

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/RATIONALE

With the recent world wide trend of increasing demand for nuclear energy, there exist high expectations of stake holders for flawless construction of nuclear power plants, ensuring safety as the top priority. The status of safety and quality of newly built nuclear power plants 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.

“The Management System for Nuclear Installations” (GS-G-3.5) provides recommendations and guidance supplementary to those provided in “Application of the Management System for Facilities and Activities” (GS-G-3.1) for establishing, implementing, assessing and continually improving a management system that integrates elements of safety, health, environment, security, quality and economics during construction phase of nuclear installations. While there exist safety requirements and guidance on management systems for ensuring high quality of the construction management, a technical guidance on more detailed level in areas such as civil engineering and construction, mechanical, electrical, I&C, software installations are not yet provided by existing safety standards. This Safety Guide is to provide recommendations to follow during construction with regards to technical activities of manufacturing and assembling the systems, structures and components; the carrying out of civil works; the installation of components and equipment; tests; inspections; and verifications at the completion of critical technical activities.

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 proceed with a high quality, consistent with applicable codes, standards, and design requirements. It will also provide the necessary assurance that construction completion enables the demonstration that the plant can be commissioned and operated safely.

This safety guide is not a procedural guidance on how to construct a nuclear installation, but rather identifies safety significant construction activities from technical perspectives which must be considered, checked, and reviewed for ensuring safety and quality.

4. JUSTIFICATION

There exist IAEA Safety Guides, such as GS-G-3.1 and GS-G-3.5, on the processes for implementing a management system during construction. However, the technical aspects of construction implementation are not

yet fully developed and covered by the existing safety standards. To address this, the proposed new Safety Guide will provide recommendations during construction with regards to technical aspects of manufacturing and assembling the systems, structures and components; the carrying out of civil works; the installation of components and equipment; tests; inspections; and verifications at the completion of critical technical activities. The recommendations will embody international best practices derived from internationally recognized consensus standards using the insights of technical experts in disciplines including civil, mechanical, electrical, I&C, and computer related software.

This new Safety Guide focuses on the technical aspects of construction activities and supplements the guidance provided by GS-G-3.1 and GS-G-3.5 on implementation of construction activities in accordance with management system. It may also be used to assist in oversight and evaluation by the regulatory body of the specific activities performed during construction with recommendation on specific inspection areas and timings; to assist an organization in providing technical specifications to a vendor, via contractual documentation, that are pertinent to the supplied product; and to assist an organization in the understanding of the technical aspects that should be considered when assessing vendors' qualifications and performance.

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

The new guide will elaborate the defence in depth concept of Fundamental Safety Principles which requires nuclear installations to be constructed in accordance with appropriate quality levels, technical attributes and engineering practices in order to prevent system failures (the first level of defence). 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 NS-R-1 "Safety of Nuclear Power Plants: Design" and NS-R-2 "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.

The publication will not supersede any existing IAEA document. This will be the first technical guide providing recommendations for the construction of nuclear installations from the perspective of civil engineering and construction, mechanical, electrical, I&C and software manufacturing and installations for safe operation. The management system requirements and relevant recommendation and guidance for facilities and activities during construction are already covered by GS-R-3 and GS-G-3.1. The relevant recommendation for implementing management system in nuclear installations is provided in GS-G-3.5.

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

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

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

The guidance for the regulatory activities pertinent to the technical construction activities of manufacturing, installation and relevant tests will be included in this Safety Guide, but not to overlap with the above safety standards.

6. OVERVIEW

Summary of proposed scope

This Safety Guide will provide technical 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 and the modernization of existing nuclear installations. Although most recommendations of this Safety Guide are general and applicable to all types of nuclear installations, some specific recommendations and examples mainly apply to water cooled reactors.

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

1. INTRODUCTION

- Background
- Objective
- Scope
- Structure

2. SAFETY CLASSIFICATION

3. CIVIL/ARCHITECTURAL ENGINEERING AND CONSTRUCTION

- Scope

- Technical Issues

- Civil and Architectural Work based on Regional and Site Investigation Results
- Engineering
 - Quality Control/ Inspection Test Plan
 - Inspection Organisations
 - Work Phase Inspections/ Inspections during Manufacturing
 - Readiness Inspection before Concreting/Manufacturing/Installation
 - Inspections/Review after Concreting/Manufacturing/Installation
 - Commissioning of Structures
 - Records Keeping for Material, Manufacturing, Test results, and Delivery
- Excavation, Tunnelling and Surface Preparation
- Civil and Structural Work
 - Concrete Structures
 - Concrete
 - Steel Reinforcements
 - Pre-stressing System
 - Containment Liner and Associated Parts
 - Pools
 - Metal Structures
 - Structural Fire Protection
 - Coatings
 - Underground and Conduits
 - Other Civil Works (Brickwork, Drainage, Injection, Insulation)

4. MECHANICAL COMPONENT MANUFACTURING AND INSTALLATION

- Scope

- Manufacturing

- Material Production (Fabrication)
 - Source material
 - Melting
 - Casting
 - Forging
 - Forming
 - Machining/cutting/grinding
 - Heat treatment
 - Welding
 - Destructive and non-destructive testing
 - Surface treatment
 - Cleanliness

- Installation

- Environmental Conditions
- Installation Sequence and Procedure
- Cleanliness
- Installation Checks

- Pre-Commissioning Tests

5. ELECTRICAL AND I&C COMPONENTS MANUFACTURING AND INSTALLATION

- Scope

- Manufacturing

- Marking and Identification of Cables and Conductors
- Factory Acceptance Test

- Installation

- Environmental Conditions

- Ambient Conditions
- Electrical and Fluid Supply Networks and Conditions
- Installation Sequence and Procedure
- Electrical Cabinets
 - Cable Routing and Terminal Connections
 - Isolation by Train, Channel and Safety Class
 - Earthing Network
 - Cable Trays
- Electromagnetic Compatibility
- Cleanliness
- Installation Checks
- Pre-Commissioning Tests

6. IMPLEMENTATION, SYTEM INTEGRATION AND INSTALLATION OF SOFTWARE FOR COMPUTER BASED SYSTEMS

- Scope
- Technical Considerations
- Development Process and Activities
 - Software Implementation
 - Verification and Analysis
 - Computer System Integration
 - Validation of Computer Systems
- Installation and Tests

7. WELDING

- Preliminary Verifications, Qualifications and Acceptances
 - Weldability of Materials
 - Filler Materials
 - Welding Procedure
 - Welders and operators
 - Production Workshops
- Production Welds
 - Scope
 - Storage and Use of Welding Materials
 - Preparation and Examination of Edges and Surfaces for Welding
 - Execution on Production Welds
 - Heat Treatments
 - Repair by Welding
 - Non-destructive and Destructive Examinations
 - Hardfacing

8. 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	April 2010
Approval of DPP by the NUSSC	June 2010
Approval of DPP by the CSS*	Oct. 2010
Approval of draft by the Coordination Committee	April 2011
Approval by the NUSSC for submission to Member States for comments	June 2011
Approval of the revised draft by the Coordination Committee	March 2012
Review in NS-SSCS	March 2012
Approval by the Safety Standards Committees for submission to the CSS	June 2012
Endorsement by the CSS*	Oct 2012
Approval by the Publications Committee	Nov 2012
Target publication date	Early 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.