Decommissioning Operations at Marcoule

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DEN-DDCC
- Nuclear industry is 3d largest industry (2,500 French companies, nearly 220,000 employees)
- Decommissioning benefits from this supply chain constantly in action from the sixties.
WEIGHT OF DECOMMISSIONING AT CEA - DISTRIBUTION OF RESOURCES

Overall CEA Budget 2017
€ 5,0 billion

Civilian activities
2,4 billion

Defence activities
1,8 billion

Decommissioning
0,74 billion

+ 100 Projects
5 to 50 years

5 Civilian sites
350 M€ to several Billions

+ 1100 CEA employees
+ 100 Industrial partners, 2500 employees

25 000 m³/year Conditioned waste

French Alternative Energies and Atomic Energy Commission
Need to comply with annual subside but also need to accelerate projects to decrease total project costs:

- Prioritization of operations
- Associated organization
- Reduction of fixed costs

Main priorities in Marcoule

1. Magnesium ILWLL
2. UP1 Plant (Alpha)
3. Waste & SF Facility 72
4. Vaults Facility 56
5. Bitumen vaults
6. Sludges tanks UP1 plant and FPS
7. North zone legacy waste
8. APM Buildings 211 & 213
9. FAR: Building 53
10. Tritium/ Heavy water CELESTIN

- Operations & waste management on sites (44%)
- Fixed costs (28%)
- Investments (12%)
- Management (6%)
- CIGEO (10%)
MARCOULE: A UNIQUE SCIENTIFIC & INDUSTRIAL PLATFORM IN OCCITANIE, SOUTHERN FRANCE

- Technological research
- Industrial development
- Initial and continuing training
- A national and international showcase for expertise in Decommissioning

Workforce: 5,000 +
First industrial site of Gard, Second in Occitanie region

Cycle R&D + D&D projects
D&D: 850
MELOX: 725
Transports

Waste treatment

Sterilized material

- Lifesciences
- Transports

1,500
170
10

French Alternative Energies and Atomic Energy Commission
Early 1950s: Marcoule selected as the development center for CEA nuclear activities

Very important economical impact
- **1500 employees**: 66% in Gard, 12% in Bagnols sur cèze
- **367 M€ expenses** (~2200 jobs), **172 M€ in Gard** (1130 jobs)

Long term vision: heavy and constant investments
- **Site**: ~120 M€ since 2005
- **Heavy investments**: > 200 M€

Facilities under decommissioning:
- 3 gas cooled reactors
- 2 reprocessing plants
- A fast breeder reactor
- 2 reactors for tritium
### UP1 DECOMMISSIONING PROGRAM

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1958</td>
<td>Commissioning for reprocessing of spent fuel from defense reactors</td>
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<tr>
<td>1976</td>
<td>Creation of COGEMA, industrial branch of CEA: extension to industrial clients</td>
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<td>1996</td>
<td>Creation of CODEM joint venture (EDF, CEA, AREVA)</td>
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<td>1997</td>
<td>Shut down - 18,200 tons reprocessed</td>
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<td>2004-2005</td>
<td>Dissolution of CODEM: CEA in charge of the decommissioning program as owner; project management delegated to a consortium lead by AREVA</td>
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<td>2010</td>
<td>CEA takes over project management and awards contracts to the supply chain</td>
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#### 6 Decommissioning Projects:
- UP1 plant
- Decladding facilities
- AVM / FP storages
- Support Workshops
- Bitumen and non Bitumen waste reconditioning
Both radiation and contamination: alpha radionuclides with criticality risks and radiation levels up to 300 Gy/h

- Relatively inaccessible areas: ventilation systems, basement areas
- 300 cells, each is a specific workshop
NEED FOR HOLISTIC APPROACH BASED ON OPTIMIZATION OF WASTE

- Characterization
- Scenarios
- Rinsings
- Decontamination
- Remote operations
- Waste treatment and conditioning
- Facility maintenance and management
- Safety measures
• Operators not used to project management of huge projects with lot of uncertainties and need for constant questioning and adaptation to situation
• Need for people underestimated in terms of number and of qualification, especially for Project management
• Few subcontractors specialized in Decommissioning in 1997 (STMI, ONET, SALVAREM)
• but large spectrum of local companies working in the field of maintenance and used to adaptation of facilities in active environment under strict specifications from operators.

First of the kind of “integrated team” finally put in place in 2001, built on synergy between teams and creation of new skills in Decommissioning.
2. FROM 2010= CEA TAKES OVER PROJECT MANAGEMENT AND AWARDS CONTRACTS

• Need to hire new comers from outside
• Procurement following rules of public bids with competition and departure from the exclusive reliance on AREVA
• Change the mindset of CEA staff to be more self-committing to the project implementation.

Management of human resources with to coherence between:
- Skills and competences of people writing specifications
- Number of people in charge of project management onsite
- Skills and expertise of supply chain
- Complexity and size of work packages subcontracted

• Project Management type Organization but management of plant and project management still not driven by same persons and no hierarchical power given to project managers.

Drivers for organization:
- Synergy between project management and security/safety management
- Address transversal topics and knowledge management
HISTORICAL EVOLUTION OF THE OVERALL ORGANIZATION
3. FROM 2017- NEW DIRECTORATE DEDICATED TO D&D AT CEA

- Creation of local units in charge of both project management and Management of plant with security and safety responsibilities
- Head of unit with hierarchical power
- Program management at national level in charge of transversal topics
- Full lead in tackling with D&D works: industrial strategy for contracting, definition of lots, associate management of resources, etc.

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<tr>
<th>Director</th>
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<tr>
<td>Headquarter:</td>
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<tr>
<td>- Performance</td>
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<td>- Purchasing, Finance</td>
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<td>- Prospective and International Dypt</td>
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<th>Methodology control and Assistance</th>
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<th>Transversal Programs</th>
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<tr>
<td>Waste Flow management</td>
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<td>Waste storages</td>
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<td>Fissile material management</td>
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<td>Transportation - Packaging</td>
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<td>Support Nuclear facilities</td>
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<td>R&amp;D for D&amp;ER</td>
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<td>Nuclear sources management</td>
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<tr>
<th>D&amp;ER Projects</th>
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<tr>
<td>Marcoule D&amp;ER Projects</td>
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<td>- UP1 Plant / Vitrif. S.</td>
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<td>- UP1 Bitumen</td>
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<td>- Construction EIP +Dihadem</td>
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<td>- APM</td>
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<tr>
<td>- D&amp;ER Fontenay/ Roses</td>
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<td>- D&amp;ER Saclay</td>
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<td>- UP1 Legacy waste</td>
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<td>- PHENIX</td>
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<td>- G1/G2/G3, Pierrelatte</td>
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<th>Autres projets Mar (ISAI, Atoll, labo...); 13%</th>
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<tr>
<td>STEL (Stema et rénov.); 25%</td>
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<tr>
<td>D&amp;ER; 29%</td>
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<td>SAC; 3%</td>
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<tr>
<td>CAD; 9%</td>
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<tr>
<td>FAR; 1%</td>
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<tr>
<td>PHENIX; 13%</td>
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<td>APM; 7%</td>
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French Alternative Energies and Atomic Energy Commission
When strong security and safety stakes: absolute necessity to verify and validate abilities of companies prior to their involvement in nuclear facilities → Acceptance process

**Point of focus for Acceptance**
- Skills in management, training,
- Management, organization,
- Safety culture
- Feedback
- Equipment and practices for radioprotection
- Management of subcontractors

**Step by step approach**
Workshops with Pu or Tritium in 2d steps

**Interest and drawback of new comers**
- Competition, new methods and technologies → Open platform for calls, dedicated annual presentations to local industry
- Risks of failure and no-perenity and more work for supervision teams
HOW TO ENHANCE MORE INNOVATIONS IN DECOMMISSIONING?

- Still further developments required, particularly aiming at improving performances, safety and waste minimization: solutions to pending problems, optimization, methodology and even standardization wherever possible
- Also non-technological issues i.e. competence maintenance, education and training, dialogue with society regulators, etc.)

**e.g. at CEA, needs for:**

- Retrieval, filtration and conditioning of radioactive sludge
- Graphite blocs retrieval and conditioning
- Soil control and remediation (RN propagation)
- Laser-cutting with aerosols management
- Conception of a new transport equipment for highly radioactive sources
- ... and qualification / industrialisation

- More impulse needed to develop and to use research and innovation in Decommissioning and to promote and organize at co-financing of developments and demonstrators at national and international level
- Need to encourage creation of companies to commercialize innovation (spin-out, ...)
EXAMPLE OF IMPLEMENTATION OF INNOVATIVE TECHNOLOGIES IN DECOMMISSIONING:

- Uranus 65
- 1.9 m diameter
- 3.5 m high

- Successful Implementation of innovations developed by CEA R&D
- Equipments are now moved to 2\textsuperscript{nd} dissolver
- Demonstrator for further high active workshops in UP1
EXAMPLE OF TECHNOLOGY TRANSFER TO LOCAL INDUSTRIES
REMOTE Dismantling of UP1 MAR 200 Dissolvers

Developments
CEA R&D
- Development of MAESTRO
- Laser cutting
- Development of Virtual reality simulation tools

Manufacturing / Commercialisation
- CYBERNETIX
- PERMANOVA
- ONET
- OREKA
- LIGHT & SHADOW
- HAPTION

Decommissioning of UP1-MAR200 Dissolvers

CEA Owner
(Conceptual design, safety, procurement, etc.)

CEA R&D
- TRIALS
- TRAINING
- LASER SOURCE
- ASSISTANCE

ONET Technologies
(Detailed design, procurement, etc.)

Cybernetix
Permanova
Gonzales
Etc.

Cybernetix
MAESTRO
Permanova
Laser Head
Gonzales
Cells manufacturing

French Alternative Energies and Atomic Energy Commission
OTHER LOCAL PARTNER OF CEA FOR MECHANICAL DEVICES
Ex: Cementation line in Marcoule new facility STEMA

Specific device used for transfer, control and reconditioning of waste containers from storage pit
Continuous challenge to avoid delays and cost increase, while fulfilling its safety and security commitments

Importance of adequate organization: need for integration / synergy among teams but also need to address cross-cutting issues and lessons learned

Increased role of project management

Wide range of contracts with economical and social local impact: need to lead partnership with supply chain

Certain level of maturity in Decommissioning in Marcoule and all over the world, but still further developments required, aiming at improving performances, safety and waste minimization

Mutual interest for enhanced collaboration within Decommissioning stakeholders
Thank you for your attention.