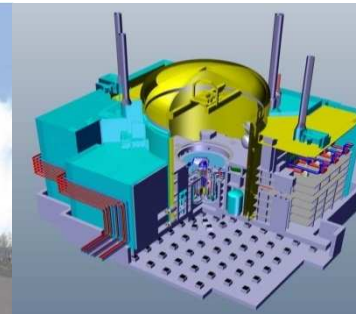


DE LA RECHERCHE À L'INDUSTRIE



OPTIMISING ENVIRONMENTAL STEPS FOR NEW LICENSED NUCLEAR FACILITY PROJECTS



www.cea.fr

Hotlab – Idaho Falls | Marie Ladurelle

2013, Sep 23-27th

CONTEXT AND METHODOLOGY

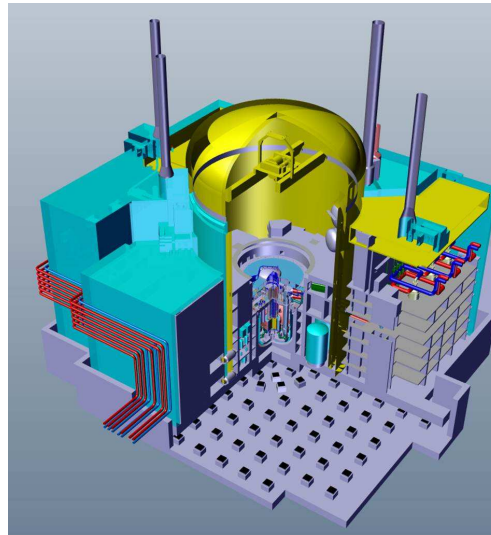
- In the 90s, environmental questions often felt as an additional new stress for projects
- New regulatory texts
 - ISO 14031 standards: environmental directives
 - French ministerial order of 26 April 2011: best available techniques
 - French ministerial order of 7 February 2012 define the general rules relative to licensed nuclear facilities
- Now, it's a positive way to enhance the value of a project (importance for public opinion) :
An effective sustainable development strategy is set on new projects :

“to avoid, reduce and offset the environmental impacts of the project through its whole life cycle”

The presentation will focus about the CEA's experience as project owner of 3 projects :



DIADEM: Waste storage facility project



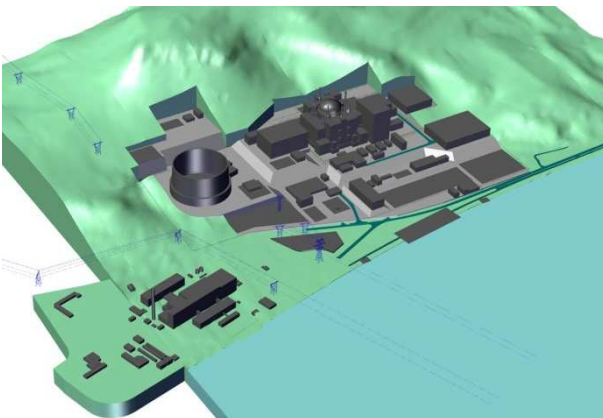
ASTRID
Advanced Sodium Technological
Reactor for Industrial
Demonstration

4th generation reactor (600 MWe)
industrial and experimental
purposes



RJH: experimental reactor
(100 MWth) :

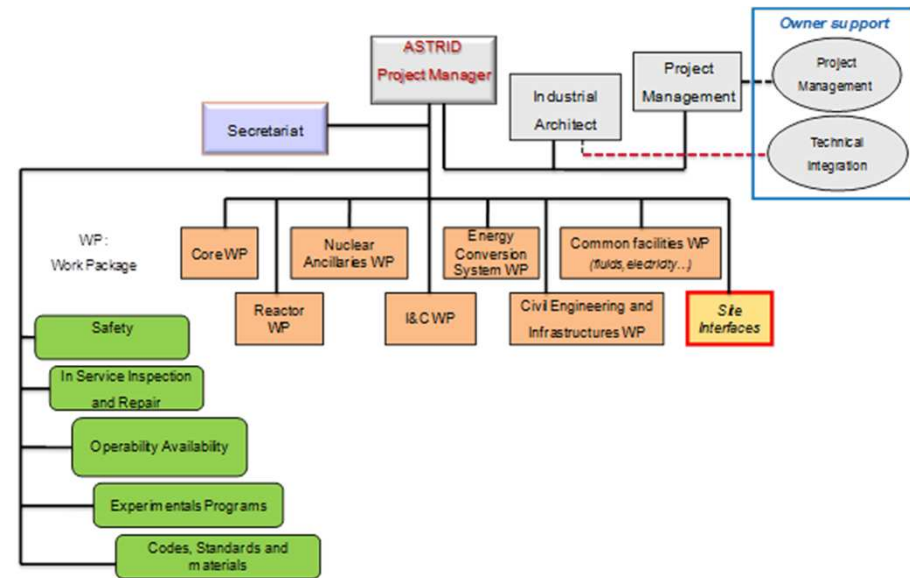
- behaviour studies on irradiated materials;
- production of radioelements for medical purposes



ENVIRONMENTAL ASSESSMENT FOR THE PROJECT LIFE CYCLE

Project organization

- Project team:
a leader for site and environment matters



- Specification documents : to put environmental requirements in the major structuring documents
 - Functional specifications
 - Project management specifications
 - Performance management plan
- Documents to be produced by engineering firms at the end of conceptual design
 - Principle, quantification and means of minimising waste and effluents
 - Waste and effluent zoning plan

Methodology: to consider the environment as a criterion of choice

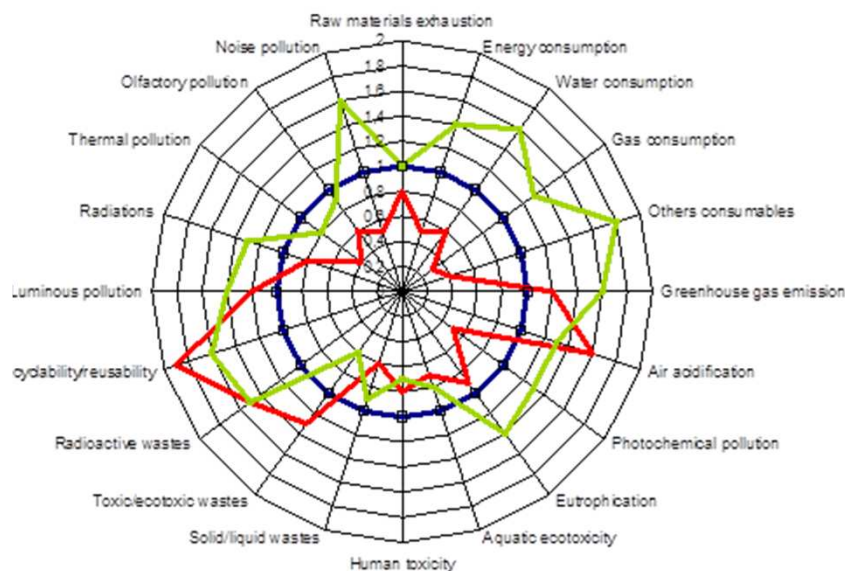
■ Definition of environmental specifications : French ministerial order of 7 February 2012

The facility operator must ensure that:

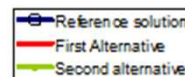
- ❖ Its facility is designed, built, operated, maintained, decommissioned and dismantled with the lowest level of risk and environmental impact deemed economically acceptable,
- ❖ The best available techniques are applied whenever possible,
- ❖ All measures are applied to offset any negative impacts that cannot be avoided or sufficiently reduced.

■ Quantification of environmental performance levels for options

■ Assessment of the life cycle for different options



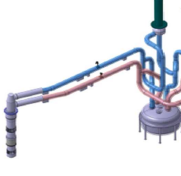
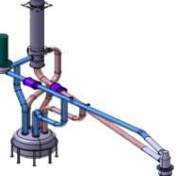


Impact category	Environmental Performance Indicator
Consumption and use of natural materials and resources	Depletion of raw materials, Energy consumption, Water consumption, Gas consumption,
Emissions/Releases	Greenhouse gas emissions, Air acidification, Photochemical pollution, Aquatic eco-toxicity
Waste	Solid/liquid waste, Toxic/eco-toxic waste, Radioactive waste, Recyclability
Pollution	Luminous pollution, Thermal pollution, Olfactory pollution, Noise pollution



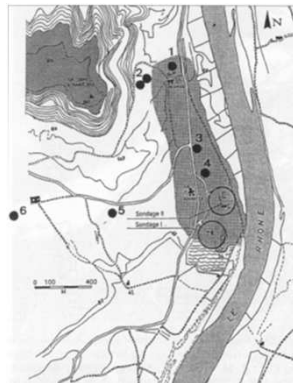
ENVIRONMENTAL APPROACH IN DESIGN / CONSTRUCTION / OPERATION / DISMANTLING

■ Option selection process

				
	Solution 1	Solution 2	Solution 3	Solution 4
Safety	19/30	11/30	25/30	30/30
Cost	10/30	17/30	18/30	16/30
Global arrangement	13/30	14/30	17/30	18/30
Inspection	1/10	5/10	6/10	7/10
Maintainability, Reliability	3/10	5/10	7/10	6/10
Readiness TRL (Risk level)	6/10	4/10	5/10	5/10
Environment	3/10	8/10	6/10	6/10
TOTAL	55/130	64/130	84/130	90/130

Processing of choosing a site

- A previous site (on a nuclear site)
- Site studies to confirm the low environmental impact
 - from an archaeological point of view



- From an ecologic point of view: to preserve wildlife and habitats



Alouette lulu



Process of choosing a site

- Site studies
 - To optimize integration into the landscape



Traditionnal cooling tower



Lower design with invisible plume

- The result of the environmental assessment (and measures to minimise the project's footprint) is submitted to public acceptance during the public debate (conceptual design) and then public enquiry (basic design)

Green site policy

- Involvement of all partners
- Documents with environmental targets
- Concrete actions in the field:
 - Optimising transport of materials



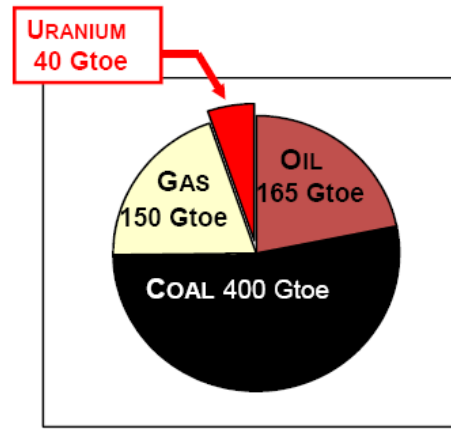
- Optimising resources (water, packaging, etc.)
- Sorting waste for specific recycling



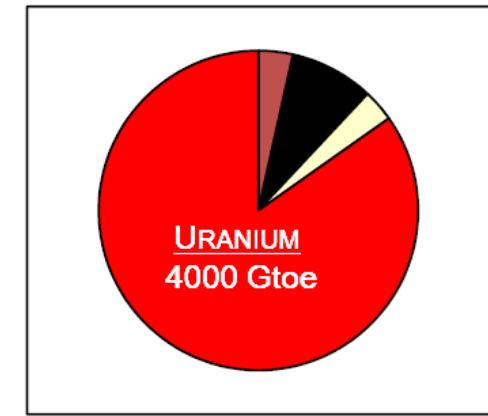


Resource preservation: fast neutron reactors advantages

- Uranium-238 unusable today turns out to be a fuel



Uranium use in current reactors



Uranium use in 4th generation reactors

Part of uranium in the global energy resources

- Multi-recycling of reprocessed plutonium



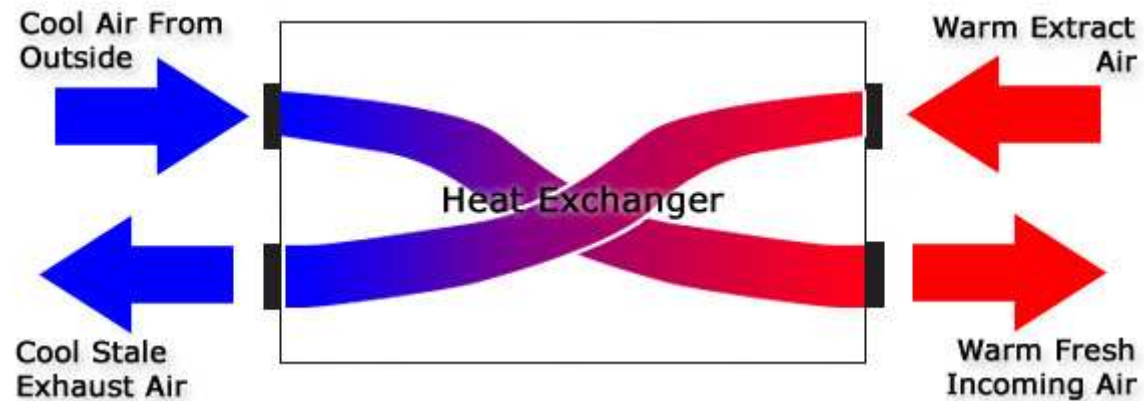
A security of supply for thousands of years !!

- The 4th generation reactors will be able to burn minor actinides (currently considered as high-level waste)

Energy management

- Ex : Heating
 - Priority: limit thermal losses : concrete + massive design

- Heat recovery :



on a specific building
... but also to heat other site's buildings !

Dismantling strategy must be integrated as soon as possible !

- The earlier you plan the strategy, the more you can reduce the impact
- During the design phase:
 - To be careful with the choice of materials
 - To estimate the quantity and radiotoxicity of waste produced during the dismantling phase
 - To organize dismantling reviews

- The environmental impact of nuclear energy is one of the lowest of any energy source (no CO₂, efficient waste management)
- Environmental strategy for new projects :
“to avoid, reduce and offset the environmental impacts of the project through its whole life cycle”
- Design: environment as a real criterion in the process of choosing options
- Construction: involving every partner of the project : project owner, engineering team and contractors



Thank you for your attention !

Commissariat à l'énergie atomique et aux énergies alternatives
Centre de Saclay | 91191 Gif-sur-Yvette Cedex

Etablissement public à caractère industriel et commercial | RCS Paris B 775 685 019

Nuclear Energy Direction
Projects Department

ladurelle@drncad.cea.fr