation (Excavation and backfill)
 - Site Preparation*
 - Site preparation Planning and Scheduling*
 - Control of Work and Component Conditions*
 - Components required for Special Cares*
 - Test and Record Keeping*
 - Installation of Structures
 - Installation of Structures*
 - Installation Planning and Scheduling*
 - Procurement*
 - Control of Work and Conditions*
 - Management of Installation Process Required for Special Cares*
 - Test and Record Keeping*
 - Identification and Correction of Deficiencies*

- Mechanical SSCs
 - Scope
 - Fabrications
 - Shop/Area Qualification*
 - Instructions of Fabrications*
 - Inspection and Tests for Fabrication Products*
 - Installation
 - Work Instructions for Installations*
 - Testing
 - Mechanical System Leak and Pressure-Tests (Integrity Tests)*
- Electric, I&C and Computer Based Systems and Components
 - Scope
 - Manufacture of Computer Based Systems and Components
 - Fabrications and Installations
 - Components and Parts*
 - Environmental Control for Sensitive Equipment*
 - Installation Sequences and Instructions*
 - Work Tools*
 - Identifications of Component and Parts*
 - Components Required for Special Cares*
 - Work Activity Oversights*
 - Confirmations after Completion*
 - Pre-Commissioning Test / System Function Test
 - Establishment of Test Procedures*
 - Test Schedule*
 - Organisations and management of pre-operational tests*
- Welding
 - Scope
 - Technical Consideration
 - Design Basis that Influence Welding*
 - Procurement
 - Procurement and Receipt Inspection of Base and Weld Filler Metals*
 - Fabrication and Installations
 - Document Control for Welding*
 - Instructions*
 - Performance Qualification of Welders and Welding Operators*
- Modular Construction
 - Modular Scope
 - Modularization
 - Module Fabrication, Transportation and Storage
 - Installation

5. AUTHORIZATION AND COMMISSIONING

REFERENCES

GLOSSARY

7. PRODUCTION SCHEDULE:

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

Approval of DPP by the Coordination Committee	Sep. 2010
Approval of DPP by the NUSSC/WASSC	Nov/Dec. 2010
Approval of DPP by the CSS*	Mar. 2011
Approval of draft by the Coordination Committee	Sept. 2011
Approval by the NUSSC/WASSC for submission to MSs for comments	Nov. 2011
Approval of the revised draft by the Coordination Committee	Aug. 2012
Review in NS-SSCS	Aug. 2012
Approval by the Safety Standards Committees for submission to the CSS	Nov. 2012
Endorsement by the CSS*	Mar. 2013
Approval by the Publications Committee	Apr. 2013
Target publication date	Summer 2013

*Note: * is necessary only for the Safety Standards.*

8. RESOURCES

It is estimated that development of the new guide would involve approximately 50 weeks of effort by member states experts. This is based upon assuming 5 one-week expert meetings involving average of 5 experts and an average of 1 week of work per expert between meetings.

Secretariat resources involved are estimated at 20 weeks of effort by agency staff plus support for expert travel and honoraria for experts whose effort is not otherwise funded.