



**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*



Shut down

Immediate or deferred  
dismantling ...

End state

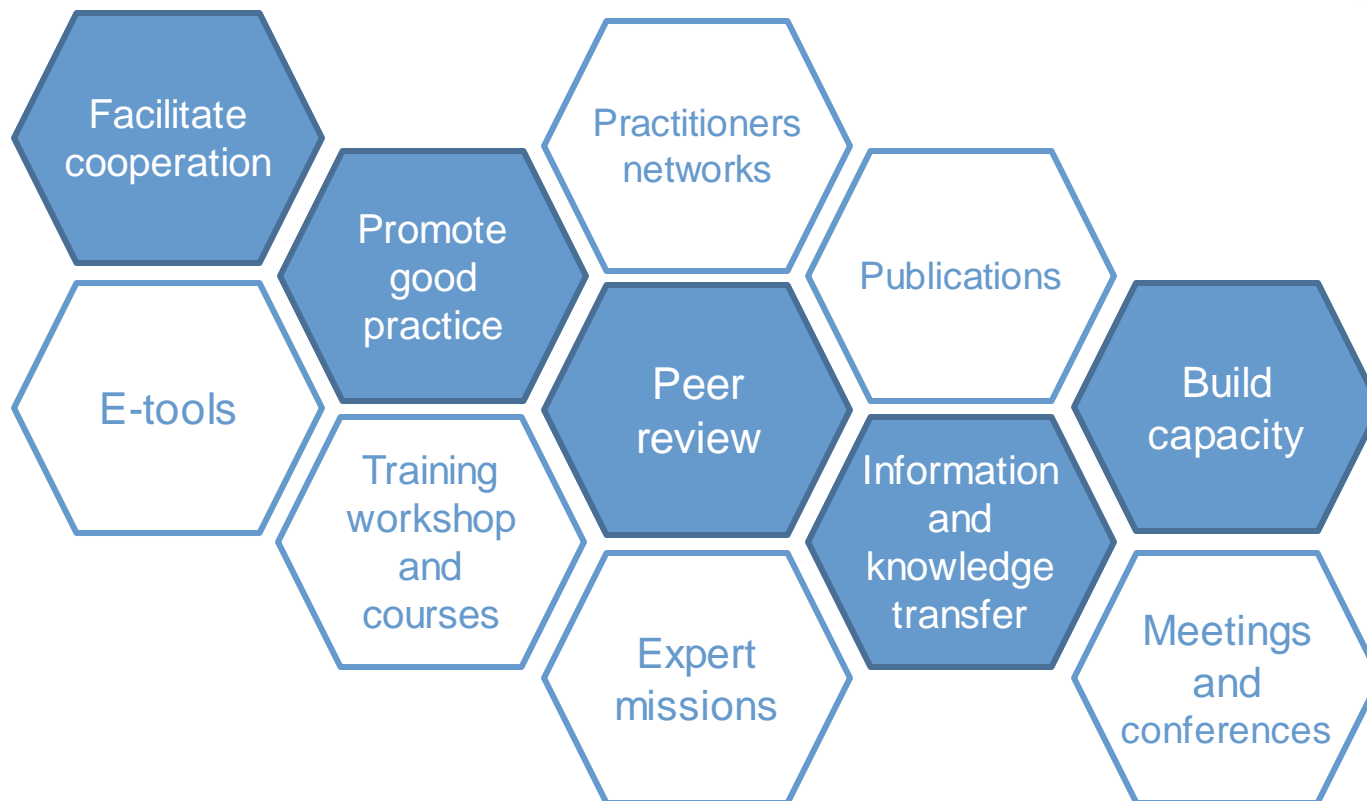
## Interregional Workshop on Technology Selection for Decommissioning of Large and Small Nuclear Installations: IAEA Perspectives on Implementation

*Florida International University, Miami, 9-13 September 2019*

*Patrick O'SULLIVAN*

*Decommissioning & Environmental Remediation Section | Division of Nuclear Fuel Cycle  
and Waste Technology | Department of Nuclear Energy*

# Our goals and activities



# International Decommissioning Network

The IDN was established by the IAEA in 2007 to provide a **forum for collaboration and interaction among individuals involved in the decommissioning of nuclear facilities**, including persons employed by facility owners, implementing organizations, regulatory agencies, waste management organizations and research entities. The network also represents an important stakeholder group with which the IAEA Secretariat interacts on topical issues affecting the planning, implementation and oversight of decommissioning programmes.

**Network activities include supporting IAEA international collaborative projects on issues concerned with the planning and implementation of decommissioning projects, together with provide support for IAEA training and capacity building activities.** The network participants also contribute to a Wiki-based information collection and sharing platform — see <https://nucleus.iaea.org/sites/connect/IDNpublic/Pages/IDN-Wiki-Introduction.aspx>.

**An IDN Annual Forum is organized each year to facilitate direct exchange of information between practitioners and promotes good practice**, e.g. on the regulatory and safety aspects, use of technologies, human resource considerations, project and contract management, and the management of radioactive waste from decommissioning.

# Collaborative Project: Human Resource Development for Decommissioning - 1

## ❖ Objective

- Provide recommendations on training and human resource management / human performance improvement for decommissioning

## ❖ Timeframe

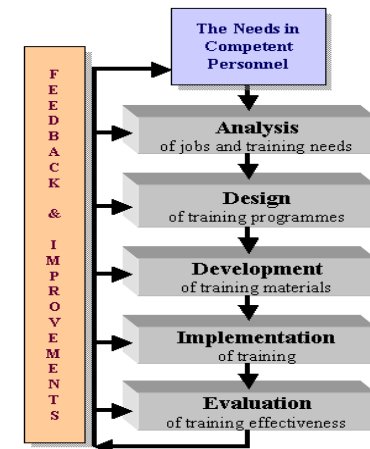
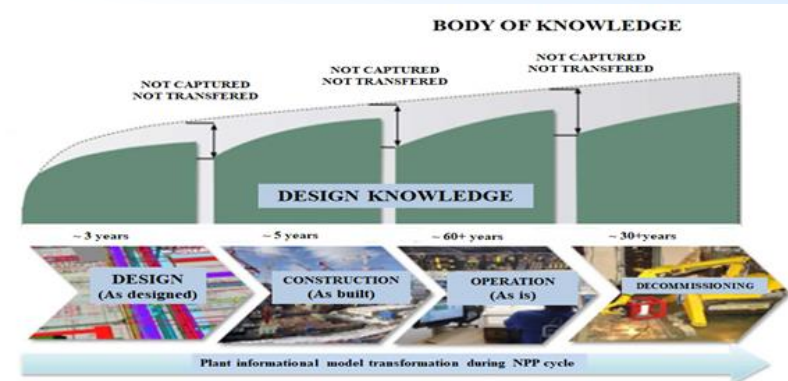
- 2018-2019
- Technical Meeting – 1-5 July, VIC [EVT1804578]

## ❖ Deliverable

- NE Series Report “*Training and Human Resource Considerations for Nuclear Facility Dismantling*” [Early 2020]

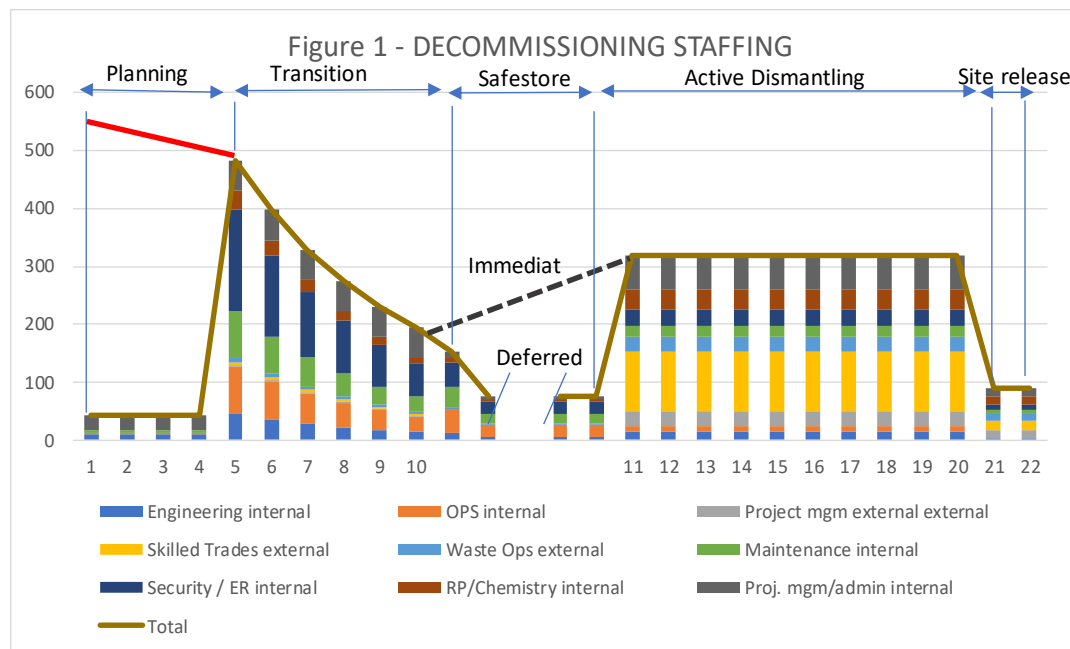
## ❖ Main topics Addressed

- Human resource considerations in preparation for decommissioning
- Transitioning from operations to decommissioning
- Knowledge management requirements for decommissioning
- Roles and responsibilities
- Training requirements and application of the systematic approach to training (SAT)
- Training facilities, instructors and training programmes
- Case studies

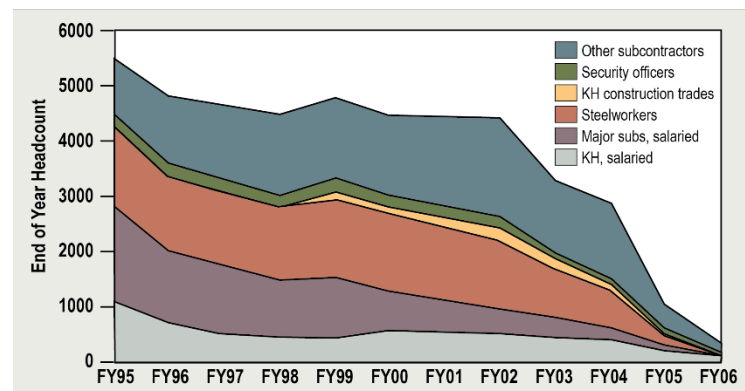


Overview of the SAT process

# Collaborative Project: Human Resource Development for Decommissioning - 2



Typical staffing profile for decommissioning of light water reactors (PWR/BWR)



Case study: Rocky Flats

# Collaborative Project: Costing of Research Reactor Decommissioning (DACCORD)

## ❖ Objective

- Sharing current good practice on costing of research reactor decommissioning including characterization and addressing uncertainties

## ❖ Timeframe

- 2013-2019
- Technical Meeting – 21-25 October, Cadarache [EVT1804580]

## ❖ Deliverable

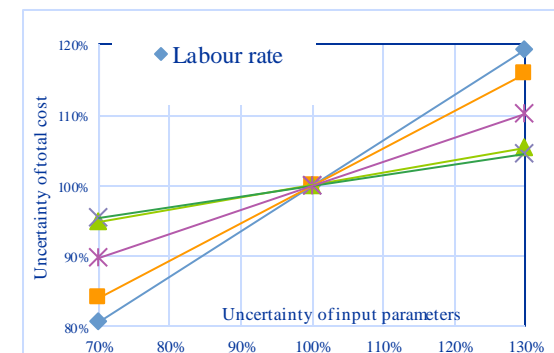
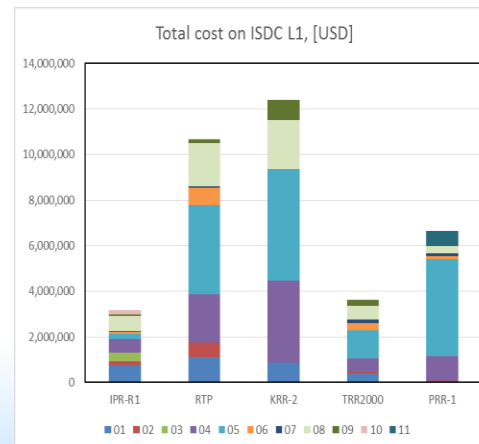
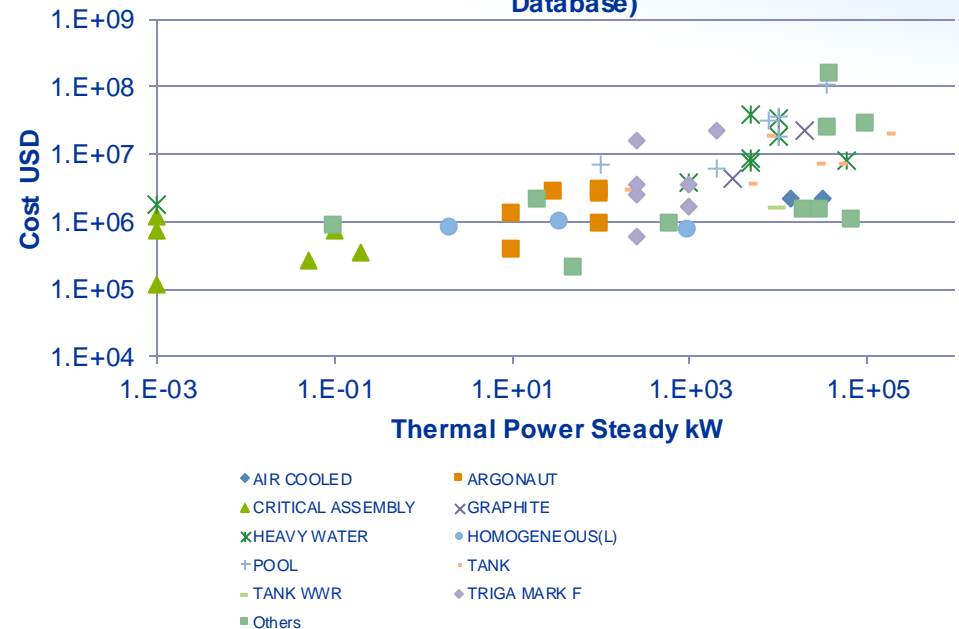
- NE Series Report “Final Report of the DACCORD Collaborative Project” [Early 2020]

## ❖ Main topics Addressed

- Cost estimation for decommissioning
- Illustrative costing cases
- Uncertainty analysis
- Impacts of planning and characterization on decommissioning

*Interregional Workshop on  
Technology Selection for  
Decommissioning of Large and  
Small Nuclear Installations, Miami,  
9-13 September 2019*

Actual Cost [USD 2013] vs. Thermal Power [kW]; (IAEA Database)



# Management of Irradiated Graphite: Industrial Process Applications (GRAPA)

## ❖ Objective

- Sharing current good practice on costing of research reactor decommissioning including characterization and addressing uncertainties

## ❖ Timeframe

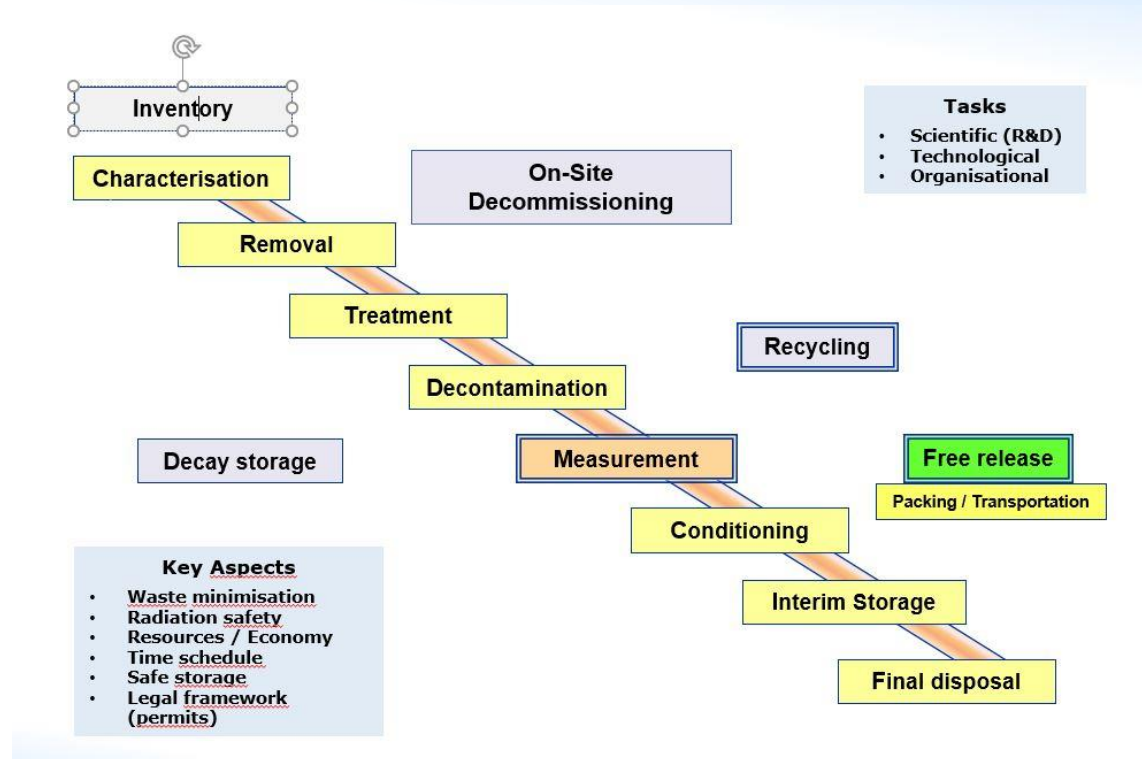
- 2016-2020
- Technical Meeting – 1-4 October, VIC [EVT1804475]

## ❖ Deliverable

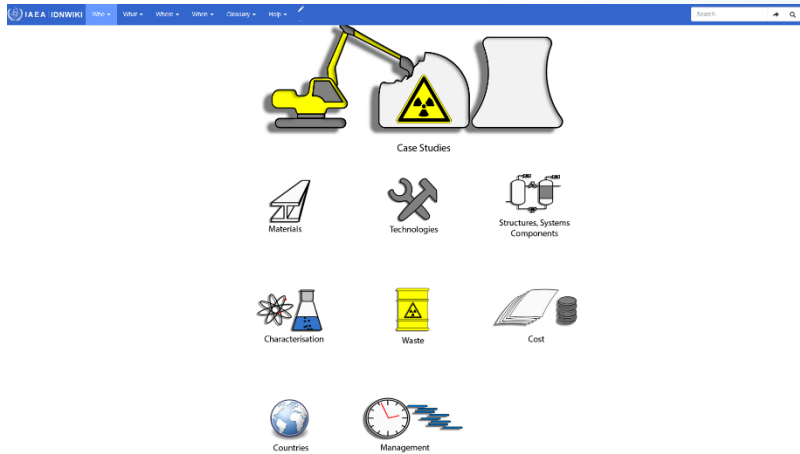
- NE Series Report “*Final Report of the GRAPA Collaborative Project*” [Early 2022]
- *Interim Report on Strategic Considerations for i-Graphite Management*

## ❖ Main topics Addressed

- Gaps in current scientific and technical knowledge
- Identification of needs for further work to fill identified gaps
- Case studies



# Decommissioning Wiki



[https://idn-wiki.iaea.org/wiki/Main\\_Page](https://idn-wiki.iaea.org/wiki/Main_Page)

## IDN Wiki - launched by IDN (2016)

- Based on Semantic MediaWiki Technology
- Aim – sharing knowledge (technologies, case studies, facility information) between decommissioning professionals
- Content is reviewed (/quality checked) by a team of moderators
- Infrastructure maintained by IAEA Secretariat

## Content

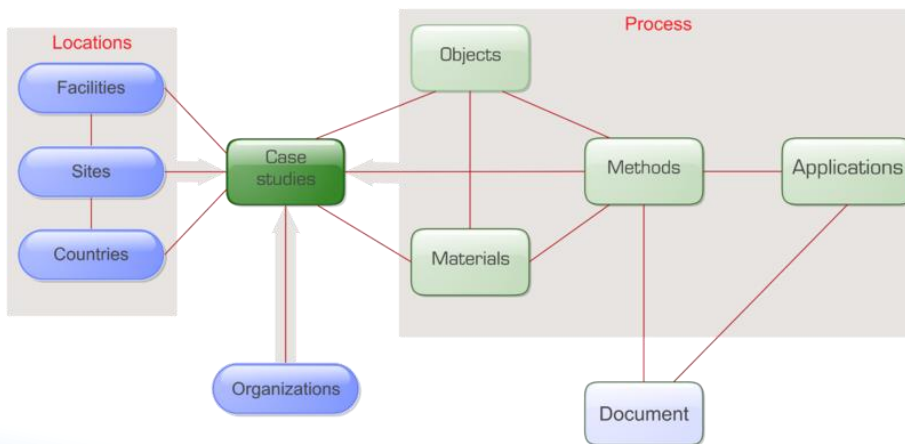
- 278 case studies
- 115 technologies in 26 “fields of application” (e.g. decontamination, characterization, knowledge management, etc.)
- 1705 facilities
- 125 glossary entries

## Maturity level of Articles

- 565 Articles
- 400 Author Drafts
- 83 Community Drafts
- 86 Trusted articles

## Next Steps (2019-2020)

- Expand towards a single **Nuclear Knowledge Wiki**
- Incremental addition of new subject domains (e.g. waste treatment, environmental remediation, waste disposal)
- Develop a parallel ‘Public’ version (Read only) from trusted articles



Not all connections shown

# Projects, Meetings and other Events on Decommissioning in 2018-2019 (2/2)

- New Project in 2019:
  - **Global Status of Decommissioning** – Launch 2019 to produce an authoritative report on main current practices and planned future activities in the field of decommissioning, providing an analysis of decommissioning strategies, technical achievements and outstanding challenges– *[TM, 26-30 August, VIC]*
  - IAEA International Workshop ‘*Application of Sustainability Principles and Circular Economy to Nuclear Decommissioning*’ hosted by Sogin (*18-21 June, Rome, Italy*)
  - IAEA International Workshop on ‘*Preparing for Implementation of Decommissioning of Nuclear Facilities*’ hosted by Fukui Prefecture (*Tsuruga, Japan, 11-14 November*)

# Capacity Building for Decommissioning

# Capacity Building



- Reports
- Expert missions & peer reviews
- Training courses/workshops
- Scientific visits & fellowships
- Conferences and technical meetings

Training Event	Host/Location
Workshop on safety assessment of sites for decommissioning and remediation [INT/9/183]	Argonne, US
Regional workshop processes for end state selection and site release criteria for NPPs [RER/9/150]	Slavutych, UA
Regional Workshop on decommissioning planning and cost estimation for decommissioning [RER/9/150]	Bratislava, SK
Regional Workshop on role of IT in knowledge management for decommissioning [INT/9/183]	Halden, NO
Regional Workshop on safety aspects of near surface disposal of radioactive waste [RER/9/150]	Kozloduy, BG
Regional Workshop on technologies for waste characterization and processing [RER/9/150]	Visaginas, Lithuania

# IAEA Collaborating Centres on Decommissioning

## Objectives:

- To promote innovation in decommissioning
- To facilitate knowledge sharing on current good practice
- To assist in long-term developing a qualified workforce through supporting a number of fellowships (i.e. secondments of several months' duration).



Courtesy of IFE, Norway



# IAEA Supported Tools



## IAEA Support: E-learning for stakeholders and newcomers to the field

<https://nucleus.iaea.org/sites/connect-members/LMS/Pages/Welcome-to-the-learning-materials-section.aspx>

## IAEA Data Bases

### PRIS Power Reactor Information System

2 modules for NP Reactors; in Operation - in Decommissioning  
<http://prisweb.iaea.org/Home/Pris.asp>

### RRDB Research Reactors Data Base

<http://nucleus.iaea.org/RRDB>

### INFCIS Nuclear Fuel Cycle Information System

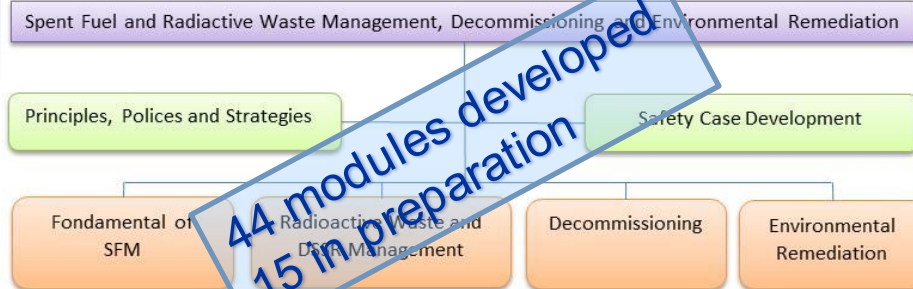
<https://infcis.iaea.org/NFCIS/Facilities>

## Specifics

## IAEA Support

### 14 Networks - Web Based Tools to support information sharing

<https://nucleus.iaea.org/sites/connect/Pages/default.aspx>



#### Networks

**URF** Geological Disposal and Research Facilities for Geological

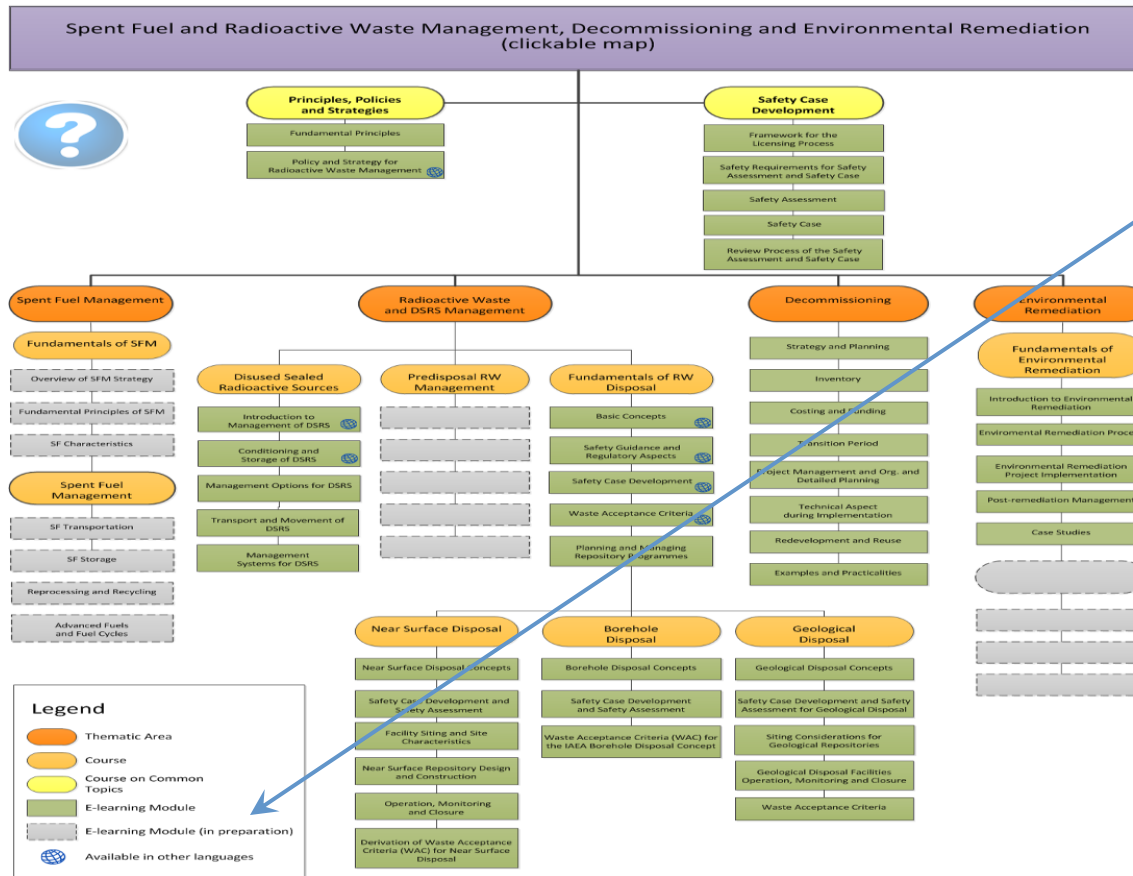
**DISP** International Low Level Waste Disposal Network Near Surface Disposal of

**SFM** Spent Fuel Management International Network on Spent Fuel Management

Launched in 2016 : WIKI



# E-learning / Briefing Material For Stakeholders and Professionals



More languages than English

CLP4Net - Agency wide Learning Management System

# Peer Reviews – ARTEMIS

- Main objectives: to provide independent expert opinion and advice to MS
  - IAEA forms a team of international experts
- Intended for facility operators and other implementing organizations, regulators, government agencies, policy makers




- Scope can include facilities and activities related to:
  - Spent nuclear fuel and RW management
  - **Decommissioning**
  - Environmental remediation

# Recent Technical and Policy Publications

**IAEA Nuclear Energy Series**  
No. NW-T-1.10

Basic Principles  
Objectives  
Guides  
Technical Reports

**Advancing Implementation of Decommissioning and Environmental Remediation Programmes**  
CIDER Project: Baseline Report




**IAEA Nuclear Energy Series**  
No. NW-T-2.8

Basic

Managing the Unexpected Decommissioning




**Advancing the Global Implementation of Decommissioning and Environmental Remediation Programmes**  
Proceedings of an International Conference  
Madrid, Spain, 23–27 May 2016



**IAEA Safety Standards**  
for protecting people and the environment

Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities


Specific Safety Guide  
No. SSG-47



**IAEA Safety Standards**  
for protecting people and the environment

Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities

International Safety Requirements Part 6  
SR Part 6



**IAEA TECDOC SERIES**  
IAEA-TECDOC-1932

Data Analysis and Collection for Supporting of Research on Decommissioning  
the DACCORD Collaborative Project



<http://www-pub.iaea.org/MTCD/publications/publications.asp>

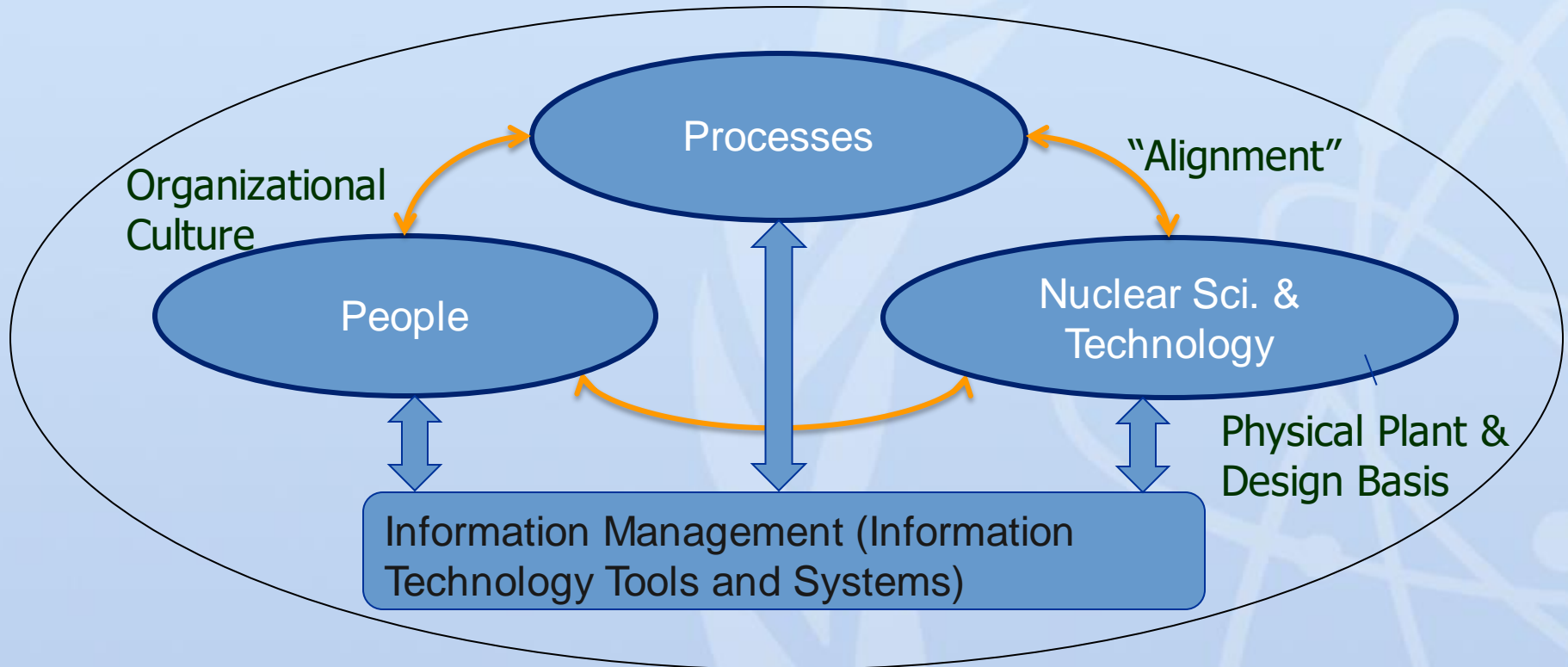
# Knowledge Management for Decommissioning



**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

## NPP Organization's Primary Knowledge Assets





**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

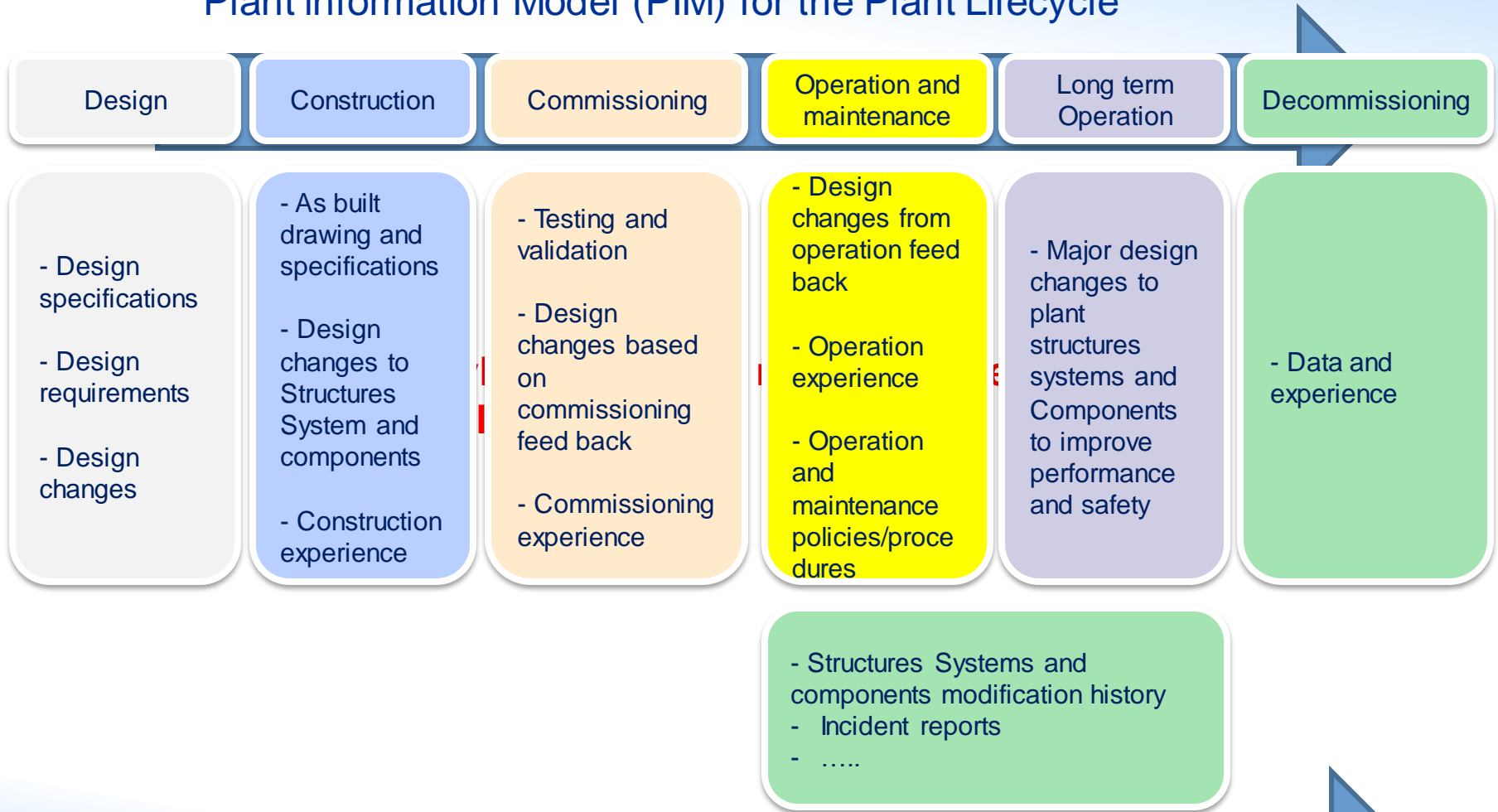
## Plant Information Model (PIM)

A **Knowledge-centric** Plant Information Model is a **semantically organized** set of interlinked facility information, relationships, rules and knowledge frameworks that collectively form digital representations of the plant throughout its life cycle



# Ways toward more efficient decommissioning

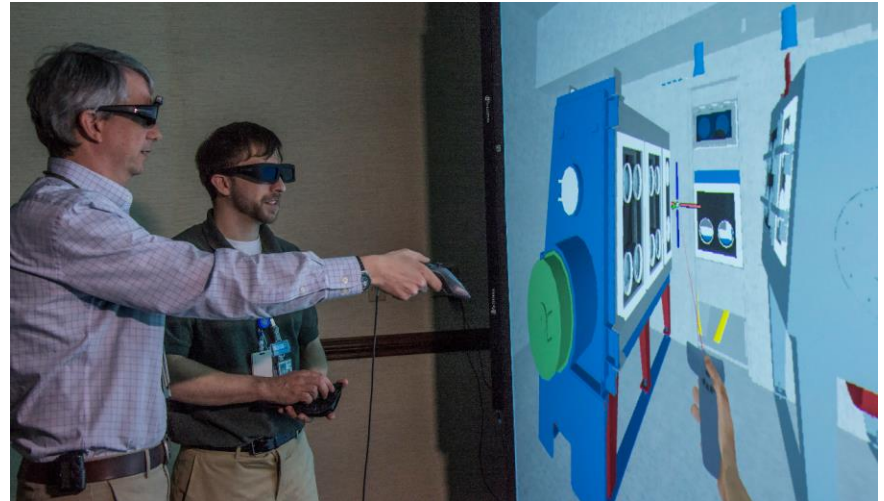
## Plant information Model (PIM) for the Plant Lifecycle



Plant Information Model captures the information as the plant moves through lifecycles (~100 years)

# Future Outlook


- Global Status of Decommissioning
- Human Resource Development for Decommissioning
- Sustainability
- Innovation




# Looking Ahead

International Conference on the  
**Management of Spent Fuel from  
Nuclear Power Reactors 2019**  
Learning from the Past, Enabling the Future


24–28 June 2019  
Vienna, Austria




Organized by the  
 IAEA  
International Atomic Energy Agency

#SFM19  
CM-27

International Conference on  
**Climate Change and the  
Role of Nuclear Power**  
7–11 October 2019, Vienna, Austria



Organized by the  
 IAEA  
International Atomic Energy Agency  
Atoms for Peace and Development

#Atoms4Climate  
CM-28

International Conference on  
**Research Reactors:**  
Addressing Challenges and Opportunities to  
Ensure Effectiveness and Sustainability

25–29 November 2019, Buenos Aires, Argentina



Organized by the  
 IAEA  
International Atomic Energy Agency

Hosted by the  
Government of Argentina  
through the  
National Atomic Energy Commission (CNEA)

CM-277



**IAEA**

International Atomic Energy Agency

*Atoms for Peace and Development*

*Thank you!*



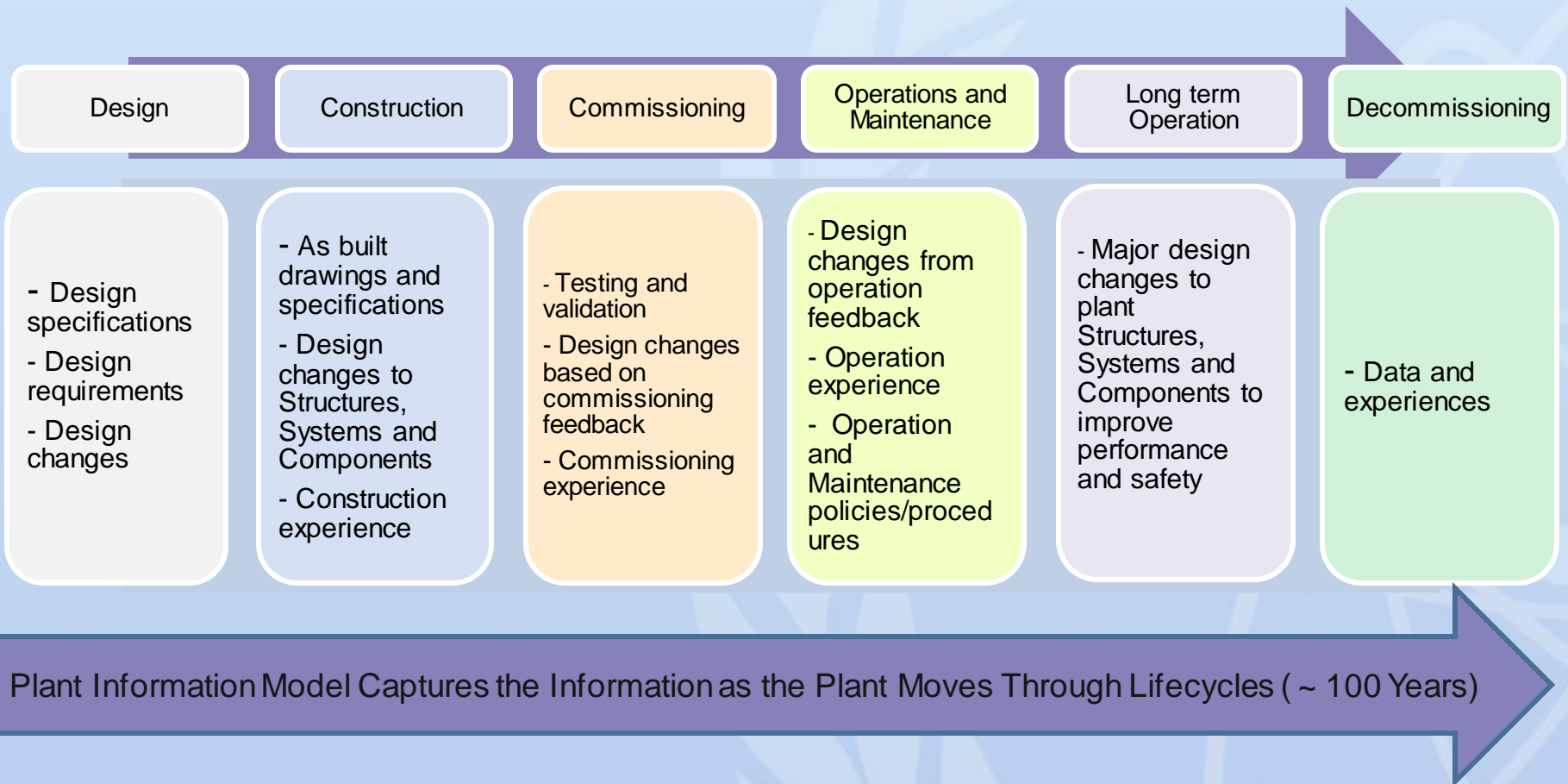


**IAEA**

International Atomic Energy Agency

*Atoms for Peace and Development*

## Plant Information Model (PIM) for the Plant Lifecycle





**IAEA**

International Atomic Energy Agency  
*Atoms for Peace and Development*

## Plant information model for decision making

