

***French Operational Experience in  
Recycling Used Nuclear Fuel***  
***FCIX Conference***

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**1** *Back-End Division*

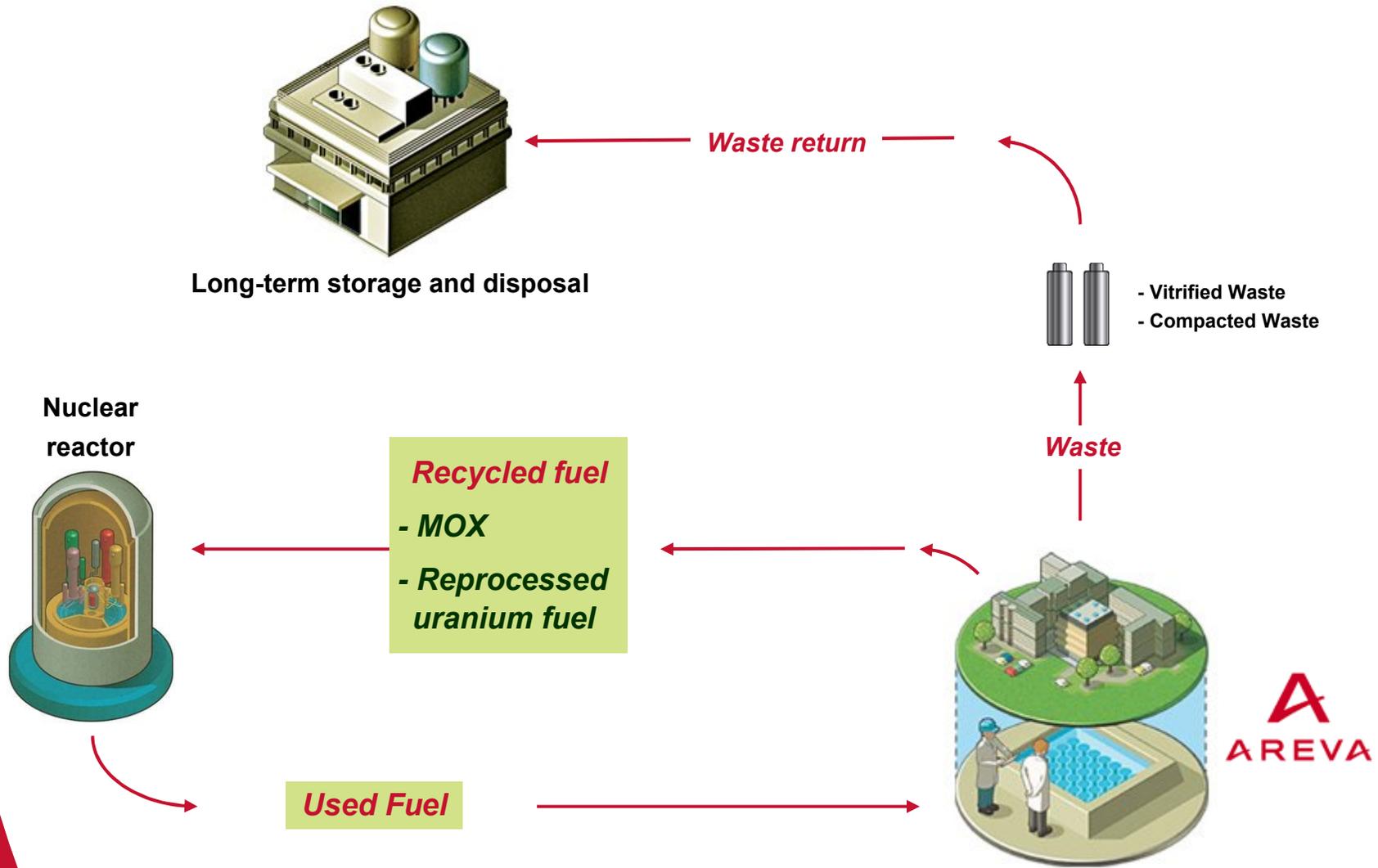
**2** *La Hague and MELOX*



## **Back-End Division**

- ▶ **Solutions for used fuel recycling**
- ▶ **Solutions for used fuel storage and transportation**
- ▶ **Facility decommissioning at the end of service life**





# Recycling Industrial Sites in France



▶ **Used fuel treatment**

- ◆ Separation of valuable materials
- ◆ Ultimate waste conditioning



▶ **MOX fuel fabrication**

▶ **RepU fuel fabrication**



**Tricastin**  
**(conversion, enrichment)**

**Note :** ■ Reprocessed uranium activities (conversion, enrichment & fuel fabrication) are included in AREVA Front-End division





## La Hague and Melox

# *La Hague Site*

## *The Largest Treatment Plant in the World*

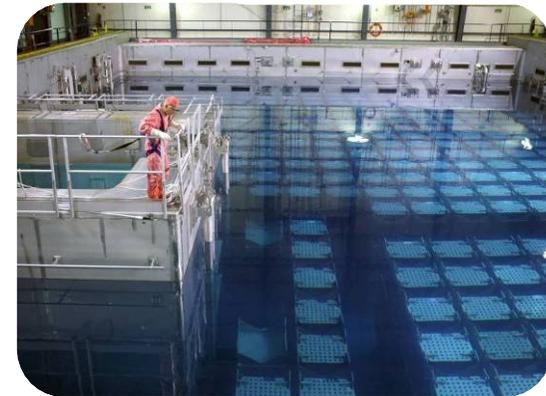
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### *Key figures*

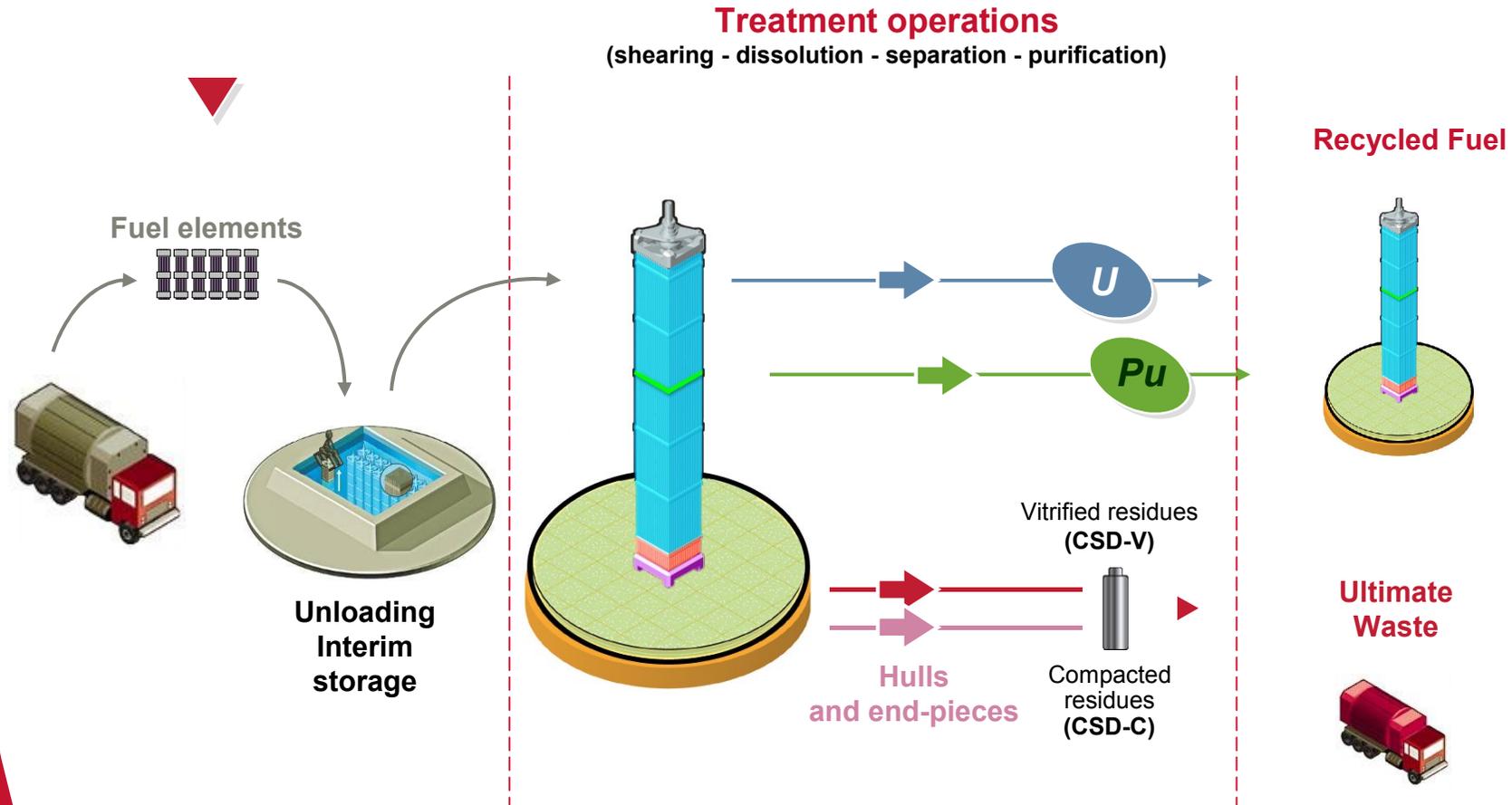


- ▶ **Surface area: 300 hectares**
- ▶ **Production capacity: 1,700 tons of used fuel**
- ▶ **Direct jobs: 3,100 direct jobs + subcontractors (5000 in all)**
- ▶ **Purchasing: €350 million injected into the local economy every year**
- ▶ **Taxes and duties: €175 million every year**
- ▶ **Environmental analyses: 70,000 analyses and 23,000 samples**

- ▶ **2 production units with the same output**
  - ◆ UP3, commissioned in 1990
  - ◆ UP2 800, commissioned in 1994
  - ◆ a total annual capacity of 1700 tons of used fuel
  
- ▶ **Original UP2-400 production unit (1966-1994) under self-funded decommissioning**



# The Main Stages in Recycling



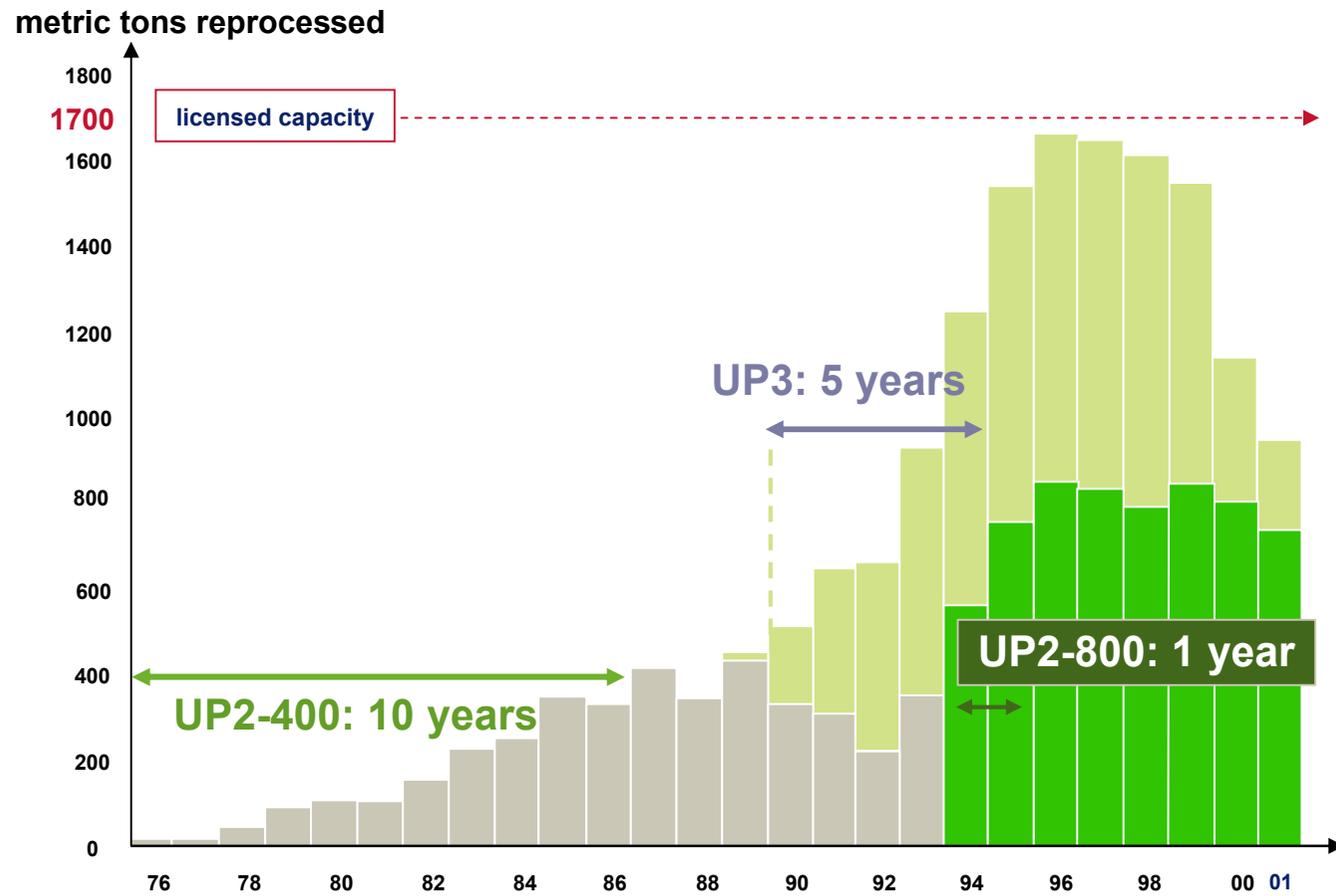
*At each stage, nuclear material accounting under EURATOM and IAEA safeguards*

# Over 23,600 Tons of Used Fuel Recycled

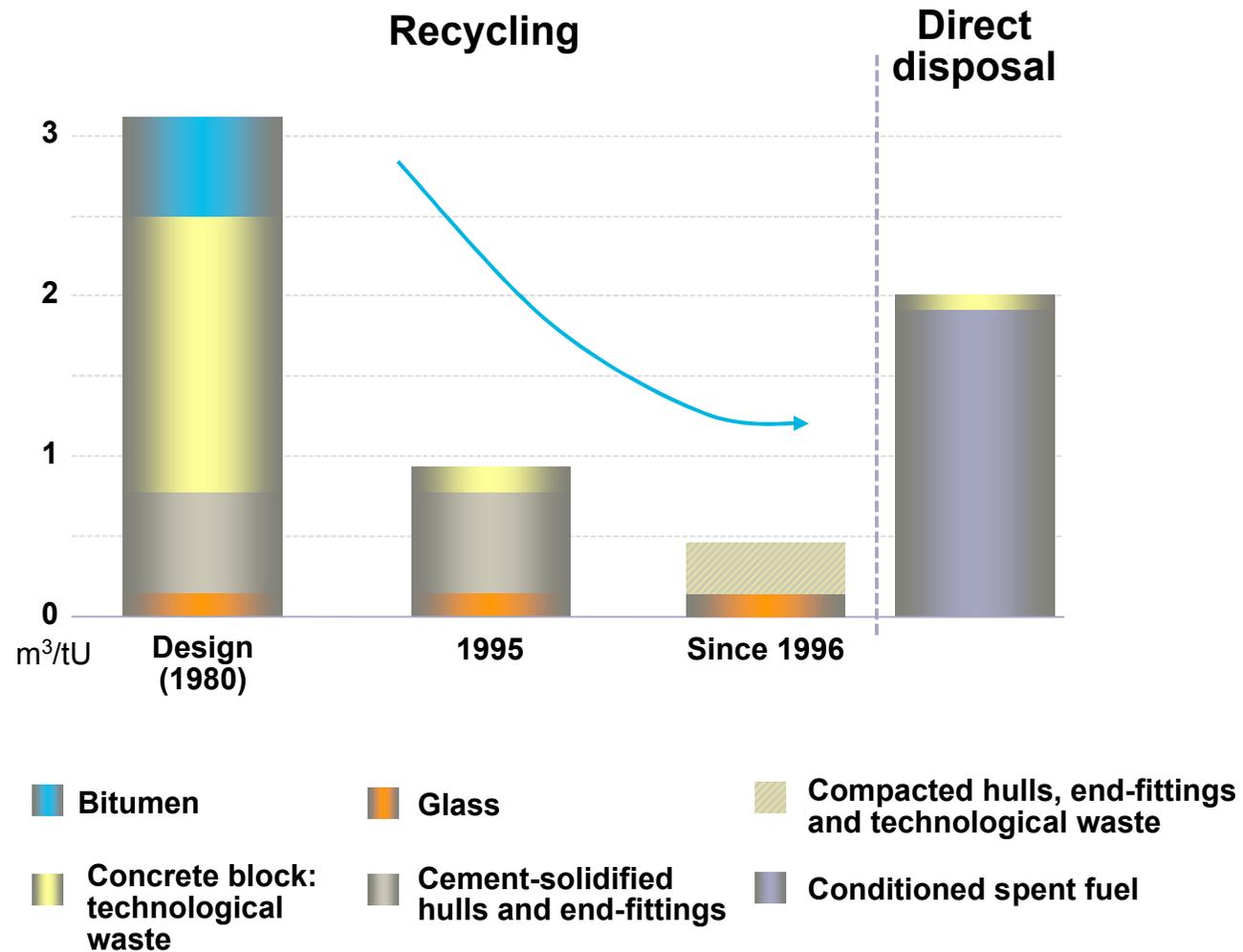
As of January 1, 2008

	Tons
<b>EDF <i>France</i></b>	<b>13,410</b>
<b><i>German</i> utilities</b>	<b>5,479</b>
<b><i>Japanese</i> utilities</b>	<b>2,944</b>
<b><i>Swiss</i> utilities</b>	<b>766</b>
<b>Synatom (<i>Belgium</i>)</b>	<b>672</b>
<b>EPZ (<i>Netherlands</i>)</b>	<b>326</b>

# La Hague Ramp-Up History

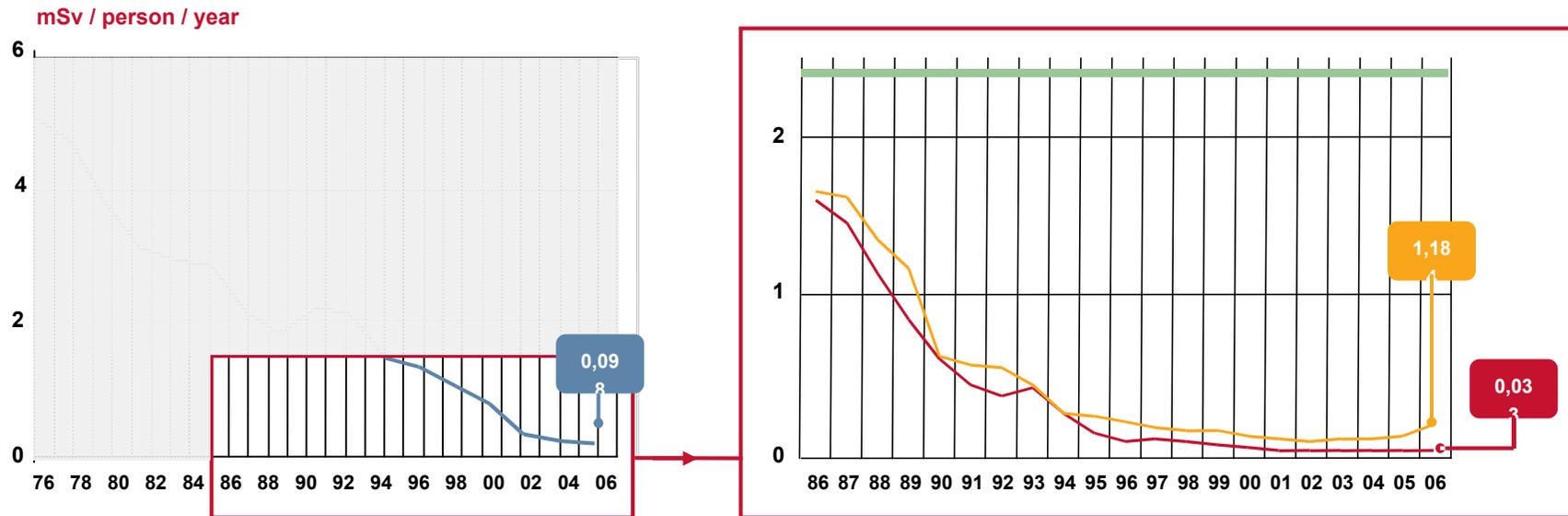


# Continuous Volume Reduction Over Time



# The Top Priority: Employees

Average annual dose per person (AREVA NC and subcontractors)



Site average

- AREVA NC-La Hague (2006: 0,098mSv/person/an)
- AREVA NC (2006: 0,033mSv/person/year)
- SUBCONTRACTORS (2006: 0,184mSv/person/year)
- NATURAL RADIOACTIVITY

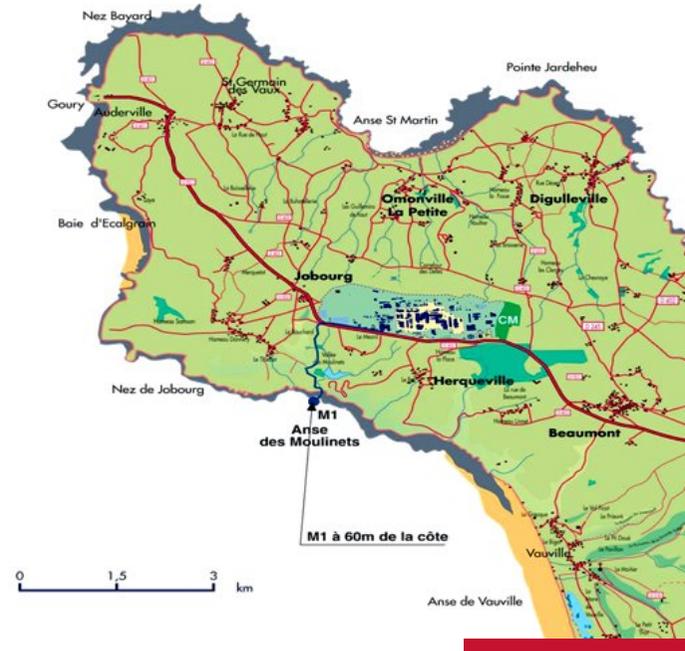
## Virtually No Impact on Health

- ▶ Example of la Hague: the maximum potential impact on the most highly exposed sectors of the public remains far below the natural radioactivity level

Natural Exposure  
2.4mSv / year

Fishermen  
< 0.02mSv / year

Farmers  
< 0.02mSv / year



*Impact calculated since 2004 using the ACADIE model produced by the GRNC, making allowance for the results of the AREVA NC public enquiry (1998), for a reference group: population likely to be the most highly exposed due to its position and lifestyle.*



## Comparison of approximate annual doses

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◆ Average <b>natural exposure</b> in France	2.4 mSv per person
◆ <b>Natural exposure</b> in Limousin	6 mSv per person
◆ A <b>medical X-ray</b> of the abdomen	1 mSv
◆ A <b>medical X-ray</b> of the lungs	0.1 mSv
◆ Consumption of one liter of <b>mineral water</b> per day during one year	0.03 mSv
<b>Annual impact of AREVA-La Hague releases : &lt; 0.02 mSv</b>	
◆ A <b>Transatlantic flight</b> from Paris	0.02 mSv
◆ A <b>400-meter increase in altitude</b>	0.02 mSv
◆ <b>Consumption of 200 grams of mussels</b>	0.02 mSv

# *MELOX site*

## *A technological achievement for France*

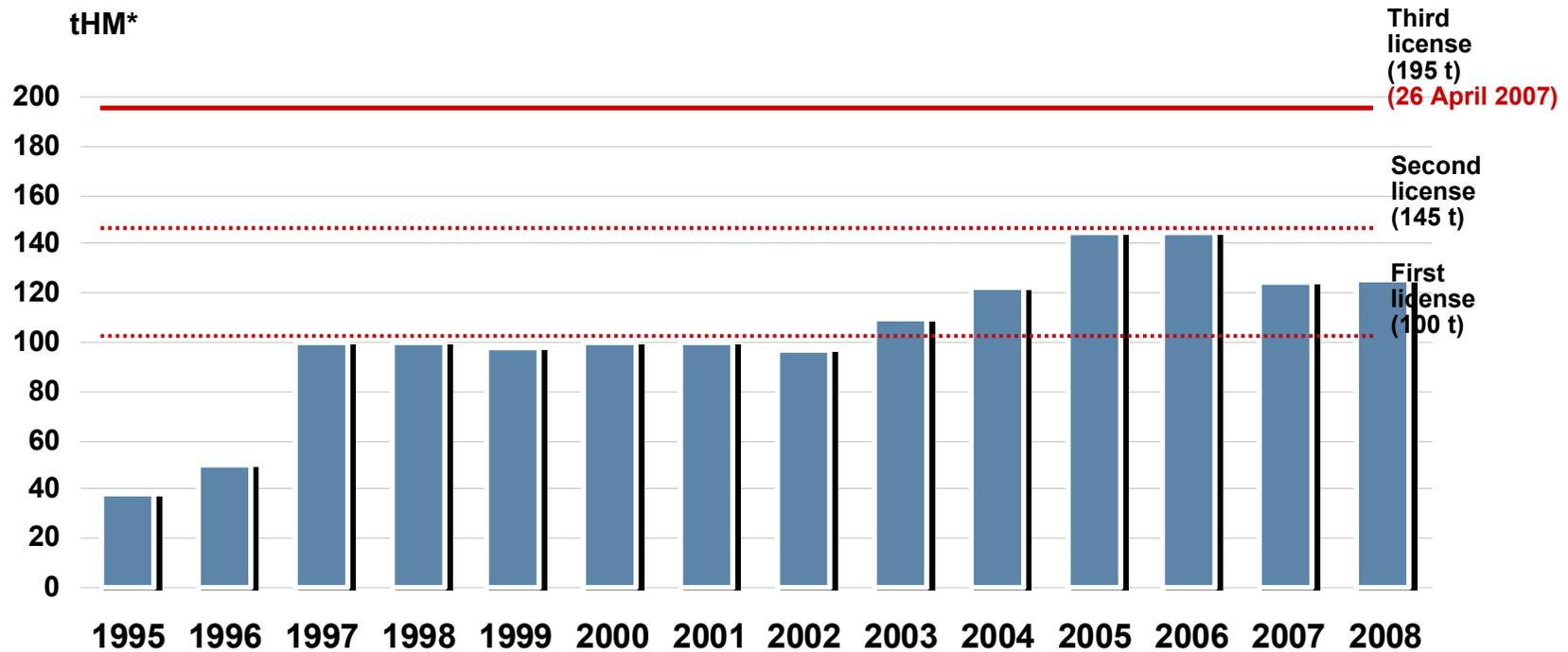
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### *Key figures*

- ▶ **Surface area: 7 hectares**
- ▶ **Annual production capacity: 195 tons (since april 2007)**
- ▶ **Direct jobs : 715 MELOX and AREVA NC employees**
- ▶ **Purchasing: over €100 million in orders divided among 700 companies, most of them in the region (60% in the Gard and Vaucluse departments)**
- ▶ **Taxes and duties: €10 million**



# Going from MOX to MELOX

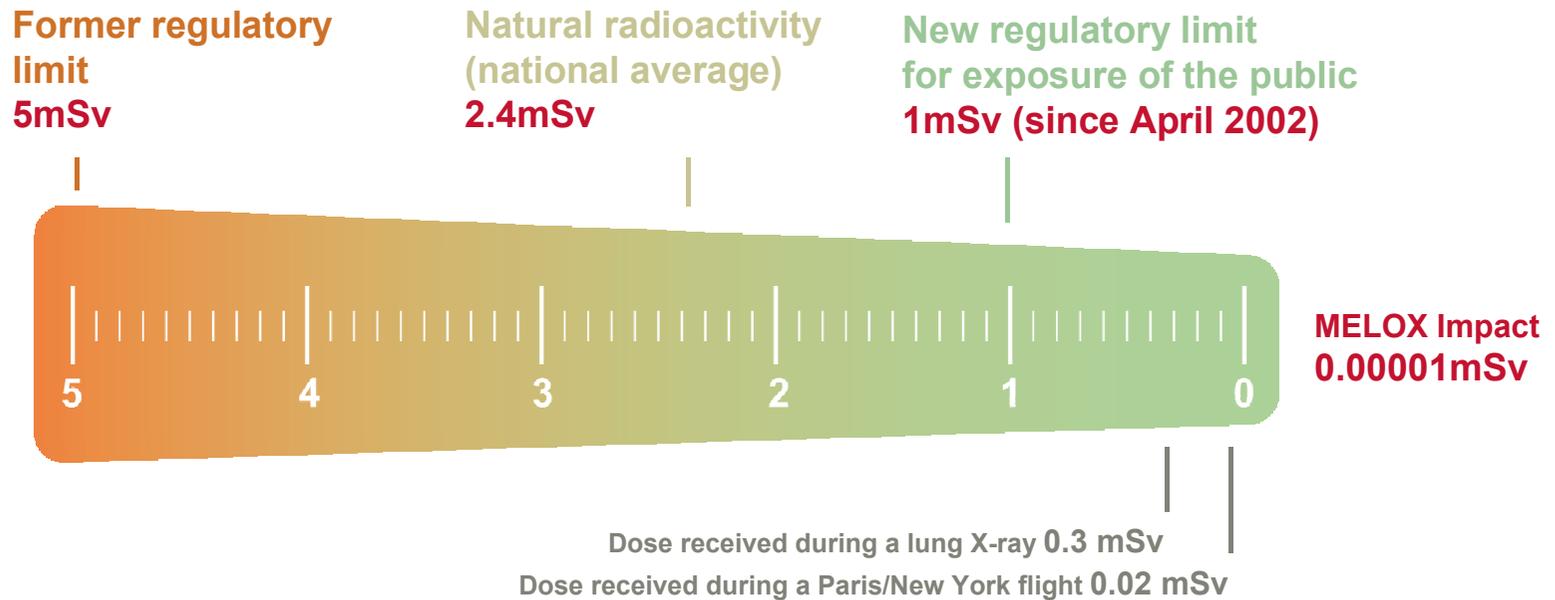


**1,425 tHM\* produced at end 2008**

(\*) tHM: tons of Heavy Metal

# Radiological impact of MELOX

- ▶ Annual impact of the radioactive liquid and gaseous effluents released from the MELOX plant was around 0.00001 mSv.



**Maximum release impact authorized by decree: 0.0017 mSv per year**

- ▶ **Recycling can help foster and sustain the nuclear renaissance**
  - ◆ **Sustainable management of the back-end of the fuel cycle**
  - ◆ **Front-end benefits for the utilities**
  - ◆ **Improving Public Acceptance for nuclear**
    - **France: 77%** of population “for or definitely for” recycling  
(Feb. 2007)
    - **US: 83%** “prefer to develop technologies to recycle nuclear fuel”  
(2009 – Bisconti Research)

**Making Nuclear Energy a *Recyclable Energy***