



**IAEA**

International Atomic Energy Agency

**National Workshop on the Development of Nuclear Safety  
Knowledge Management Programme**

Dengkil, Selangor, Malaysia

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## **2.4. Nuclear Safety Knowledge Management**

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- ***Why?***
  - Why knowledge management?
  - Why for nuclear safety?
- ***What is nuclear safety knowledge, and what is NSKM?***
- ***Relationship of NSKM ...***
  - with Safety Standards
  - with capacity building
  - with GNSSN
  - etc.
- ***Selected IAEA activities***
- ***KM Tools and Methods (my recommendations)***

*Topic*

# **IMPORTANCE OF NUCLEAR SAFETY KNOWLEDGE MANAGEMENT AND NUCLEAR SAFETY CAPACITY BUILDING**

# Importance of knowledge management

- ***Knowledge Management has been identified as one of the key resource that can contribute to the safe and secure and efficient operation of nuclear activities and facilities in Member States***
  - Safety Standards
  - General Conference resolutions
  - IAEA conferences (HR 2014, NKM 2004, 2007, 2016)
  - Nuclear Safety Action Plan
  - INSAG 21, new INSAG 27 (2017)
  - IEM Reports = lessons learned from Fukushima

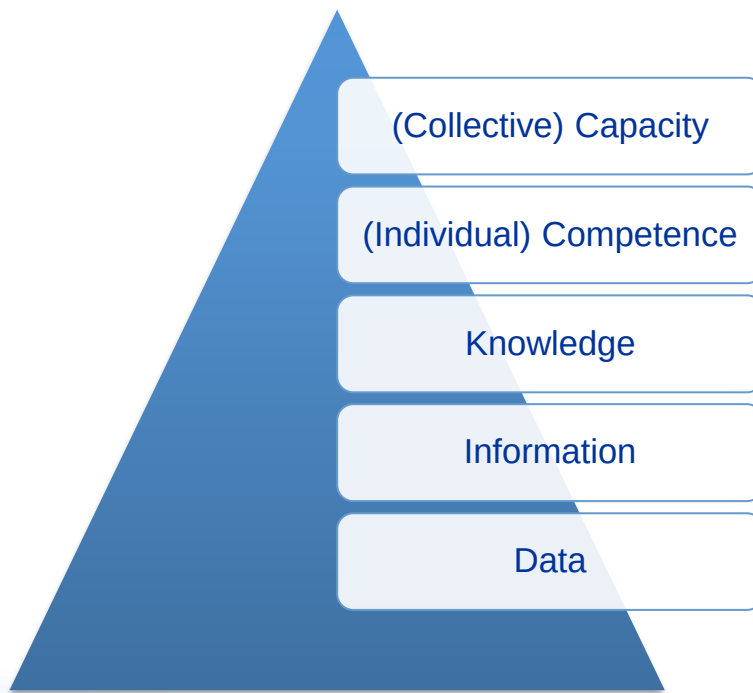
# Importance of KM for nuclear safety

- ***KM for nuclear safety poses special challenges***
  - Knowledge base legally **mandatory**
    - Required for regulatory activity and operations
  - Manyfold **types** (legal, technical, operational ...)
  - Manyfold **owners** (regulators, TSOs, vendors, operators ...)
  - Lack of nuclear safety knowledge can have significant **implications**
    - Contrast to other knowledge types
  - Long timescales (decision basis)
  - Dual role of regulators (corporate and oversight)

*We now look into:*

# KNOWLEDGE MANAGEMENT BASICS

## *Knowledge Pyramid\**



\* From the viewpoint of the Capacity Building

## *"Capacity for Action"*

- Owning information is not equal to being able to use it for action
- "Information only becomes knowledge in the hands of someone who knows what to do with it." (Peter Drucker)

# Knowledge-competence-capacity

- **Knowledge**
  - ready for action
- **Competence**
  - Set of knowledge, skills and attitudes
  - Competent staff (a person)
- **Capacity has to do with number of people who know something**
  - If two staff know the same things, the organization doesn't know more, just knows something twice
  - But: double production capacity!

# Manifold uses of KM



- ***Manifold uses***

- each with existing and available sets of tools and techniques
- KM is not equal to sharing everything and always

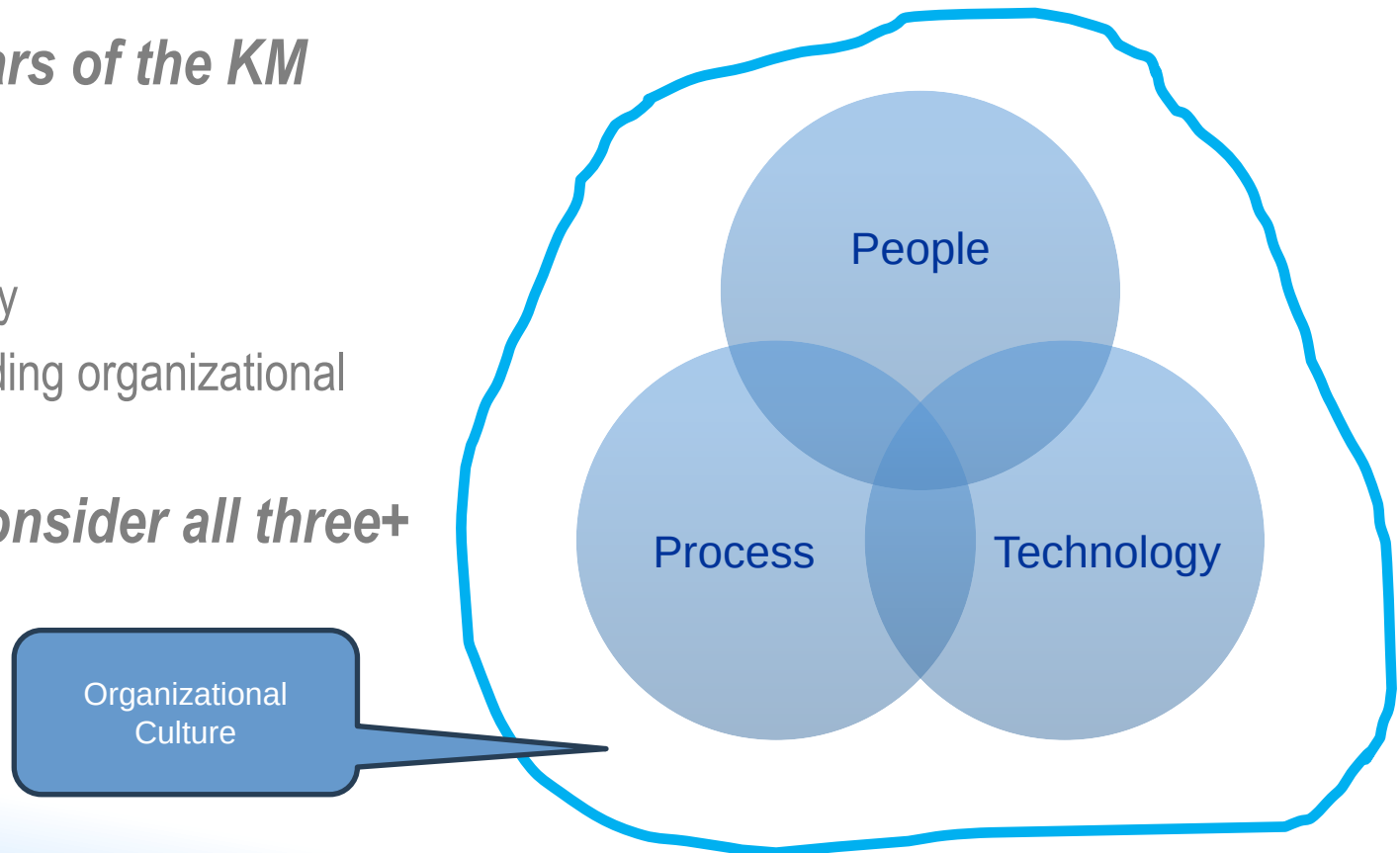
These might be the knowledge processes

# The PPT Model of KM

## *Explanation*

- ***Three+ pillars of the KM***
  - People
  - Process
  - Technology
  - + surrounding organizational culture
- ***KM must consider all three+ areas***

## *The PPT Model of KM*



# The PPT Model of KM

- *Corresponding three historical sources and types of knowledge management today*
- **People – HR departments**
  - Human resources, training, life-long learning, workforce development, migration, recruitment, generational transfers, ...
- **Process – business consulting/QA**
  - IMS with integrated KM, Communities of practice, mentoring, knowledge cafés, structured and open interviews, knowledge mapping, ...
- **Technology – ICT companies**
  - Internet platforms, search engines, document repositories, pro-active e-assistants, e-learning, ...

# Superseded IAEA Safety Standards\*

| Superseded publication |                                                                                                                                                                                                                                                                     | Current publication |                                                                                                                                                                                                                                                           |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number                 | Title                                                                                                                                                                                                                                                               | Number              | Title                                                                                                                                                                                                                                                     |
| GS-R-1                 | Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety (2000) <a href="#">Arabic</a> , <a href="#">English</a> , <a href="#">Chinese</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> | GSR Part 1 (Rev. 1) | Governmental, Legal and Regulatory Framework for Safety (2016) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                    |
| GSR Part 1             | Governmental, Legal and Regulatory Framework for Safety (2010) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                              |                     |                                                                                                                                                                                                                                                           |
| GS-R-2                 | Preparedness and Response for a Nuclear or Radiological Emergency (2002) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                    | GSR Part 7          | Preparedness and Response for a Nuclear or Radiological Emergency (2015) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                          |
| GS-R-3                 | The Management System for Facilities and Activities (2006) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                                  | GSR Part 2          | Leadership and Management for Safety (2016) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                                       |
| GSR Part 3 (Interim)   | Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, Interim Edition (2011) <a href="#">English</a>                                                                                                                          | GSR Part 3          | Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (2014) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> |
| GSR Part 4             | Safety Assessment for Facilities and Activities (2009) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                                      | GSR Part 4 (Rev. 1) | Safety Assessment for Facilities and Activities (2016) <a href="#">Arabic</a> , <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                                            |

\*You will receive also a separate pdf file with the above content

# Superseded IAEA Safety Standards

|          |                                                                                                                                                                                                                          |        |                                                                                                                                                                                                 |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GS-G-1.1 | Organization and Staffing of the Regulatory Body for Nuclear Facilities (2002) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>            | GSG-12 | Organization, Management and Staffing of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Spanish</a>             |
| GS-G-1.2 | Review and Assessment of Nuclear Facilities by the Regulatory Body (2002) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                 | GSG-13 | Functions and Processes of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> |
| GS-G-1.3 | Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body (2002) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> | GSG-13 | Functions and Processes of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> |
| GS-G-1.4 | Documentation for Use in Regulating Nuclear Facilities (2002) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                             | GSG-13 | Functions and Processes of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> |
| GS-G-1.5 | Regulatory Control of Radiation Sources (2004) <a href="#">Arabic</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Spanish</a>                                                                       | GSG-12 | Organization, Management and Staffing of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Spanish</a>             |
|          |                                                                                                                                                                                                                          | GSG-13 | Functions and Processes of the Regulatory Body for Safety (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a> |
| GS-G-3.2 | The Management System for Technical Services in Radiation Safety (2008) <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a>                                                                       | GSG-7  | Occupational Radiation Protection (2018) <a href="#">Chinese</a> , <a href="#">English</a> , <a href="#">French</a> , <a href="#">Russian</a> , <a href="#">Spanish</a>                         |
| GS-G-3.3 | The Management System for the Processing, Handling and Storage of Radioactive Waste (2008) <a href="#">English</a>                                                                                                       | GSG-16 | Leadership, Management and Culture for Safety in Radioactive Waste Management (2022) <a href="#">English</a>                                                                                    |
| GS-G-3.4 | The Management System for the Disposal of Radioactive Waste (2008) <a href="#">English</a>                                                                                                                               |        |                                                                                                                                                                                                 |

# Superseded IAEA Safety Standards

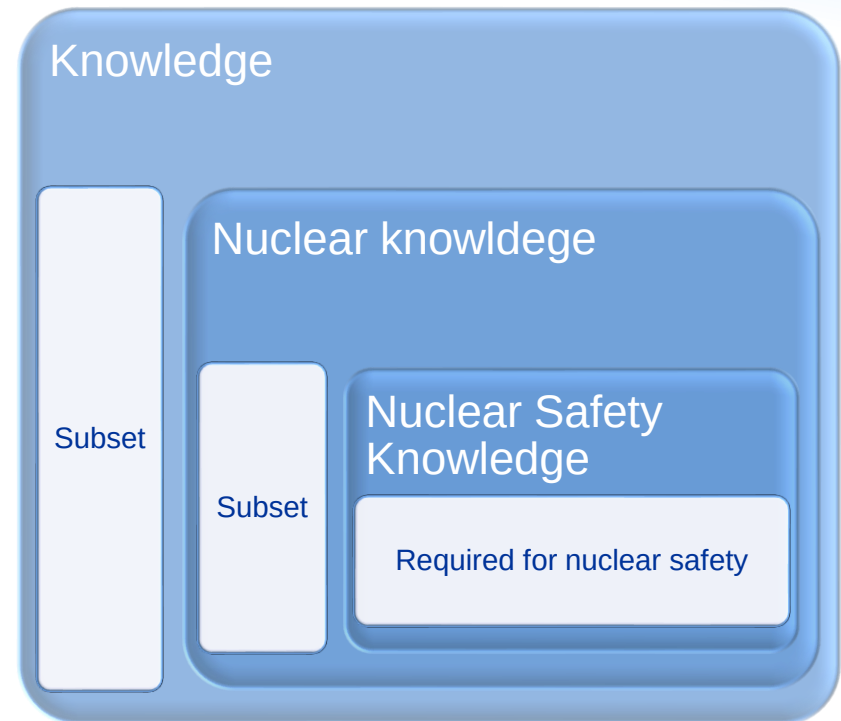
|          |                                                                                                                                          |                |                                                                                                                                         |
|----------|------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| GSG-4    | Use of External Experts by the Regulatory Body (2013) <a href="#">English</a>                                                            | GSG-12         | Organization, Management and Staffing of the Regulatory Body for Safety (2018) <a href="#">Chinese, English, French, Spanish</a>        |
| GS-G-4.1 | Format and Content of the Safety Analysis Report for Nuclear Power Plants (2004) <a href="#">Chinese, English</a>                        | SSG-61         | Format and Content of the Safety Analysis Report for Nuclear Power Plants (2021) <a href="#">English</a>                                |
| NS-G-1.1 | Software for Computer Based Systems Important to Safety in Nuclear Power Plants (2000) <a href="#">Chinese, English, French</a>          | SSG-39         | Design of Instrumentation and Control Systems for Nuclear Power Plants (2016) <a href="#">English, Russian</a>                          |
| NS-G-1.2 | Safety Assessment and Verification for Nuclear Power Plants (2001) <a href="#">Chinese, English, French, Russian, Spanish</a>            | SSG-2 (Rev. 1) | Deterministic Safety Analysis for Nuclear Power Plants (2019) <a href="#">Chinese, English, Russian</a>                                 |
|          |                                                                                                                                          | SSG-3          | Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (2010) <a href="#">English, Russian</a> |
|          |                                                                                                                                          | SSG-4          | Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (2010) <a href="#">English, Russian</a> |
| NS-G-1.3 | Instrumentation and Control Systems Important to Safety in Nuclear Power Plants (2002) <a href="#">Chinese, English, French, Russian</a> | SSG-39         | Design of Instrumentation and Control Systems for Nuclear Power Plants (2016) <a href="#">English, Russian</a>                          |
| NS-G-1.4 | Design of Fuel Handling and Storage Systems for Nuclear Power Plants (2003) <a href="#">English, Russian, Spanish</a>                    | SSG-63         | Design of Fuel Handling and Storage Systems for Nuclear Power Plants (2020) <a href="#">English</a>                                     |
| NS-G-1.5 | External Events Excluding Earthquakes in the Design of Nuclear Power Plants (2003) <a href="#">English, Russian</a>                      | SSG-68         | Design of Nuclear Installations Against External Events Excluding Earthquakes (2021) <a href="#">English</a>                            |
| NS-G-1.6 | Seismic Design and Qualification for Nuclear Power Plants (2003) <a href="#">English, Russian</a>                                        | SSG-67         | Seismic Design for Nuclear Installations (2021) <a href="#">English</a>                                                                 |
| NS-G-1.7 | Protection Against Internal Fires and Explosions in the Design of Nuclear Power Plants (2004) <a href="#">English, Russian</a>           | SSG-64         | Protection against Internal Hazards in the Design of Nuclear Power Plants (2021) <a href="#">English</a>                                |

*Topic*

# NUCLEAR SAFETY KNOWLEDGE MANAGEMENT

# Nuclear safety knowledge

- ***Nuclear safety knowledge is***
  - ... that subset of knowledge owned by an organization, or other entity,
  - ... that is relevant to or required for nuclear safety.



# Nuclear safety knowledge

- ***Explanation***

- A regulator, for example, has a huge body of knowledge required for daily conduct of business.
  - A (bigger) subset of this knowledge will be nuclear knowledge
    - and a subset of this will be nuclear safety knowledge.

- ***Examples***

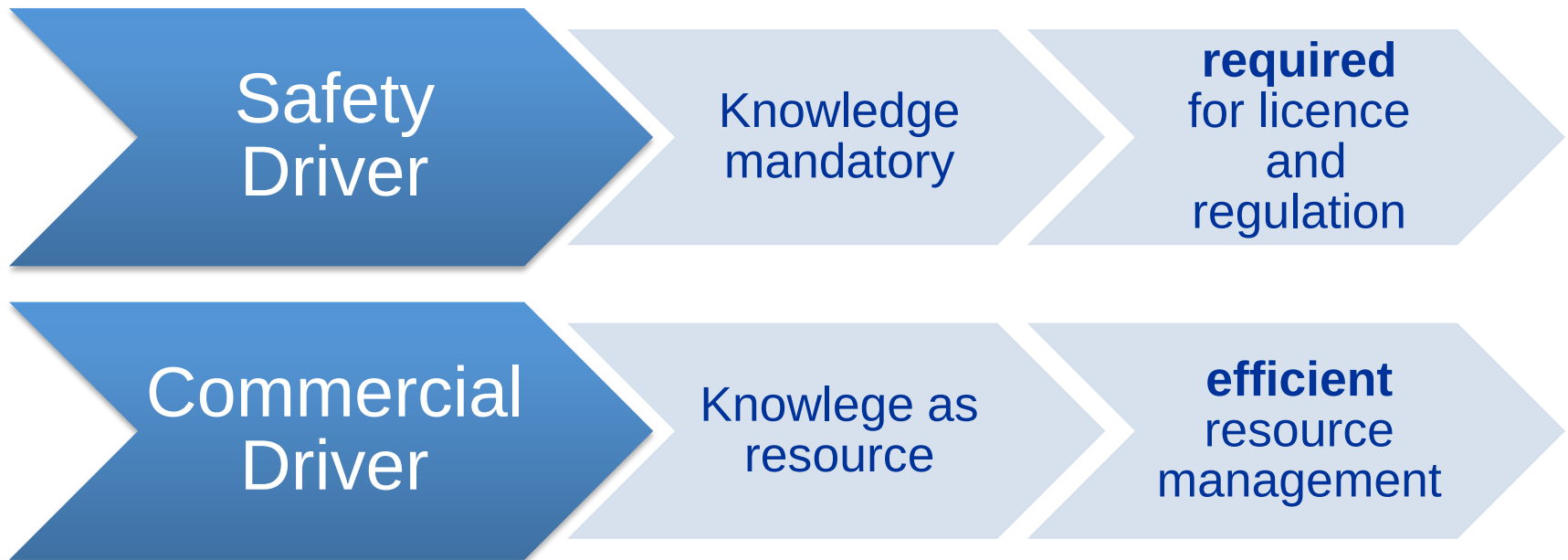
- Knowledge, but not nuclear knowledge
  - E.g., knowledge about the payroll. It is needed for regulatory operation but is not required for nuclear.
- Nuclear knowledge, but not nuclear safety knowledge
  - Knowledge specific to reactor designs that were developed, but never build or operated.
  - Can nevertheless be of high commercial value.

# Nuclear Safety Knowledge Management



- *Nuclear Safety Knowledge Management is the management of knowledge relevant to or required for nuclear safety.*
- ***Nuclear Safety Knowledge Management entails***
  - ... using knowledge management approaches, tools and techniques
  - ... for the purpose of nuclear safety

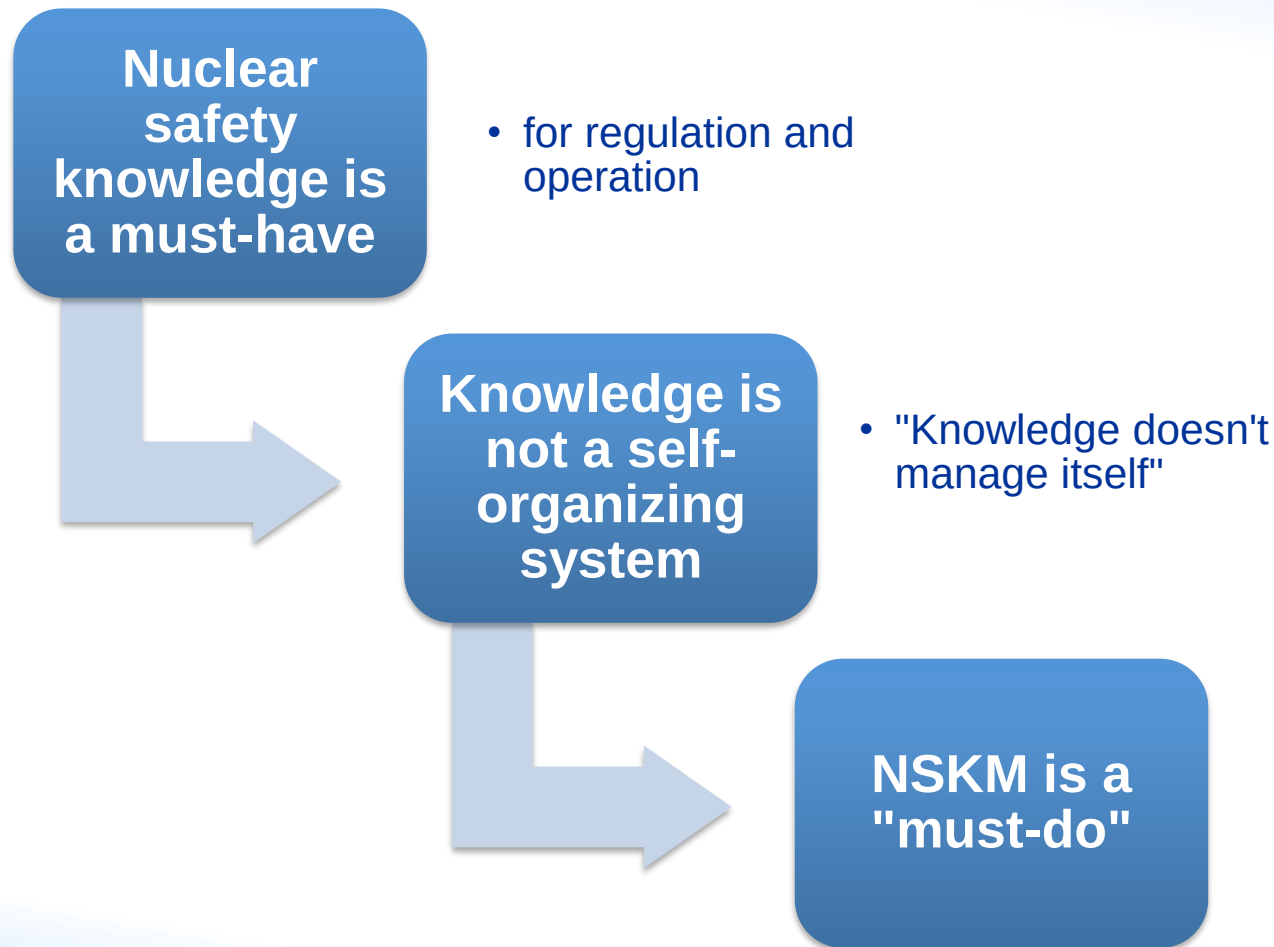
# Two Driver Model



# Two Driver Model

- ***Explanation: look at loss of knowledge***
  - Loss of **commercial** knowledge
    - Possibly less revenue for the utility
    - Possibly less commercial value of utility
    - Undesirable, but not critical
  - Loss of **safety** knowledge
    - Operator: stop operation?
    - Regulator: stop oversight = stop operation?
    - "Critical"

# "Must have" meanst "must do"



# General benefits of NSKM

- **Achieve *safe* operation**
  - Support culture for safety
  - Support leadership and management for safety
  - Support the integrated (systemic) approach to nuclear safety
- **Achieve *efficiency* gains**
- **Support intergenerational knowledge transfer**
- **Facilitate *innovation* and learning**
- **Identify and protect *sensitive* knowledge**
  - Security, safeguards, intellectual property
- **Contribute to an efficient and effective response in a nuclear or radiological emergency (EPR)**
- **Support *public awareness***

# Ultimate Objective

- ***The ultimate objective of all nuclear safety knowledge management activities is ...***
  - to sustain and improve the competence of individuals and
  - the capacity of organizations or countries
  - to use knowledge effectively and responsibly
  - **for (nuclear) safety.**

# NSKM is comprehensive

- ***The definition of NSKM is meant to be comprehensive***
  - Nuclear installation safety
  - Nuclear transport and waste safety
  - Nuclear radiation protection
  - Nuclear power
  - Nuclear applications
  - Legal, scientific, technical, institutional knowledge
  - All facilities and activities.

# Levels of NSKM

## Global

- Global safety experience, incl. emergencies, joint human heritage
- Globalization of nuclear sector, workforce migration

## National

- National development plans, role of governments, coordination mechanisms
- Knowledge interfaces between regulator, TSO, operator, response organizations

## Organizational

- KM as part of integrated management system
- Responsibilities of regulator, TSO, operator

## Individual

- Attitudes, learning, awareness. creativity.
- Career paths for everyone

# NSKM and Capacity Building

- ***Link NSKM to Capacity Building***
  - Umbrella approach



## Capacity Building

Human  
Resource  
Development

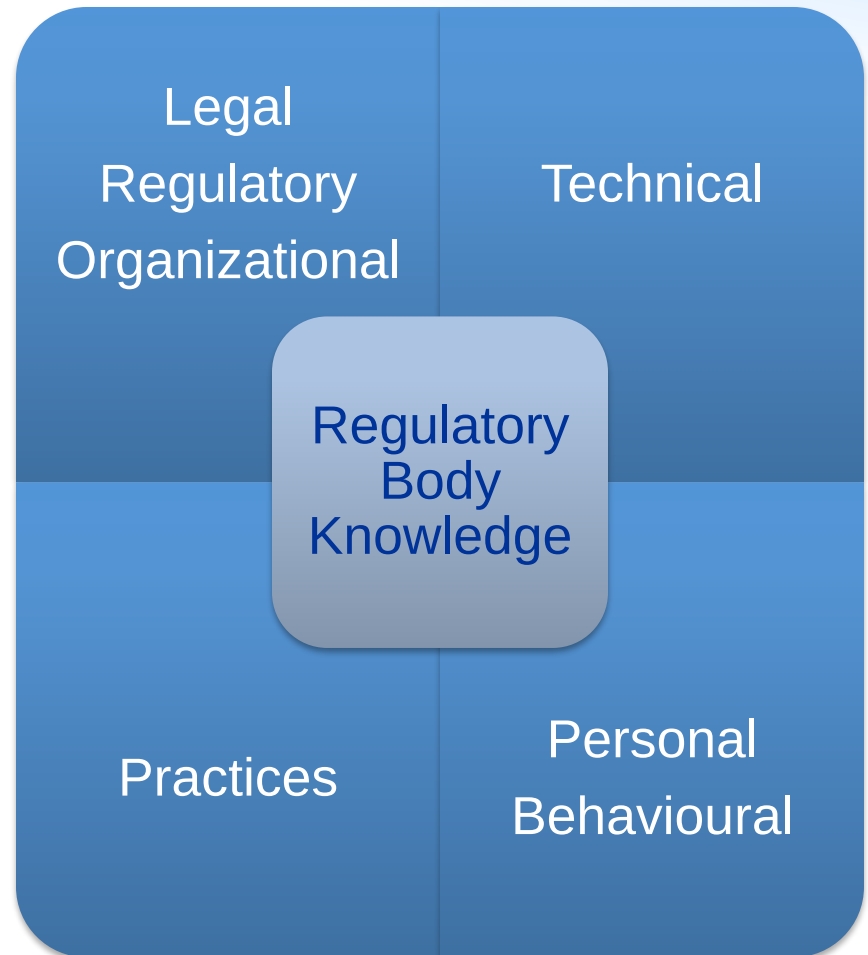
Education and  
Training

Knowledge  
Management

Knowledge  
Networks

# Knowledge mapping

- ***Structure as used in mindmaps***
- ***"Four quadrant model"***
  - Initially a model for structuring *organizational competence* by four quadrants
  - SRS No. 79 (SARCoN)



*Topic*

# NATIONAL LEVEL CONSIDERATIONS

Will be presented tomorrow!



**IAEA**

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***Thank you for your attention!***

***Questions/Comments?***