

INPRO Dialog Forum DF-8
26-29 August 2014

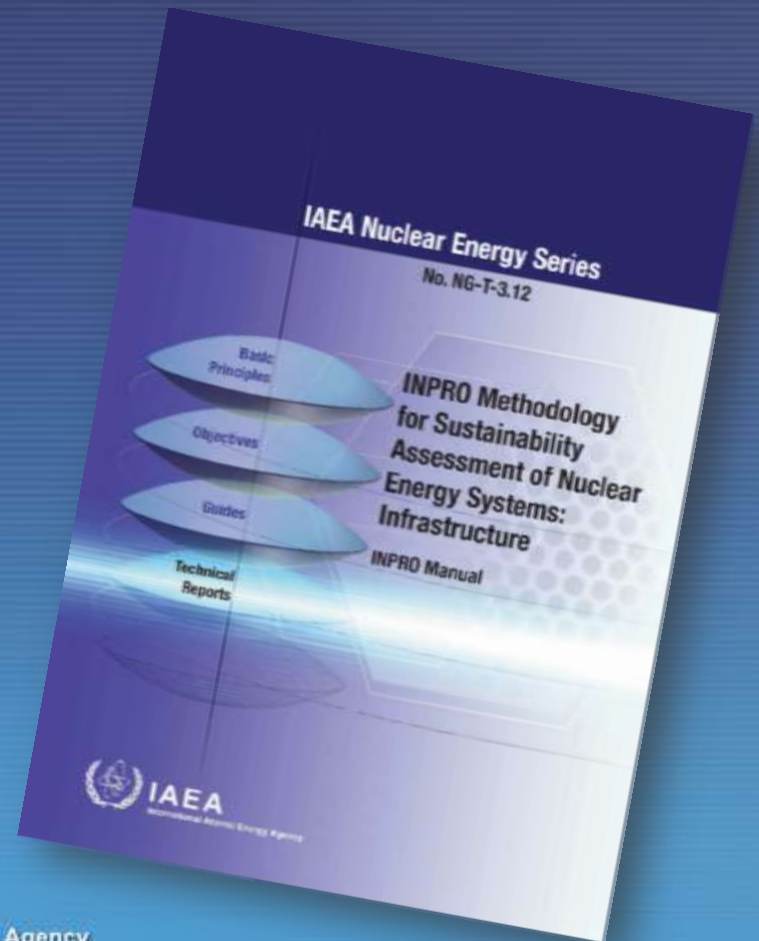
Revised INPRO Methodology in the Area of Infrastructure

Presented by J.R. Phillips
IAEA/INPRO Section



IAEA

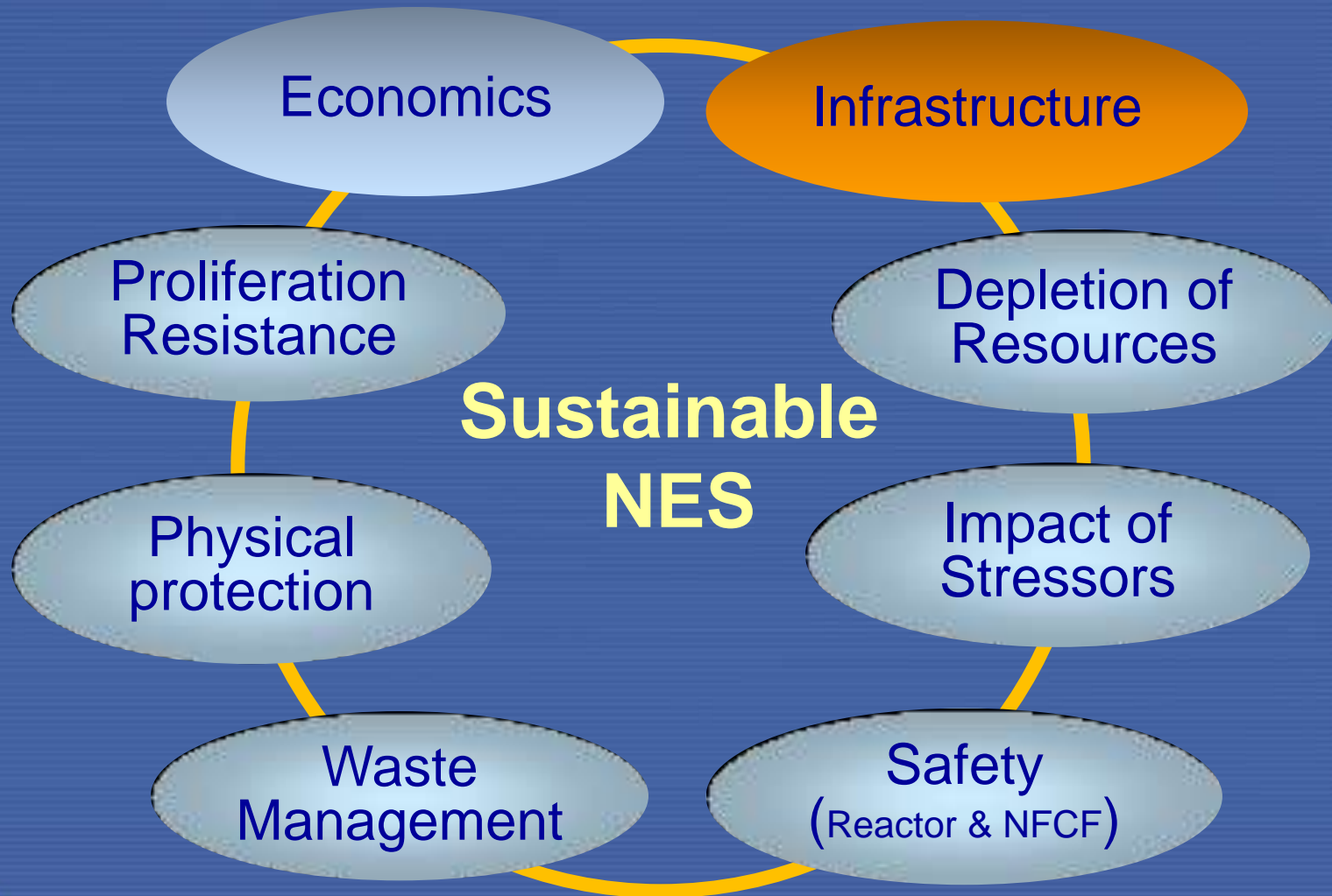
International Atomic Energy Agency



Content

- Introduction
- Technical update of the infrastructure manual
- Contents of the manual
- Input Data for INPRO assessment
- Conclusion

INPRO methodology areas



History of INPRO manual update

- **July 2012:** INPRO steering committee initiated the project to update the INPRO methodology.
- **November 2012:** kick-off meeting was organized in Vienna.
 - For the INPRO methodology area of infrastructure, 38 specific comments were received (plus 44 general comments for all areas of the methodology) and resolved in the update.
- **May 2013:** updated report on infrastructure was distributed for discussion internally in IAEA, and externally to participants of kick-off meeting. Received comments were formally disposed in the updated manual.
- **August 2014:** manual on infrastructure was approved and published as NE-Series document NG-T-3.12: “INPRO Methodology for Sustainability Assessment of Nuclear Energy Systems: Infrastructure” (now available for download on the IAEA website)

Technical updates in INPRO Manual on Infrastructure

- Options in old user requirements UR1 to UR4 were converted into two new user requirements UR5 and UR6 covering:
 - **Optimization** of infrastructure **by design** (reduction of personnel for operation, maintenance and decommissioning, use of prefabrication).
 - Use of **regional and international arrangements** (harmonization of licensing, use of international support industry, use of international educational institutions, BOO).
- Inclusion of latest references (IAEA, etc.) available in the area of infrastructure.

Technical updates in INPRO Manual on Infrastructure (cont.)

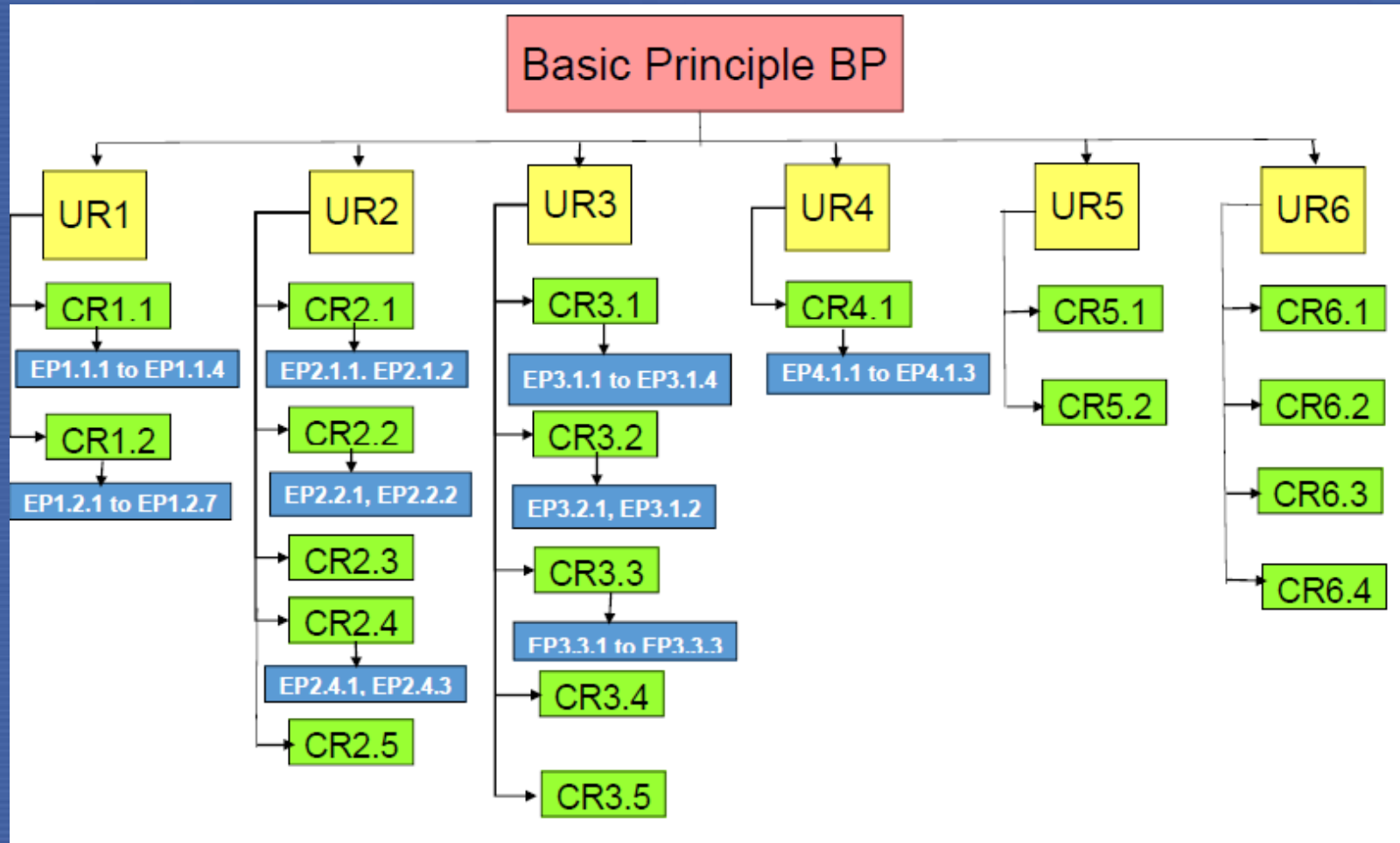
- **INPRO assessment** of infrastructure and application of the **Milestones Approach and INIR Missions**:
 - Milestone Approach and INIR Missions are an IAEA expert advisory service provided to countries developing their nuclear power infrastructure in support of introduction of nuclear power programs and construction of an NPP.
 - INPRO Methodology checks status of infrastructure in regard to sustainability of nuclear energy system – **INPRO Methodology is a NES sustainability metric, not an expert advisory service specific to infrastructure development in embarking States.**
 - NESAs assessors from a Member State can use documentation developed from the **Milestones Approach** as supporting data for an INPRO infrastructure assessment **if INIR missions have been previously completed.**



IAEA

INPRO
International Project on
Innovative Nuclear Reactors
and Fuel Cycles

Updated Structure of the Infrastructure Assessment



Basic Principle in the updated area of Infrastructure

To be sustainable:

“A country shall be able to adopt, maintain, or enlarge a nuclear energy system for the supply of energy and related products without making an excessive investment in national infrastructure”.

Six User Requirements in the updated area of Infrastructure

UR1: Legal framework and institutions.

UR2: Industrial and economic considerations.

UR3: Public acceptance and political support.

UR4: Human resources.

UR5: Optimization by design.

UR6: Consideration of regional or international arrangements.

Nineteen Criteria (CR) cover all aspects of these six URs.

UR1: Legal and Institutional Framework

- **Legal framework:** Nuclear Law, Conventions, Treaties, Regulations and Guidelines, Regimes for Nuclear Liability, Safety, Emergency Preparedness, Security and Non-proliferation.
- **Institutional framework:** Regulatory Bodies responsible for maintaining nuclear regimes.
- Objective of framework: protection of individuals, property and environment against radiation and other nuclear hazards.

➔ To be sustainable, NES needs a legal and institutional framework established by the State **in accordance with international requirements, standards and good practices.**

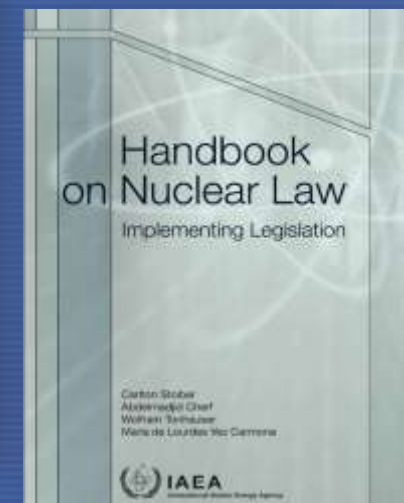
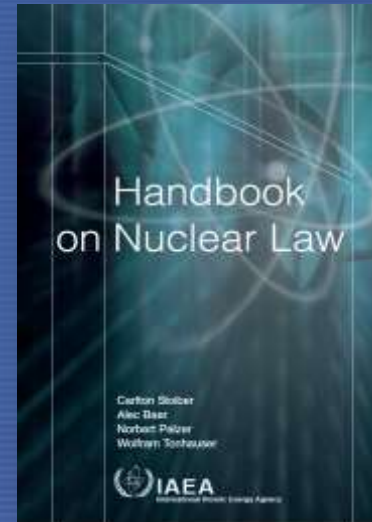


IAEA

INPRO
International Project on
Innovative Nuclear Reactors
and Fuel Cycles

UR1: Legal and Institutional Framework (cont.)

- INPRO methodology checks:
 - completeness of scope and adequacy of nuclear law and regulations, participation in conventions.
 - Independence and general functions of regulatory body, nuclear regimes (e.g., safety).
- Example of international standards for a legal and institutional framework:
 - IAEA Handbook on Nuclear Law published 2003 and 2010.



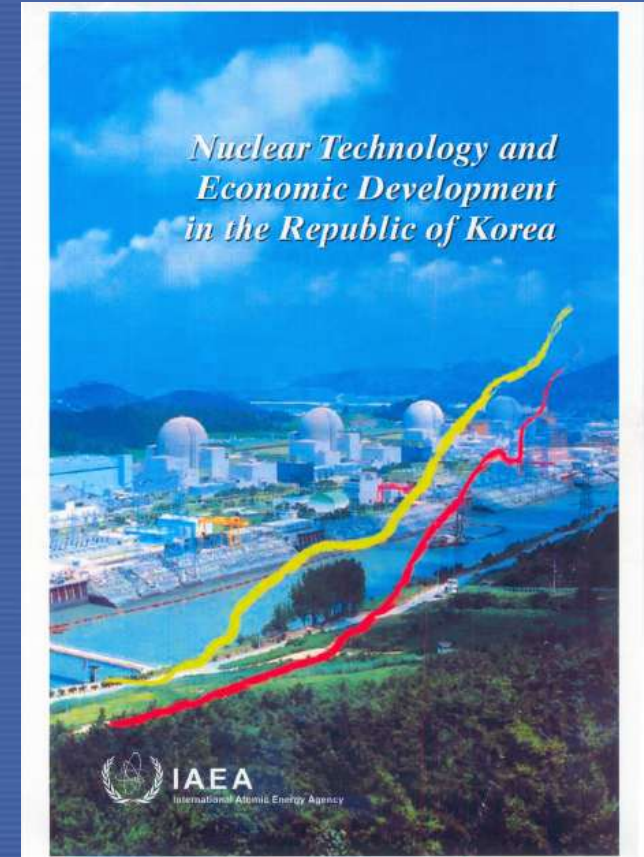
UR2: Industrial and Economic Infrastructure

➔ To be sustainable a NES needs:

- Sufficient **funding** to finance nuclear infrastructure in industry and government institutions.
- Sufficient **benefit to society** (added value of nuclear power program) to cover costs of infrastructure.
- Proper **siting and sizing** of nuclear facilities (power plants and fuel cycle facilities).
- Sufficient **technical support** to operator by national industry based on plan for national participation.

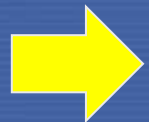
UR2: Industrial and economic infrastructure

- Example study (2009) determining the **benefit to society** of introducing nuclear power:
 - In 2005 value added contribution by nuclear to GDP around 1.3 % (similar to steel industry) in Republic of Korea.



UR3: Public acceptance and political support

- Public Acceptance of nuclear power is strongly influenced by **perception of risk**. Main factors include public perception of:
 - **Familiarity/knowledge/understanding** of the risk.
 - **Benefits/rewards** associated with risk.
 - **Possibility to control/influence** risk.
 - **Trust in institutions** (regulator, operator) responsible for control of risk.



To be sustainable, a NES needs both public acceptance and long term commitment of government to nuclear power.



IAEA

INPRO
International Project on
Innovative Nuclear Reactors
and Fuel Cycles

UR4: Human Resources (HR)

- ➔ To be sustainable a NES needs:
- Skilled and trained HR in government, operators and national nuclear industry.
 - Adequate education and training system (for craftsmen, technicians, engineers and scientists).
 - Sufficient attractiveness of national nuclear power sector (salary and benefits).

UR5: Optimization by Design

➔ To be sustainable a NES should avoid excessive investment in nuclear infrastructure. The designer of a nuclear facility is asked:

- To **optimize number of personnel required** to operate, maintain, repair and decommission nuclear facilities – **use of automation, etc.**
- To use **prefabrication of components** to the extent possible – **capture of manufacturing economies of scale.**

UR6: Regional and international arrangements

➔ For smaller national programs to avoid excessive investments in nuclear infrastructure, a country is asked to consider **regional and international arrangements** to optimize:

- Institutional infrastructure through **harmonization of licensing requirements.**
- Industrial infrastructure by **use of international support industries, BOO contracts, or other means.**
- Education of human resources by **use of international technical training capabilities.**

Input Data for INPRO assessment

- **Data sources** for nuclear energy system assessment (NESAs) in the area of infrastructure:
 - Compiled results of specific **IAEA services** from various IAEA Departments.
 - Published national legal, regulatory, policy and design authority documentation.
- **Examples of IAEA services and missions:**
 - **Milestones approach** (INIR: Integrated Nuclear Infrastructure Review) and **Energy System Planning** support.
 - IRRS, EPREV, SEED, ISCA, IPPAS, ISSACS, Legislative assistance, etc.



IAEA

INPRO
International Project on
Innovative Nuclear Reactors
and Fuel Cycles

V. Conclusion

Updated INPRO Methodology in the area of Infrastructure assesses 6 main issues:

- Legal and institutional framework
- Economic and industrial infrastructure.
- Public acceptance.
- Human resources.
- Optimization of infrastructure by design.
- Consideration of regional and international arrangements.



INPRO Dialog Forum DF-8 26-29 August 2014



Thank you for your attention!
www.iaea.org/INPRO



IAEA

International Atomic Energy Agency