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DE LA RECHERCHE À L'INDUSTRIE

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CEA'S DECOMMISSIONING

Strategies & Options

Immediate, deferred, entombment

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Decommissioning - main strategies & option

Two strategies:

- **Immediate dismantling**

The dismantling commences after the end of the operation

- **Safe enclosure (Deferred dismantling)**

The nuclear facility plant will be locked for about 30-50 years
After this period a dismantling will take place

One option:

- **Entombment**

The nuclear power plant will be entombed “forever”

Decommissioning – when and why?

- At the end of their operating time nuclear facilities reach the end of their service life
- The end of the service life typically depends on technical and/or economical marginal conditions
- Legal obligations may play a role
- The end of the life cycle leads to the decommissioning of the nuclear facilities
- The need of a free site for erecting a new facility

Basic aspects - International recommendations

IAEA Safety guides

- ✓ Decommissioning of Nuclear Power Plants and Research Reactors Safety Guide N° WS-G-2.1, 1999
- ✓ Decommissioning of facilities using radioactive Material n° WS-R-5
- ✓ Safety reports Series N° 50
- ✓ Decommissioning Strategies for facilities using radioactive material
- ✓ Safety guides for nuclear waste, i.e. for nuclear facilities as long they are used and for disposal facilities

WENRA (Western European Nuclear Regulator´s Association)

- ✓ WGWD - Decommissioning Safety Reference Levels Report (version 2.0, November 2011)
- ✓ WGWD Waste and spent fuel storage safety reference levels report (version 1.0, December 2006, new version: version 2.2, April 2014)

National regulations

- National regulations are based upon international guidelines/recommendations
- The countries have the free choice of creating their laws, international law should be respected
- Changes in the law are difficult to deal with; This may be evident if the decommission process is already running

Which strategy? General considerations

- One main strategy has to be chosen

- There are several aspects for the choice of the strategy
i.e. legal, technical, radiological and economical aspects

- The target (end state) is important:
  - Deconstruction, remediation, rehabilitation and release of the site - "green fields"
  - Release of existing buildings and plants - industrial utilization - constraints
  - Further nuclear use – utilization under nuclear energy law (when existing)

Which strategy? Technical and radiological aspects

- **The type of the nuclear facility**
  - PWR (& VVER)
  - BWR
  - Gas-cooled
  - RBMK
  - Research Reactors
  - Fuel cycle facilities (research, pilot, industrial)
- **Space for the flow of the waste**
- **Radiological aspects**
- **Availability of a disposal site (Repository)**

Factors favoring Immediate Dismantlement

- Decommissioning funds available and costs are known/estimated
- Low-level waste disposal sites are available
- Least expensive option
- Experience of facility personnel and proven technologies are available
- Minimizes future regulatory uncertainty and near-term impact to the local economy
- Presents positive public perception
- Makes site available for re-use

Factors favoring Deferred Dismantlement

- Funds not available for immediate dismantlement
- Smaller radioactive waste volumes
- Lower staff radiation exposures
- More time to resolve waste management issues
- Some areas may be able to be immediately reused
- Benefit from technology enhancements

Factors favoring Entombment

Used only in rare instances

- **Geographic location - remote sites**
- **Limited funding and resources available – quick and easy solution**

However

- **Waste disposal site created**
- **Creates longer term liability / monitoring requirement**
- **Presents burden to future generation**

Immediate decommissioning

Advantages

- Personnel from operation is available (and their knowledge)
- Operating history is well known & could be recovered
- Time scale is well defined, also the costs
- Existing infrastructure can be used (i.e. ventilation, cranes …..)
- No further consideration of duration of life are needed
- Current laws and guidelines

Disadvantages

- Higher collective dose
- Greater complexity if shielding or remote controlled systems are used
- Final repository is needed
- Intermediate storage of radioactive waste is needed if no final repository exists

Safe enclosure, followed by decommissioning

Advantages

- Activity is reduced
- Lower collective dose
- A greater part of the material can be reused (if clearance)

Disadvantages

- Loss of knowledge and experience
- Preliminary work must be done under same dose rates like immediate decommissioning - no benefit
- Control must be established for tens of years (30-50 ….)
- Safety relevant parts must be operated/checked/ maintained for tens of years additional lifetime
- Infrastructure like cranes and ventilation has to be assessed for tens of years
- When restarting decommissioning, facility safety must be fully renovated to fit to existing requirements - necessary to upgrade - high costs

Entombment

Advantages

- Fast
- Less expensive than other methods
- Only little material goes to final repository (no big storage capacity needed)

Disadvantages

- Preliminary work must be done under same dose rates like immediate decommissioning, but less work needed
- Material can not be reused (cleared) and is wasted
- Site can not be reused
- Unwanted legacy for future generations
- Local final repositries are created
- Public opinion

What is the CEA's strategy ?

CEA chose direct dismantling

- **Allows the usage of the experience and the knowledge of the personnel from operating time**
- **Job security for personnel, new jobs could be induced**
- **Leads to a clean site, ready-to-use & closes the cycle**

But currently, in CEA, many dismantling operations are in progress simultaneously.

So, priorities will be to make between these different operations …

Summary

- There are several strategies possible
- Many of these strategies have been used worldwide or are currently used
- CEA's strategy is direct decommissioning with an interim storage to reduce the amount of radioactive waste
- According to certain conditions, another strategy or mixed strategies may be chosen