



IAEA

International Atomic Energy Agency

Overview: Project management and management systems

Technical Meeting on Synergies Between Nuclear Fusion Technology Developments and Advanced Nuclear Fission Technologies

3.08 Technology, safety, security and safeguardability for synergies and know-how transfer: Project management and management systems

Pedro Dieguez Porras

Pekka Pyy

Nuclear Power Engineering Section

Nuclear projects are megaprojects

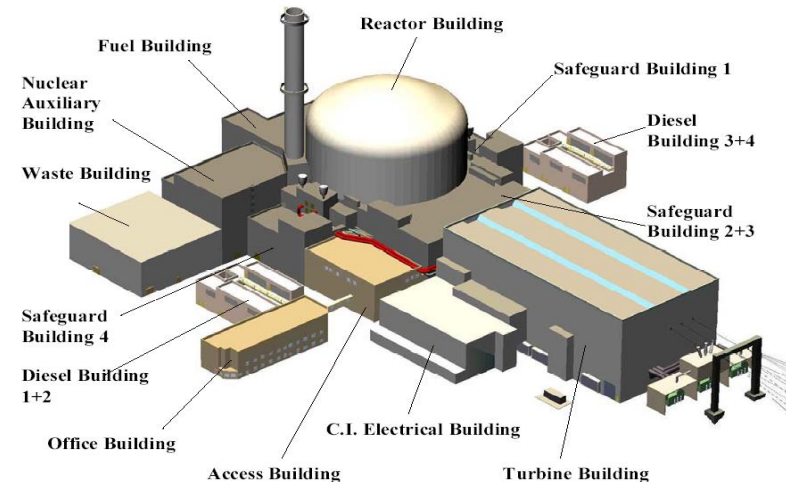
Olkiluoto 3

- Total building volume **1,000,000 m³**
- Excavation volume **500,000 m³**
- Amount of concrete **300,000 m³**
- Structural steel **52,000 t**

Construction began in 2005 and the commercial operation was supposed to begin in 2009 (current estimate during 2022 – nuclear fuel has been loaded)

Arbitration claims of app. 3 B€ on both side (contract price 3 B€), the building consortium finally agreed to compensate 450 M€

Not only Olkiluoto 3, but several megaprojects have failed due to far-from-perfect design/construction management, one-sided decisions, failed requirements management etc. ...



It does not have to be nuclear for a megaproject to fail...

Berlin (GER) Willy Brandt airport

- Was supposed to open in 2010
- Opened commercial traffic 31 Oct 2020
- Original budgeted / final cost: 2,8 B€ / 6,5 (?) B€
- Reasons: "poor design/construction planning, management, execution, corruption,"



ITER final cost and delay ??

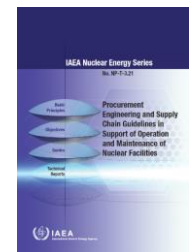
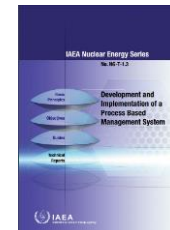
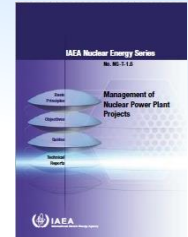
Typical characteristics of a NPP (project)

- **Long term commitment** for a NPP > 100 years
- Many governmental authorities involved and **tedious licensing processes** with sometimes conflicting regulations
- Long design, manufacturing and construction time
- Roles and core tasks of management may change over the different project phases and time
- Many **stakeholders** with various views toward nuclear
- A large amount of different (levels of) contractors
- Many nationalities and different cultures
- Nuclear **infrastructure** to be developed (or upgraded)
- Many different (inter)national treaties to be complied with

- NPP newbuild is a technically and humanly a complex high risk megaproject (even with SMRs)

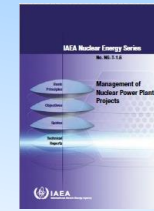
NE Series publications relating to project management

- **Management of Nuclear Power Plant Projects** ([NG-T-1.6](#))
- **Project Management in Nuclear Power Plant Construction: Guidelines & Experience** (NP-T-2.7, 2012)
- **Development & Implementation of a Process Based Management System** (NG-T-1.3, 2015)
- **Procurement Engineering and Supply Chain Guidelines** in Support of Operation & Maintenance of Nuclear Facilities (NG-T-3.21, 2016; contains procurement guidance, including proactive actions for new NPP contracts)



Management of Nuclear Power Plant Projects

NG-T-1.6 - Structure

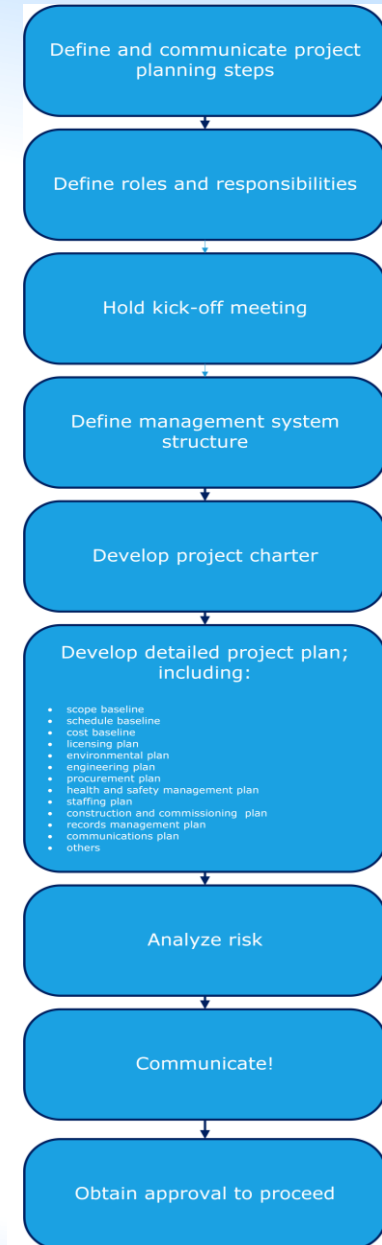
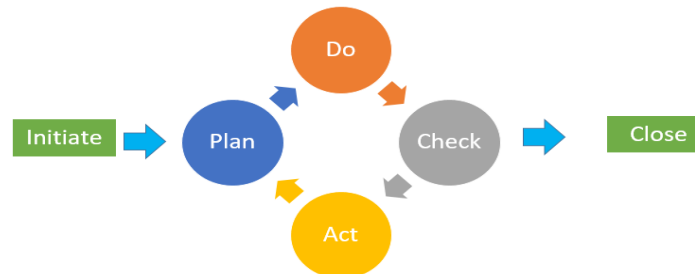
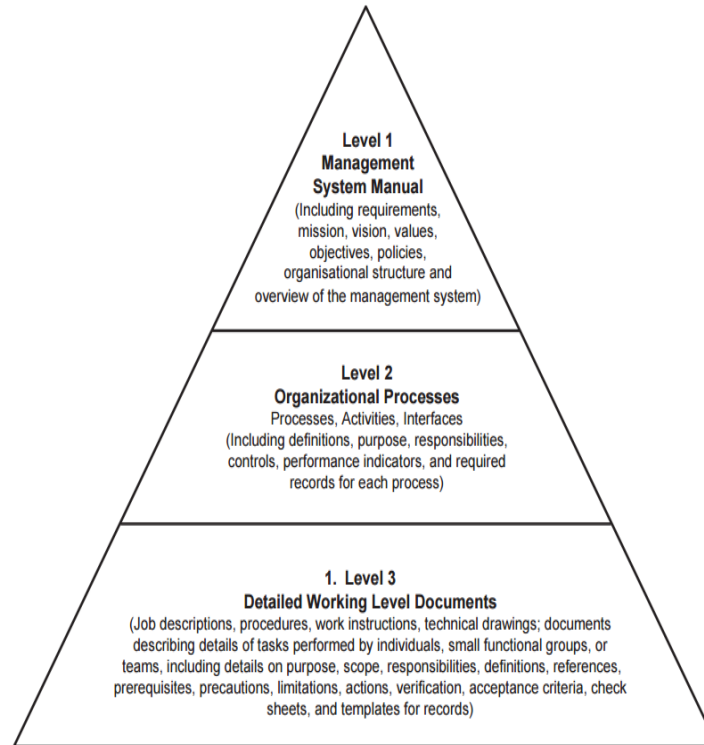


- **Section 1: Introduction**
- **Section 2: Nuclear projects and their influencers:** Overview of projects in general and what organizational factors that influence such projects.
- **Section 3: Project management guidance:** IAEA and international project management guidance related to both small projects and large mega-projects.
- **Section 4: Items to be managed (in the nuclear projects):** List of items to be managed within a project and methods to manage them
- **Section 5: Developing and implementing project management systems and best practices:** Steps to be followed to implement a project management system and to incorporate documented best practices into the system.
- **Section 6: Project management activities for a new NPP project within each project phase:** Specific project management steps to be taken in each of Phase I, II and III of an NPP project, as well as during commissioning, operations and decommissioning.
- **Section 7: Summary and conclusion:** Provides an overview of the key messages from this publication.

Special PM cases

- **Small project management**
 - Apply PM principles at a cost proportionate to project size and project cycle time “graded approach”
- **Megaproject management**
 - Projects larger than the companies undertaking them...
 - How to get these done without failures?
 - According to many sources, about 70 % of them fail (reasons: see project triangle in the modern supply world)
- **NPP EPC projects** are typically megaprojects

PROJECT MANAGEMENT PROCESSES



Items to be managed (see also next page)

- Integration
- Scope
- Time
- Cost
- Quality
- Human resources
- Communications
- Risk
- Procurement
- Stakeholders

- Radiation dose
- Radioactive waste
- Industrial safety & health
- Licensing
- Emergency planning and response
- Security
- Safeguards
- Lessons learned

blue = relatively unique for nuclear projects

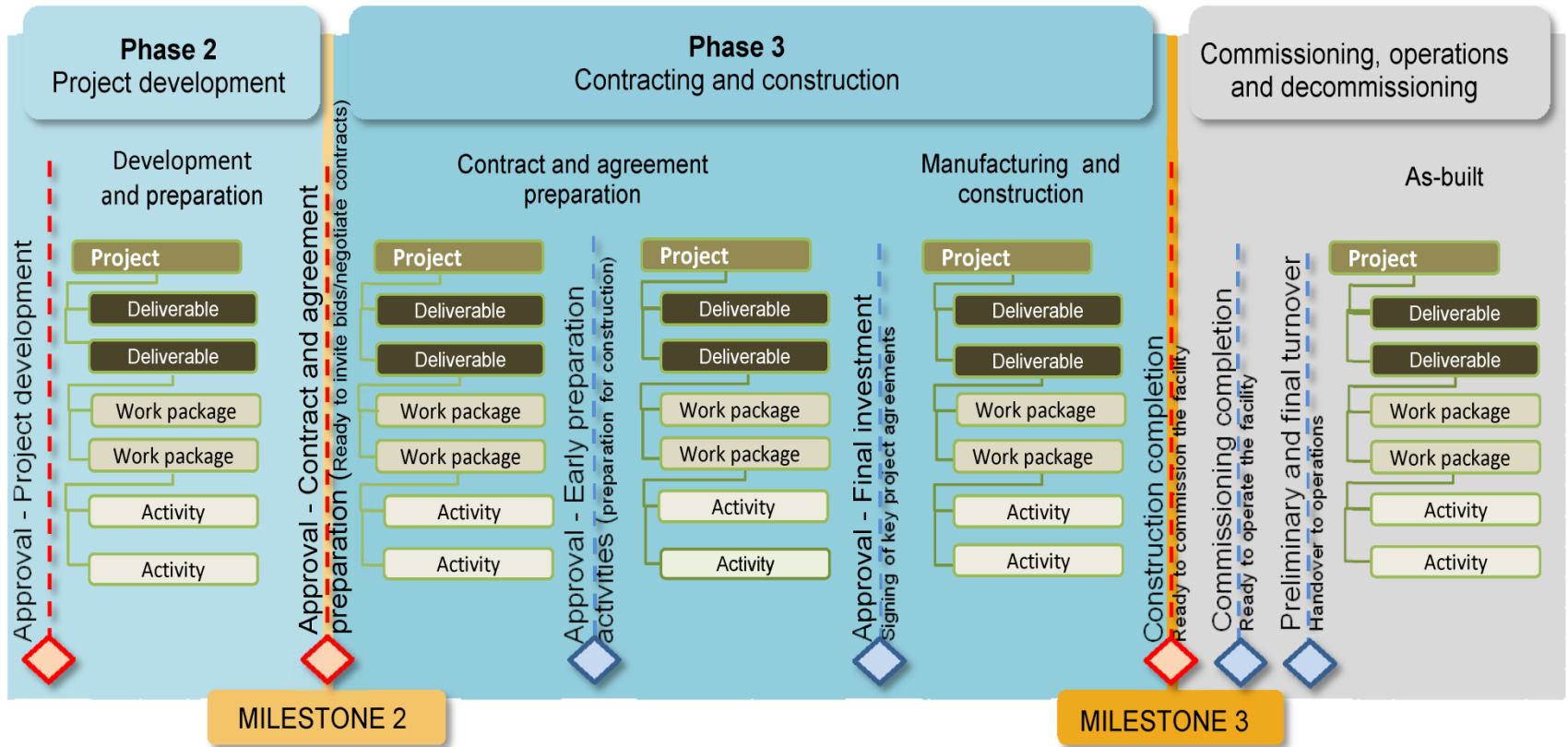
What you may need to agree with the vendor / EPC contractor (Example)?



- Project Execution
- Communication
- Contract & Change Management
- Risk Management
- Insurance Management
- Dispute Management
- Turnover/closeout
- Information Management
- Project Control Management
- Personnel Management (HR)
- Requirement Management
- Quality Management
- Design Management
- Configuration Management
- Procurement Management
- Manufacturing Management
- Construction Management
- Installation Management
- Commissioning Management
- HSE Management
- Licensing and Permitting
- Security management (classified)
- Safeguards Management

Remember – it is not just your organization that needs to deliver quality results!

PM ACTIVITIES IN EACH PHASE



You are supposed to update your plans after each approval gate!

How to get confused with project methodologies...



International
Organization for
Standardization



Project documentation in numbers – example

- User accounts: ~ **450**
- Contractors managed through the CSMS: **40**
- Processed documents:
(more than **106.000** considering all revisions) ~ **45.700**
- Comment sheets issued ~ **102.000**
- Avg. time for commenting activities ~ **28 days**
- Avg. number of documents under commenting ~ **3.000**
- Number of recorded comments ~ **205.000**

This does not represent the maximum!

It is important to have a good and scalable EDMS (Electronic Documents Management System) from the beginning

What is Management System for a newbuild project / programme?



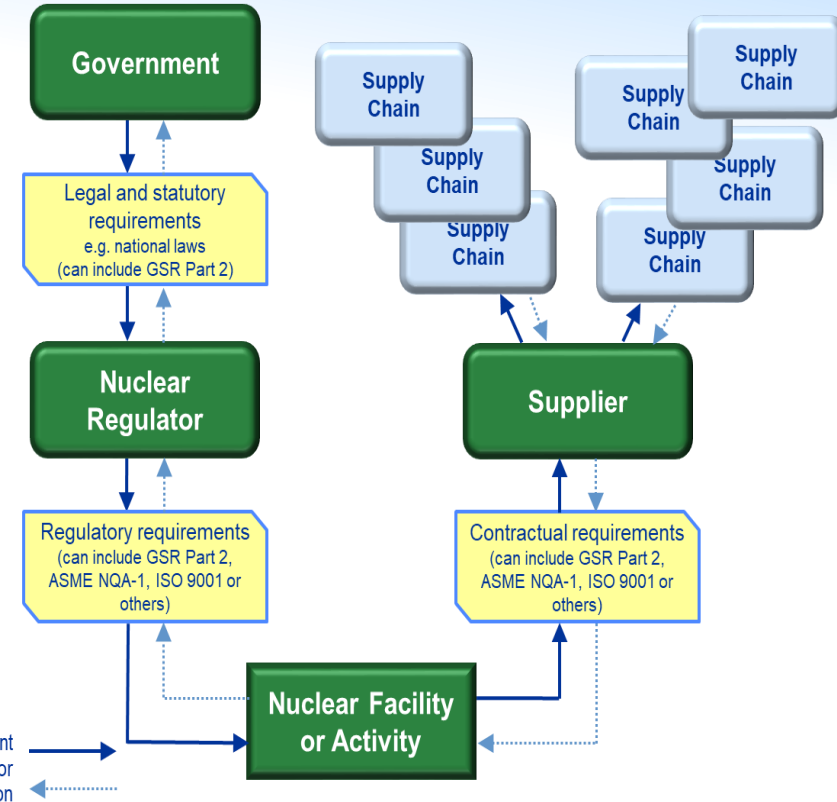
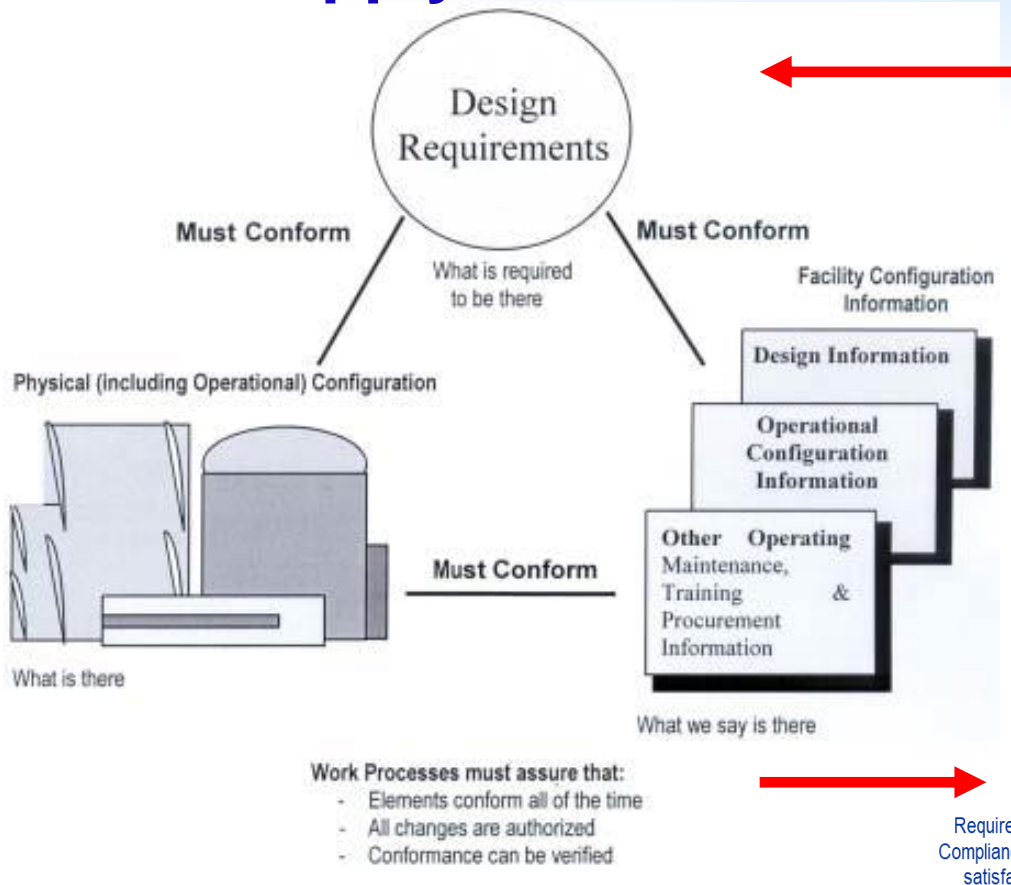
- A management system is a set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective way.
- A management system integrates all elements of an organization into one coherent system, to enable all of the organizations objectives to be achieved and satisfy the stakeholders. These elements include the structure, resources and processes.

Think: 1. New NPP project / programme vs 2. A project to change something in an existing facility/organization

-

similarities and differences?

Problem: Configuration Management & Supply Chain



Difficulty: how to ensure conformance with all the objectives in a full international and national supply chain in a mega-project with a myriad of interfaces?

Strategy for supply chain management:



Business impact versus supply market risk (Kraljic 1983, “Purchasing must become supply management”)

Supports the concept of “extended enterprise”

Suppliers of products and services are your important stakeholders

Business impact

LEVERAGE	STRATEGIC
<ul style="list-style-type: none"> High expenditure area Many existing alternate products/services Many qualified supply sources Goods/services readily available Commercial involvement can significantly impact price <p>Commodities (gravel, transport,...) ...local suppliers, focus on price / image</p>	<ul style="list-style-type: none"> Strategic to operations Few qualified supply sources Large expenditures Design to quality critical Complex specifications <p>Global technology vendors, long term partnerships ...</p>
ROUTINE	BOTTLENECK
<ul style="list-style-type: none"> Many existing alternate products/services Many sources Low value Small individual transactions “Anyone” could buy it Unspecified items for everyday use <p>Office supplies/services, cafeteria, ...small effort, mid-term contracts (?)</p>	<ul style="list-style-type: none"> Very complex specifications Few alternate products available Few qualified sources of supply May have big impact on ongoing operations or maintenance New technology or untested processes involved in the provision of the product or service <p>Analyses, inspections, high tech parts,...), long term, contracts, bringing up suppliers, ensure buffers</p>

Supply market challenge

Common requirements/advice from IAEA sources



- **Documented MS**
- Processes to be defined
- **Organization (licensee) to retain responsibility for safety**
- Continual improvement processes / corrective action programmes
- Promote a strong safety culture
- Safety shall be paramount
- **Application of requirements may be graded**
- Adequate resources
- Staff to be trained
- **Processes for procurement, purchasing, including outsourced activities**
- **Inspection, testing, verification & validation** requirements and acceptance criteria to be specified
- Products are to be controlled
- **Supplier selection** to be by specified criteria & their performance evaluated
- **Documents and records** to be controlled



Common requirements/...

(cont.'d)



- Defined process needed for **managing contractors** (including providing oversight)
- Organization to have clear understanding of product or service being supplied (**'informed customer' capability**)
- Procurement activities related to design to follow a controlled process
- **Configuration management** is critical
- Plant **modifications** to be controlled
- Inventory levels and spare parts to be managed
- Procurement organization to:
 - Transfer clear **information** to suppliers (**cascading info**)
 - Ensure suppliers are capable
 - Monitor suppliers to confirm performance
 - Conform products and services conform to requirements
 - Specify contact persons and interfaces

IAEA Safety Standards
for protecting people and the environment

Construction for
Nuclear Installations

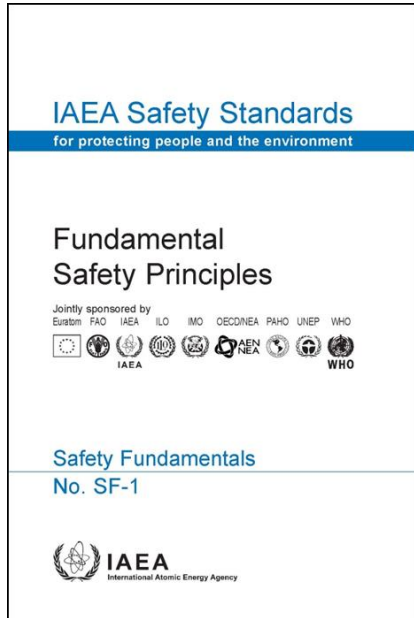
Specific Safety Guide
No. SSG-38



IAEA Safety Standards on Management System

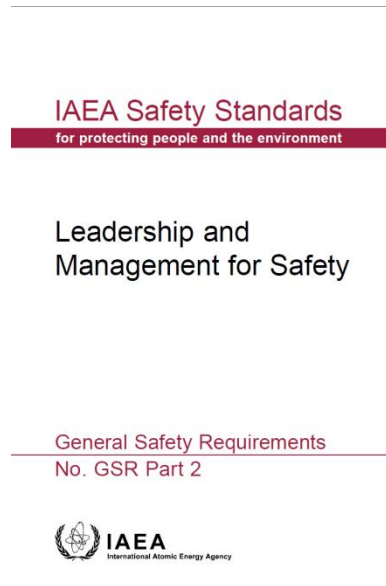


SAFETY FUNDAMENTALS



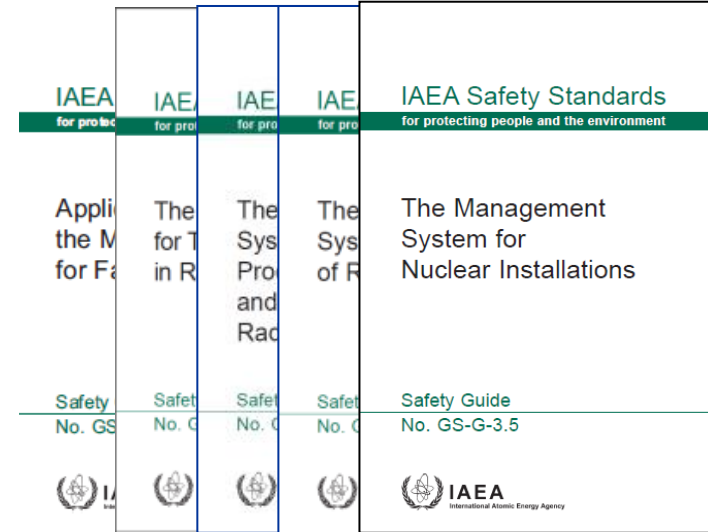
The pillars of a safe, secure and sustainable nuclear programme

SAFETY REQUIREMENTS



The requirements for a management system ensuring safety is not compromised

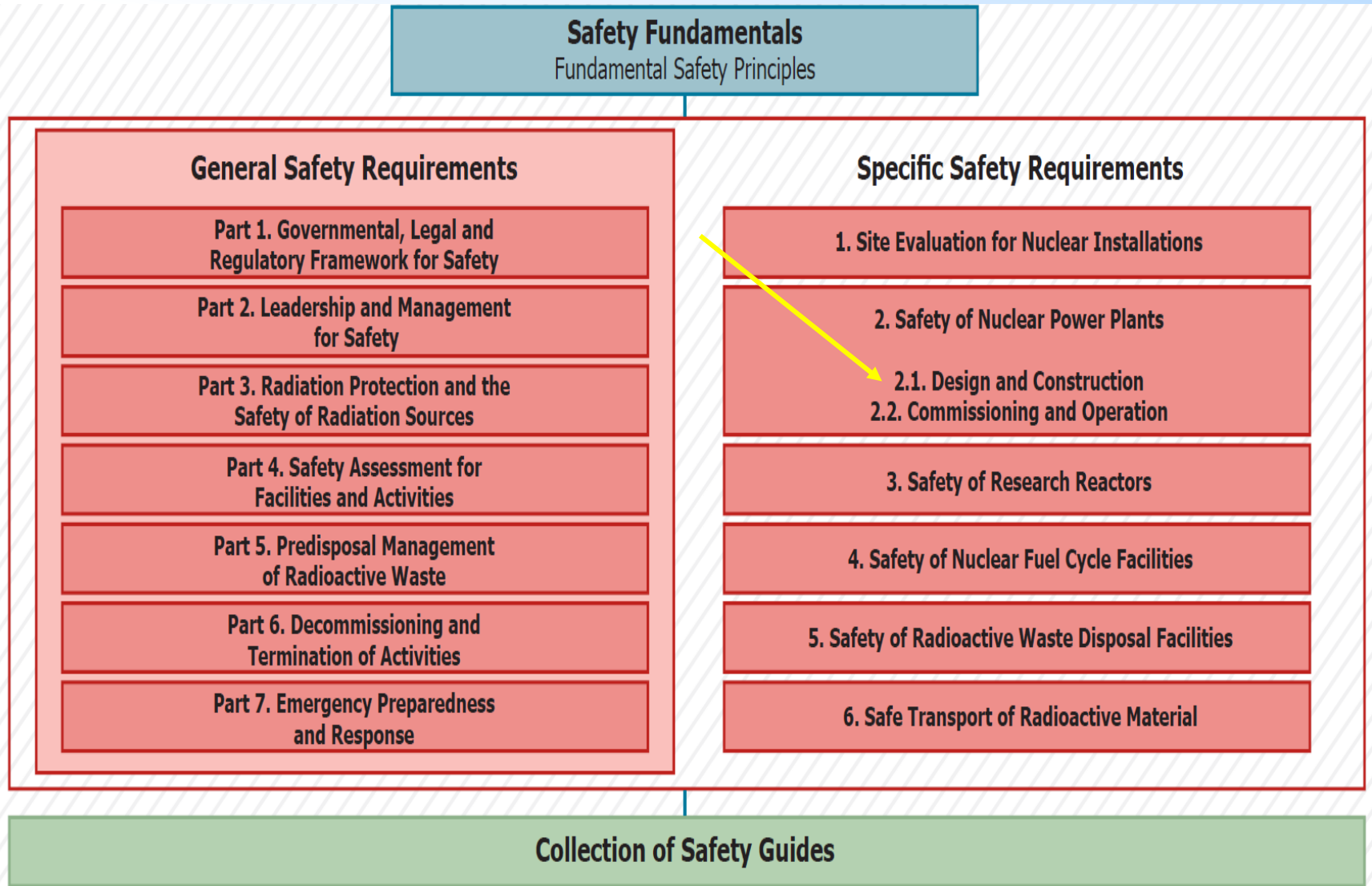
SAFETY GUIDES



Guidance for implementing a management system that meets the established requirements

Not only for operating facilities, but include rather limited set of project specifics

IAEA set of requirements



... and NE Series practical guidance to aid in implementation

WHAT CAPABILITY DOES THE CUSTOMER NEED TO HAVE?

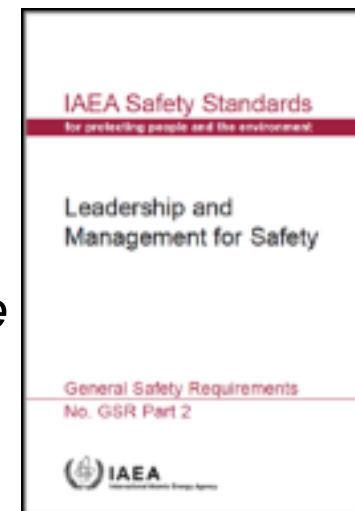


GSR PART 2 – LEADERSHIP AND MANAGEMENT FOR SAFETY:

The capability of the organization to have a clear understanding and knowledge of the product or service to be supplied is sometimes termed an ‘informed customer’ capability

- The concept relates to a capability required of organizations when using suppliers of (manufactured) products, contractors or external expert support (e.g. TSOs/inspection organizations/NBs)
- It allows for discrete, ‘hands-on’ oversight of critical activities where outcomes or process steps can be less well defined
- *We often talk about how good or bad the suppliers are – are the customers doing their share?*

See also IAEA Safety Fundamentals and Nuclear Energy Basic Principles / what do they say about responsibility



Recent activities 2019-2020

Nuclear Supply Chain Management Webpages opened in 2020

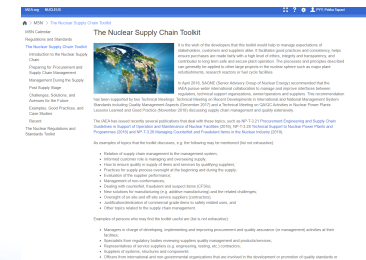
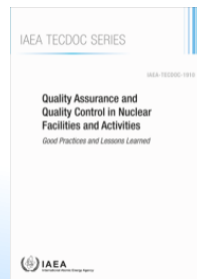
Webinar on COVID19 and the Nuclear Supply Chain (July 2020) and Webinar Series of Nuclear Supply Chain started (December 2020)

Nuclear Supply Chain Management toolkit launched in November 2020
CM on Quality Assurance in the context of Nuclear Power Plant Advanced Manufacturing (September 2020)

Toolkit for Regulations and Standards in the Area of Quality and Management Systems Requirements (pilot use from December 2020)

TECDOC 1910 issued: (June 2020): Quality Assurance and Quality Control in Nuclear Facilities and Activities - Good Practices and Lessons Learned

Pilot Training Course on Nuclear Supply Chain Management, Oct 2019



Events 2021

1. **IAEA Training Course on Nuclear Supply Chain Management and Procurement** with Rosatom, fully virtual, 20-22 Oct 2021
2. SC [Webinars](#) on supply chain (2020-2021) – see the relevant page
3. Conference on [MSE2021](#) “Management systems for a sustainable nuclear supply chain”, 7-9 September 2021 (with FORATOM) – virtual
5. **Technical Meeting on Recent Topics of Nuclear Supply Chain Management** (16-20 August 2021, VIC, Vienna) - virtual



Events in 2022

1. **Technical Meeting on Use of Commercial Grade Products and Services in Nuclear Power Plants**, 19-22 April, (virtual/hybrid!) Vienna – [Website](#)
2. **IAEA Training Course on Nuclear Supply Chain Management and Procurement**, Vienna, 18-22 July (hybrid) - [Website](#)
3. **SC [Webinars](#)** on supply chain (2020-2022) – see the relevant page for updates
4. “Enhancing a sustainable nuclear supply chain”, 7-9 September 2022 (with FORATOM) – in Helsinki ([Website](#))
5. **[Technical Meeting on Inventory Management for Nuclear Power Plants, Q4, Vienna](#)**

Picture : TVO



Nuclear Supply Chain Introductory Webinars



- Covid-19 and Its Impact on the Nuclear Power Supply Chain (9 July)
- Nuclear Supply Chain Management – The Global View (3 December)
- Requirements to the Supplier – Why are they important and where do they come from? (16 December)
- How to Find Good Suppliers – and how to know if they are good for you (14 January)
- Supply Chain Management Strategy – How to simplify the complex? (28 January)
- Supervising the Supply Process – What do you need to do? (11 February)
- Non-Conformances – What are they and how to manage them? (25 February)
- Delivery Process Final Stages – What do you have to Remember? (18 March)

Nuclear Supply Chain Advanced Webinars



- Counterfeit, Fraudulent, and Suspect Items – What do you need to know? (6 May 2021)
- Use of Commercial Grade Items - When and how? (9 June in cooperation with NNF21)
- COVID-19 and the Nuclear Supply Chain – What have learned? (9 September 2021 in cooperation with FORATOM MSE2021)
- Obsolescence and inventory – Are there good practices?
- Innovations (such as Advanced Manufacturing) – Solution or threat?
- Remote and Hybrid Verifications, Audits and Inspections – What have we learned? (20 January 2022)
- Graded Approach – What are its secrets? (13 April 2022)
- Supply of service – How is it specific?

Other Publications

- **“Quality Assurance and Quality Control Activities in Nuclear Power Plants: Lesson Learned and Good Practices” – Issued June 2020**
- **“Management of Nuclear Projects” (Nuclear Energy Series), NG-T-1.6 – Issued in October 2020**
- **Managing Counterfeit and Fraudulent Items in the Nuclear Industry, NP-T-3.26, published in 2019**
- **“Challenges and Approaches for Selecting, Assessing, and Qualifying Commercial Industrial Digital Instrumentation and Control Equipment for Use in Nuclear Power Plant Applications” – September 2020**
- *Acceptance Process of Commercial Grade Products for Use in Nuclear Power Plant Safety Systems (P.Pyy) – TM in April 2022 reviewed positively*
- *Inventory Management in Nuclear Power Plants: Lessons Learned and Good Experiences (A. Dutta Ray)*

*(requires registration)

MSN Calendar

Regulations and Standards

The Nuclear Supply Chain Toolkit

Introduction to the Nuclear Supply Chain

Preparing for Procurement and Supply Chain Management

Management During the Supply

Post Supply Stage

Challenges, Solutions, and Avenues for the Future

Examples, Good Practices, and Case Studies

Recent

The Nuclear Regulations and Standards Toolkit

The Nuclear Supply Chain Toolkit



It is the wish of the developers that this toolkit would help to manage expectations of stakeholders, customers and suppliers alike. It facilitates good practices and consistency, helps ensure purchases are made fairly with a high level of ethics, integrity and transparency, and contributes to long term safe and secure plant operation. The processes and principles described can generally be applied to other large projects in the nuclear sphere such as major plant refurbishments, research reactors or fuel cycle facilities.

In April 2018, SAGNE (Senior Advisory Group of Nuclear Energy) recommended that the IAEA pursue wider international collaboration to manage and improve interfaces between regulators, technical support organizations, owner/operators and suppliers. This recommendation

has been supported by two Technical Meetings: Technical Meeting on Recent Developments in International and National Management System Standards including Quality Management Aspects (December 2017) and a Technical Meeting on QA/QC Activities in Nuclear Power Plants: Lessons Learned and Good Practice (November 2018) discussing supply chain management and quality extensively.

The IAEA has issued recently several publications that deal with these topics, such as NP-T-3.21 [Procurement Engineering and Supply Chain Guidelines in Support of Operation and Maintenance of Nuclear Facilities](#) (2016), NP-T-3.28 [Technical Support to Nuclear Power Plants and Programmes](#) (2018) and NP-T-3.26 [Managing Counterfeit and Fraudulent Items in the Nuclear Industry](#) (2019).

As examples of topics that the toolkit discusses, e.g. the following may be mentioned (list not exhaustive):

- Relation of supply chain management to the management system;
- Informed customer role is managing and overseeing supply;
- How to ensure quality in supply of items and services by qualifying suppliers;
- Practices for supply process oversight at the beginning and during the supply;
- Evaluation of the supplier performance;
- Management of non-conformances;
- Dealing with counterfeit, fraudulent and suspect items (CFSIs);
- New solutions for manufacturing (e.g. additive manufacturing) and the related challenges;
- Oversight of on-site and off-site service suppliers (contractors);
- Justification/dedication of commercial grade items to safety related uses, and
- Other topics related to the supply chain management.

Examples of persons who may find the toolkit useful are (list is not exhaustive):

- Managers in charge of developing, implementing and improving procurement and quality assurance (or management) activities at their facilities;
- Specialists from regulatory bodies reviewing suppliers quality management and products/services;
- Representatives of service suppliers (e.g. engineering, testing, etc.) contractors;
- Suppliers of systems, structures and components
- Officers from international and non-governmental organizations that are involved in the development or promotion of quality standards or supply chain sustainability

National legal and regulatory requirements in the area of quality and management systems to suppliers - Toolkit



References

🏠 > MSN > The Nuclear Regulations and Standards Toolkit (under construction) > [National Laws and Regulations](#)

Introduction, Background and Scope

Overview on Legislation, Regulation and Standards

National Laws and Regulations

Template

Standards

Community of Practice

References

National Laws and Regulations

This section is based on section "3.0 Template", which questionnaire is including regulatory management systems and quality management requirements in different IAEA Member States. Regulatory guidance is equally included. Often these requirements are those that are least tangible for all those coming from another country. In some cases, check boxes are used with completing free text description. The idea is not to replace any other reporting channel like Convention on Nuclear Safety. This information is intended to represent a brief executive summary with links to your websites or documents (preferably in English, indicate if otherwise) to the extent possible.



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Questions?

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Department of Nuclear Energy*

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Register to get regular MSN Newsletters!*

Thank you!