



**IAEA**

International Atomic Energy Agency

*Atoms for Peace and Development*

# **5.01 Mapping Human Resources Needs and identification of Common Professional Competencies between Fusion and Fission**

Technical Meeting on Synergies in Technology Development between Nuclear Fission and Fusion for Energy Production

**9 June 2022**

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**Nuclear Power Engineering Section**

# HRD experience from Fission to Fusion

**From 2015 to 2019: Experience from the ANNETTE project implemented by the European Nuclear Education Network, funded by EURATOM.**

- *Coordinating the nuclearization of Fusion*

**From 2020 onwards: Activities in the Subprogramme 1.1.2, “Management and Human Resource Development for Nuclear Power Programmes” in the Nuclear Power Engineering Section**

- *Support to management systems, leadership and stakeholder involvement*
- *Human resource development for nuclear power programmes*
  - *Systematic Approach to Training*

# HRD Strategy



# What is Workforce Planning?

Workforce planning is a process to ensure:

the right number of people with

the right Knowledge, Skills, Attitudes are employed in

the right place

at the right time

to deliver an organization's short and long-term objectives.

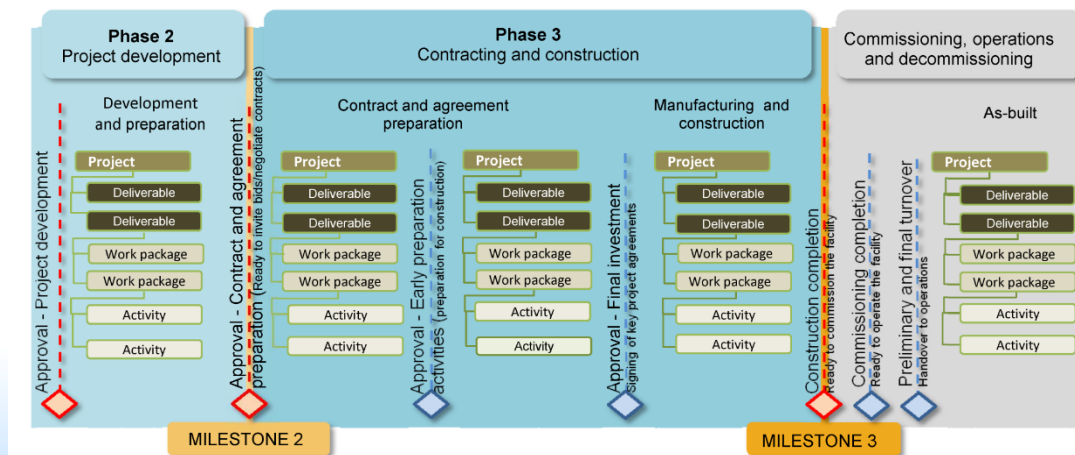
Short term planning – up to 12 months

Medium term planning – 1 to 3 years

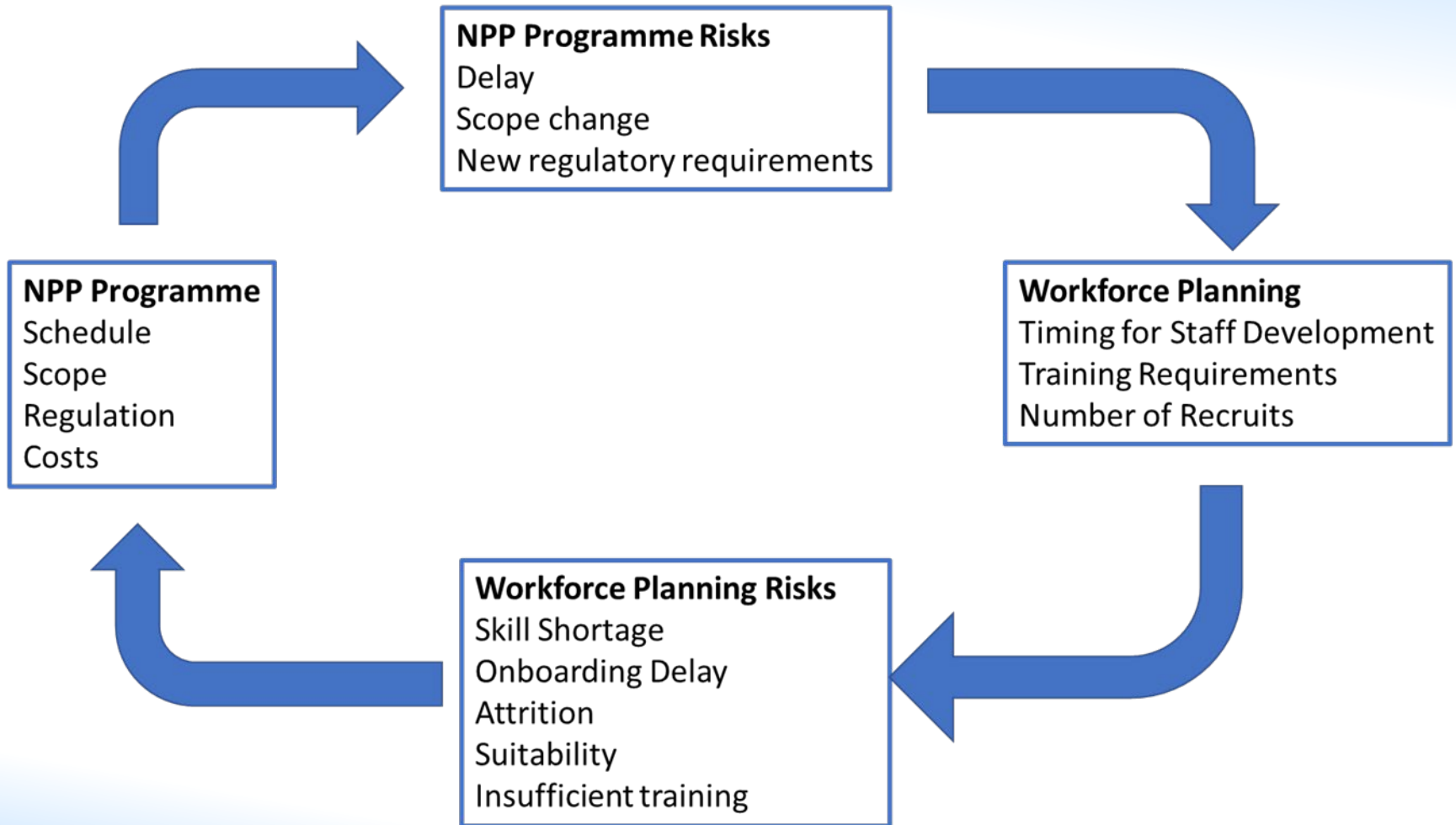
Long term planning – 3 to 10 years

# Steps of Workforce Planning

1. Assessing **current** workforce
2. Analysing **future** workforce demands
3. Identifying and determining **gaps**
4. Developing **strategies** to address the gaps
5. Identifying **lead times** for developing the individuals
6. **Reviewing** the workforce plans on a regular basis



# HRD Risk Management



# E&T Fission and Fusion Collaboration Example

## ANNETTE Project,

*“Advanced Networking for Nuclear Education and Training and Transfer of Expertise”*  
funded in 2016 by the Euratom Research and Training Programme.

Collaboration between ENEN and FUSENET => Work Package 6

**“...E&T challenges of the transition from non-nuclear to nuclear of the fusion workforce were addressed”**

*“...the human resources involved in development, design and construction of fusion facilities must possess suitable nuclear related competences”*

W. Ambrosini, L. Cizelj, P. Dieguez Porras, R. Jaspers, J. Noterdaeme, M. Scheffer, and C. Schoenfelder

[https://inis.iaea.org/search/search.aspx?orig\\_q=RN:50048691](https://inis.iaea.org/search/search.aspx?orig_q=RN:50048691)

EPJ Web of Conferences **170**, 10001 (2018) <https://doi.org/10.1051/epjconf/201817010001>  
ANIMMA 2017

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## ANNETTE Project: Contributing to The Nuclearization of Fusion

W. Ambrosini, L. Cizelj, P. Dieguez Porras, R. Jaspers, J. Noterdaeme, M. Scheffer,  
and C. Schoenfelder

**Abstract**— The ANNETTE Project (Advanced Networking for Nuclear Education and Training and Transfer of Expertise) is well underway, and one of its work packages addresses the design, development and implementation of nuclear fusion training. A systematic approach is used that leads to the development of new training courses, based on identified nuclear competences needs of the work force of (future) fusion reactors and on the current availability of suitable training courses. From interaction with stakeholders involved in the ITER design and construction or the JET D-T campaign, it became clear that the lack of nuclear safety culture awareness already has an impact on current projects. Through the collaboration between the European education networks in fission (ENEN) and fusion (FuseNet) in the ANNETTE project, this project is well positioned to support the development of nuclear competences for ongoing and future fusion projects. Thereby it will make a clear contribution to the realization of fusion energy.

**Index Terms** — ANNETTE, competence, DEMO, education, ENEN, FuseNet, fusion, ITER, nuclear, training.

I. INTRODUCTION

The ANNETTE Project (Advanced Networking for Nuclear

fusion program aiming, via a comprehensive, integrated science, technology and engineering program, to provide electricity to the grid by the middle of the 21<sup>st</sup> century. As noted in the roadmap to the realization of fusion energy (the Fusion Roadmap, see <https://www.euro-fusion.org/wp-content/uploads/2013/01/JG12.356-web.pdf>), the evolution of the fusion program requires a shift from “from pure research to designing, building and operating future facilities like ITER and DEMO. This transition requires strengthening the available engineering resources, with a marked change from non-nuclear to nuclear technologies, and has to be facilitated during Horizon 2020 by specific measures in support of training and education”.

At the beginning of 2016, the ENEN (European Nuclear Education Network, see <http://www.enen-assoc.org/>) association together with 24 partners launched the four-year project ANNETTE. This project is co-funded by the European Commission under the Euratom Research and Training Programme on Nuclear Energy within the H2020 Programme, Call NRPFP 2014-2015.

One partner of ENEN in this project is the FuseNet association (European Fusion Education Network, see

# ANNETTE Project - WP6

\*Public Deliverable 6.1: Competence Needs with Respect to Nuclearization of Fusion. Author Christian Schoenfelder.

**2016 - A workshop pioneering collaboration on competences:**

**Stakeholders** participating in design and/or construction of ITER (including manufacturing, qualification and licensing) **identified job positions that require nuclear competences:**

- Profiles of job positions
  - Job requirements (competences)
- } in the fission and the fusion area  
are comparable
- Representative **job examples** and related nuclear competences, would provide most of the items for the “**nuclearization**” training for fusion

\*Ref: <http://www.annette.eu/wp-content/uploads/2021/02/D6.1-Competence-needs-for-the-nuclearisation-of-Fusion.pdf>



# Job positions with common professional competencies

1. **Positions to Design, Manufacturing and Operation of Nuclear Components, Systems or Facilities that require Nuclear Competences.**  
Example: Safety Engineer, Radiation Monitoring Engineer, Licensing Expert
2. **(Safety) Protection Important Activities positions.**  
Example: Nuclear Engineer calculation of DBAs, Mech Eng. for Welding
3. **Job positions with critical gaps, namely**
  - a) **Whole system understanding** - Chief Engineer
  - b) **Understanding of requirements and interfaces** - Systems Engineer
  - c) **Hands-on skilled technicians**
4. **Other examples**
  - a) PSA Nuclear Experts
  - b) I&C Codes and Standards
  - c) Seismic specialists, etc...

*Education: **Fusion Nuclear Engineer** must be a Nuclear Engineer with more specialized knowledge of fusion specific topics (vacuum, cryogenic, electromagnetic, tritium waste)*

# Management areas

- 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

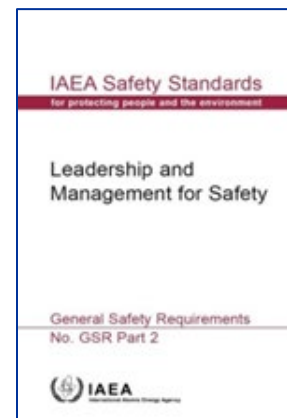
Remember – it is not just your organization that needs to deliver quality results!

# Collaboration - Fission and Fusion

ITER Organization must follow the applicable French national laws and regulations for licensing a nuclear facility:

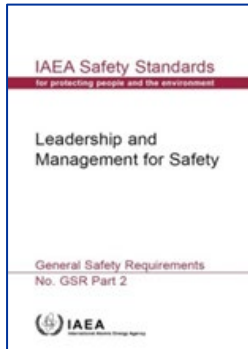
- **Throughout all its lifecycle** (design, manufacturing, assembly, construction, commissioning, operation and decommissioning)
- Ensure the activities of its **Supply Chain, including sub-contractors** (even with 5 levels) will comply with the applicable French nuclear regulation
- **Safety culture of all personnel** involved must be ensured, particularly during manufacturing, assembly, construction and commissioning activities.

## Leadership and Management for Safety



# Leadership and Management for Safety

## General Safety Requirements Part 2



*Relevant for Human Resource Management since:*

*requirements recognise the balance between Leadership, Management, and Maintaining and improving Safety Culture*

**2. Responsibility for Safety**

Req. 6: Integration of the management system

**3. Leadership For Safety**

Req. 2) Demonstrate leadership for safety by managers

**4. Management for Safety**

**6. Measurement, Assessment & Improvement**

**5. Culture for Safety**

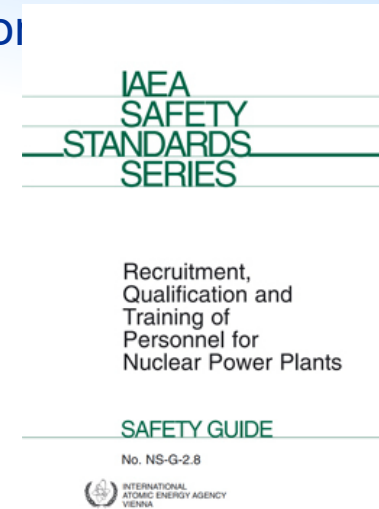
Req. 12) Fostering a culture of safety

Req. 13) Management, assessment & improvement of leadership for safety & of safety culture

# Key Publications

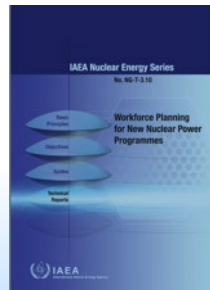
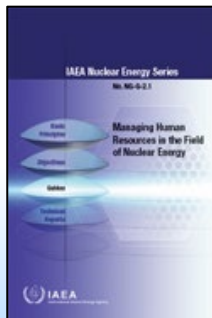
## NS-G-2.8 - Recruitment, Qualification and Training of Personnel for Nuclear Power Plants

- **Recruitment and selection**
- **Competence and qualification**
- **Systematic Approach to Training**
- **Training programmes**
- **Training facilities and Materials**
- **Attitudes and Skills for Safety Culture**



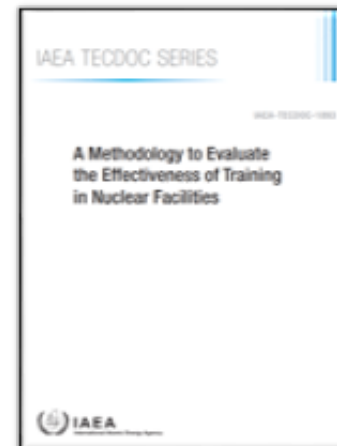
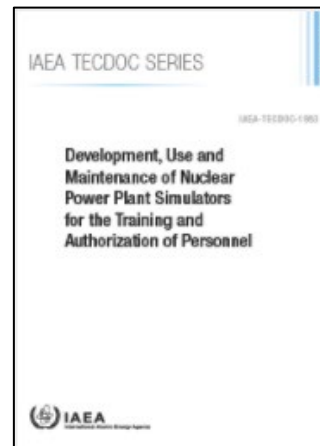
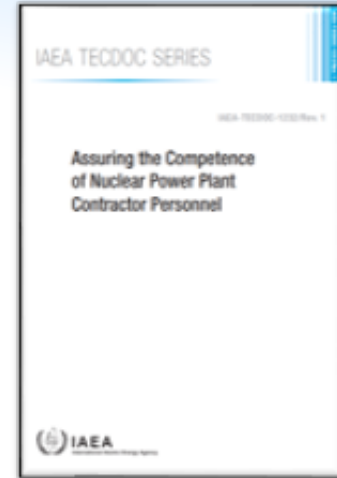
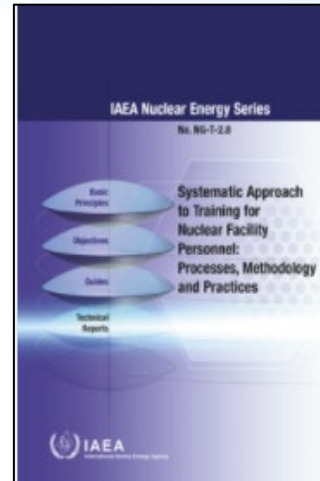
## Managing Human Resources in the Field of Nuclear Energy (IAEA NE Series No. NG-G-2.1 (Rev.1), Preprint 2021)

[https://inis.iaea.org/collection/NCLCollectionStore/\\_Public/52/070/52070541.pdf?r=1](https://inis.iaea.org/collection/NCLCollectionStore/_Public/52/070/52070541.pdf?r=1)



# Training and Qualification

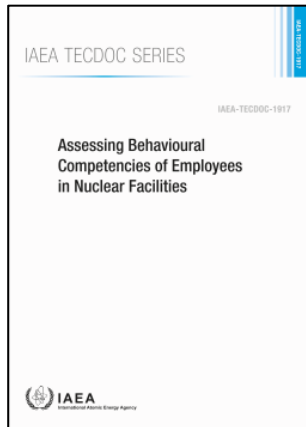
- Systematic Approach to Training for Nuclear Facility Personnel – Processes, methodology, guidance and practices NE SERIES No. NG-T-2.8 (PC approved) Draft Advance Publishing Copy
- Assuring the Competence of Nuclear Power Plant Contractor Personnel IAEA TECDOC-1232/Rev 1, (2020)
- Development and maintenance of NPP simulators for the training and authorization of personnel (ready for PC approval)
- A Methodology to Evaluate the Effectiveness of Training in Nuclear Facilities (2019)



# Assessing Behavioural Competencies of Employees in Nuclear Facilities

## PURPOSE

*To provide guidance and recommendations by offering a practical approach to **assessing the behavioural competencies** for safe, secure and effective performance across the nuclear workforce.*



- Outlines tools and approaches to aid the **behavioural assessment processes**
- Provides both **general and role-specific recommendations** to improve the quality of selection, promotion, training and development decisions
- Addresses key issues and critical considerations for **assessment practices**
- Provides reference to develop or improve a **behavioural competency assessment programme**

## SCOPE

Applicable to human resource management in all nuclear facilities, including nuclear power plants and nuclear fuel cycle and waste management facilities, and across their entire life cycle, including siting, designing, constructing, commissioning, operating, modernizing and decommissioning.

# HRD-NPES approach to Human Capacity Building







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# Questions?

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*Thank you!*