

# ALARA Program and RP Activities for the Reactor Vessel Head Replacement in Vandellòs II NPP

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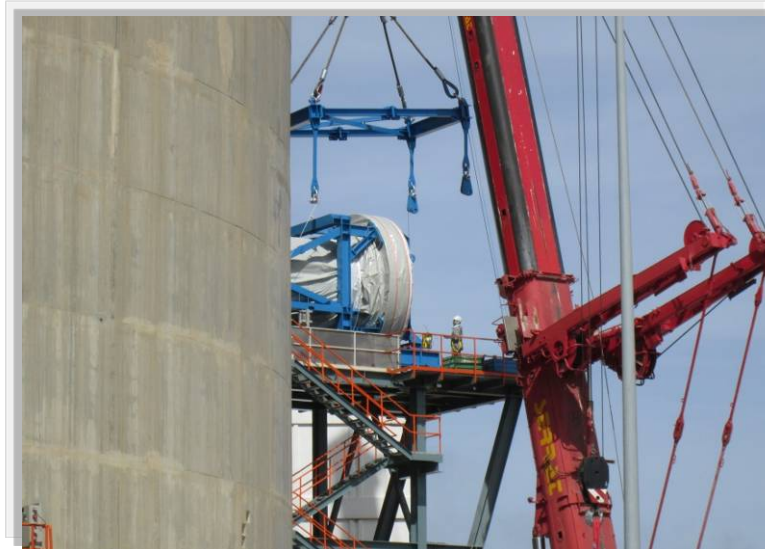
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Asociación Nuclear Ascó-Vandellòs II, A.I.E.

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1. Vandellòs II NPP: why RHVR?
2. Reactor vessel head dose rate evolution
3. Project description and dose planning
4. Dose Results Summary
5. Information and procedures
6. Learned lessons



## 1. Vandellòs II NPP: why RHVR?



**Owners**

ANAV (  endesa +  )

**Technology**

Westinghouse 3 loop  
Pressurised Water  
Reactor (PWR)

**Cooling**

Mediterranean sea and  
aircoolers. Forced draught  
cooling towers and  
safeguards pool recently  
implemented (2009)

**Power**

1,087.14 Mwe

**Start-Up**

March 1988

**Date of Current  
Operating Permit**

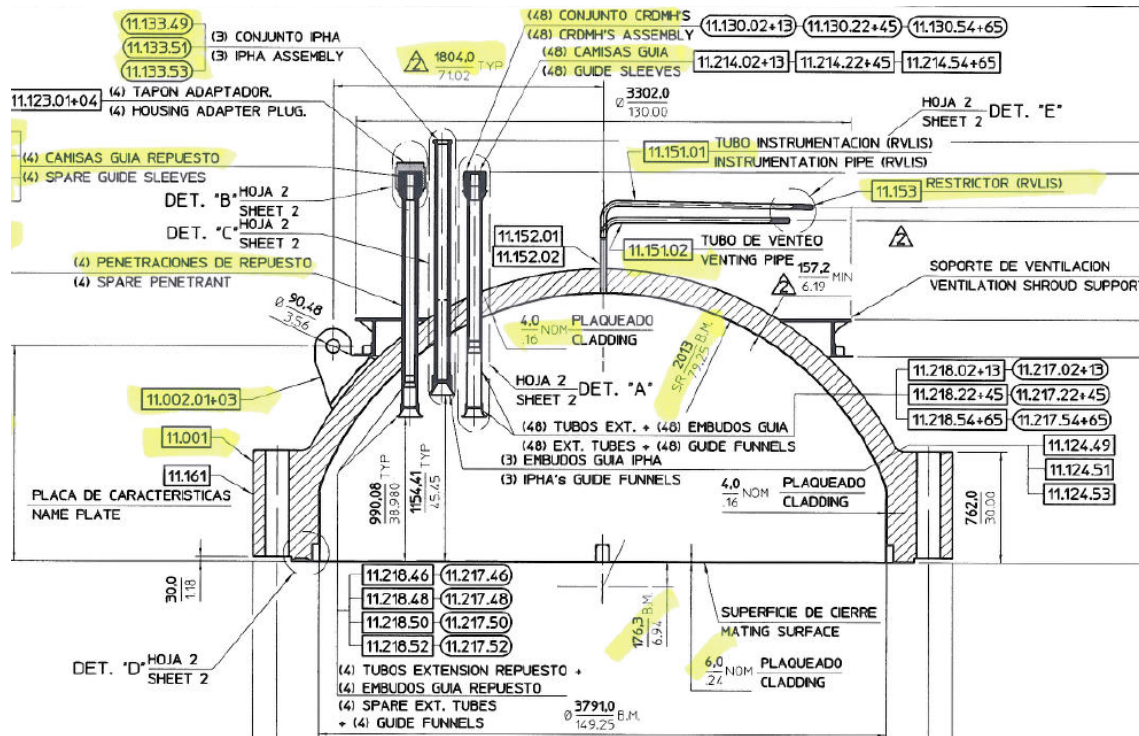
2010

**Spent Fuel Pools  
Saturation**

2020

## 1. Vandellòs II NPP: why RHVR?

### Operative international experience: PWSCC in NPP with Inconel 600 /82 /182 in the pressure barrier



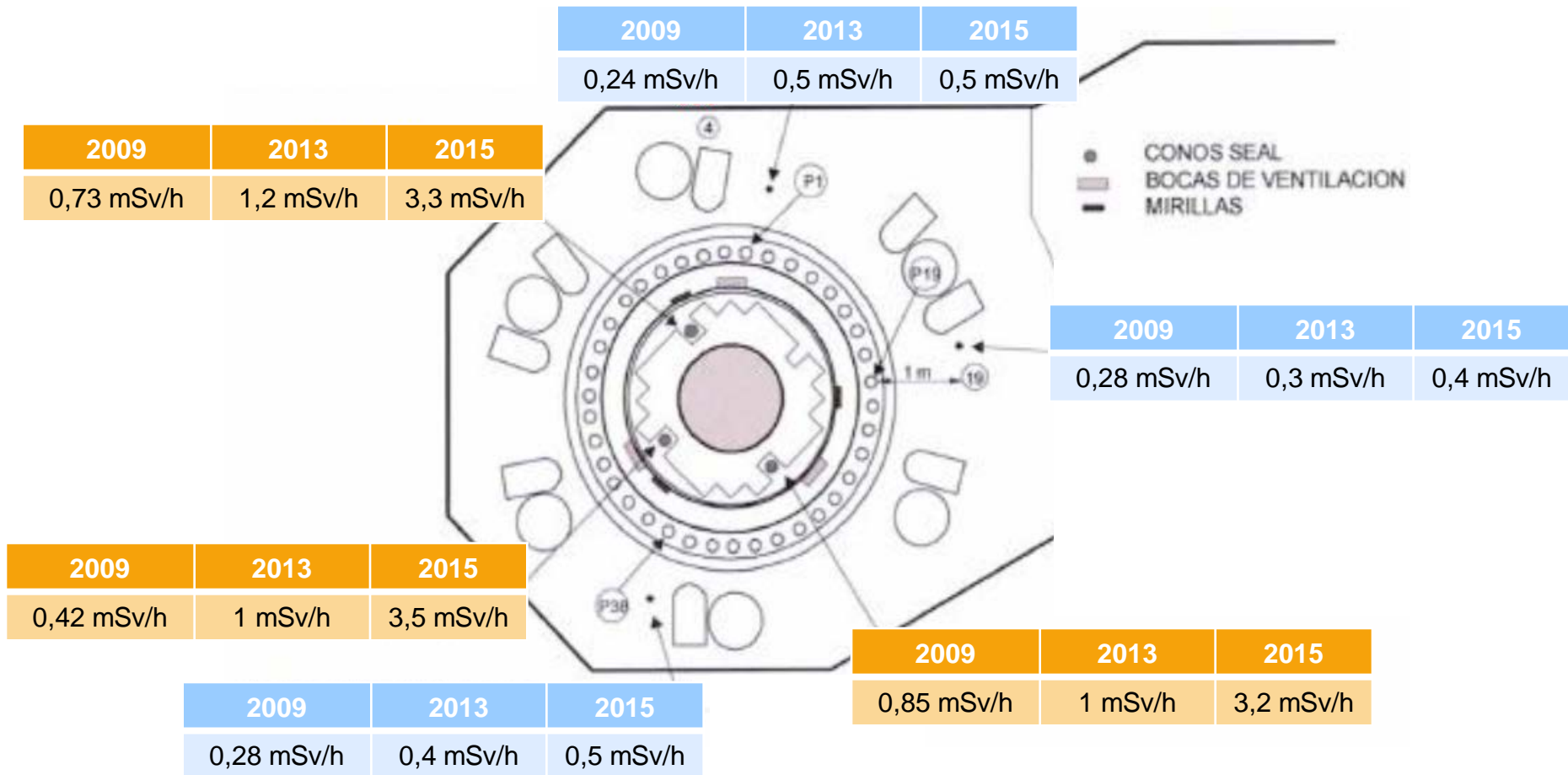
**Inconel 600 in the CRDM penetrations, thermocouples columns**

**Possible wear in thermal sleeves (specific Westinghouse issue)**

**Successive inspections: no cracking problems detected**

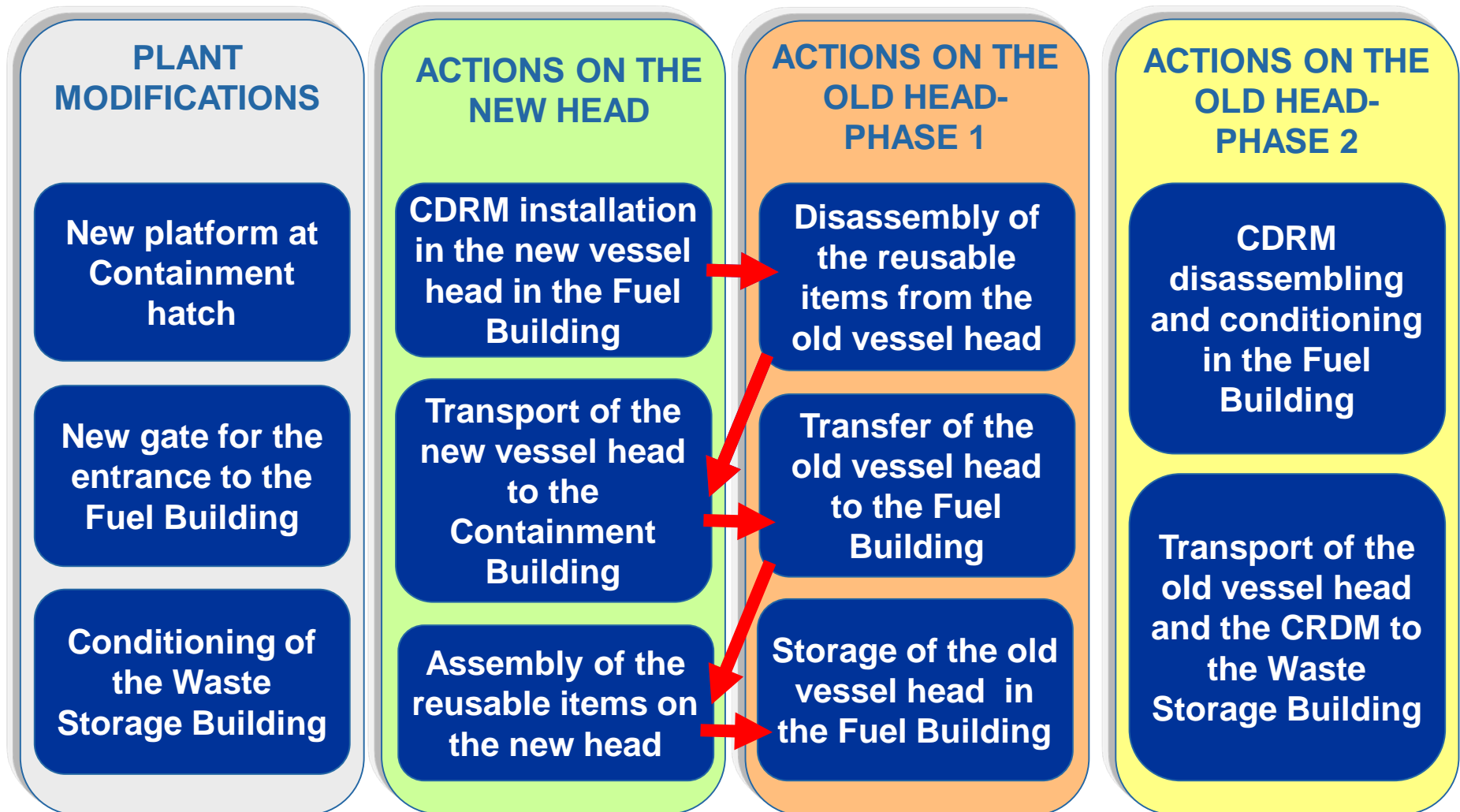
**Preventive measure: replacement of the vessel head by a necover with an improved design with Inconel 690 /52M / 152M**

## 2. Reactor vessel head dose rate evolution





### 3. Project description and dose planning



## 3. Project description and dose planning

### ACTIONS ON THE NEW HEAD

**CDRM installation  
in the new vessel  
head in the Fuel  
Building**

**Transport of the  
new vessel head to the  
Containment  
Building**

**Assembly of the  
reusable items on  
the new head**

Activity	Man-hours	Man-mSv		
	Inverted	Estimated	Re-estimated	Received
Assembly of the reusable items	<b>1091</b>	3	1	<b>1,271</b>



**No significant  
radiological concerns**

### 3. Project description and dose planning

#### **ACTIONS ON THE OLD HEAD- PHASE 1**

**Disassembly of  
the reusable  
items from the  
old vessel head**

**Transfer of the  
old vessel head  
to the Fuel  
Building**

**Storage of the old  
vessel head in  
the Fuel Building**

Activity	Man-hours	Man-mSv		
	Inverted	Estimated	Re-estimated	Received
Partial disassembly of insulation	35	10	10	<b>9,293</b>
Disassembly of the reusable items	594	34	22	<b>21,439</b>
Scaffolding	621	8	8	<b>8,105</b>
Shielding	54	1	5	<b>4,715</b>



**The shroud is the last reusable part  
to be removed. Opportunity to  
install additional shielding.**



**Dose re-estimation**



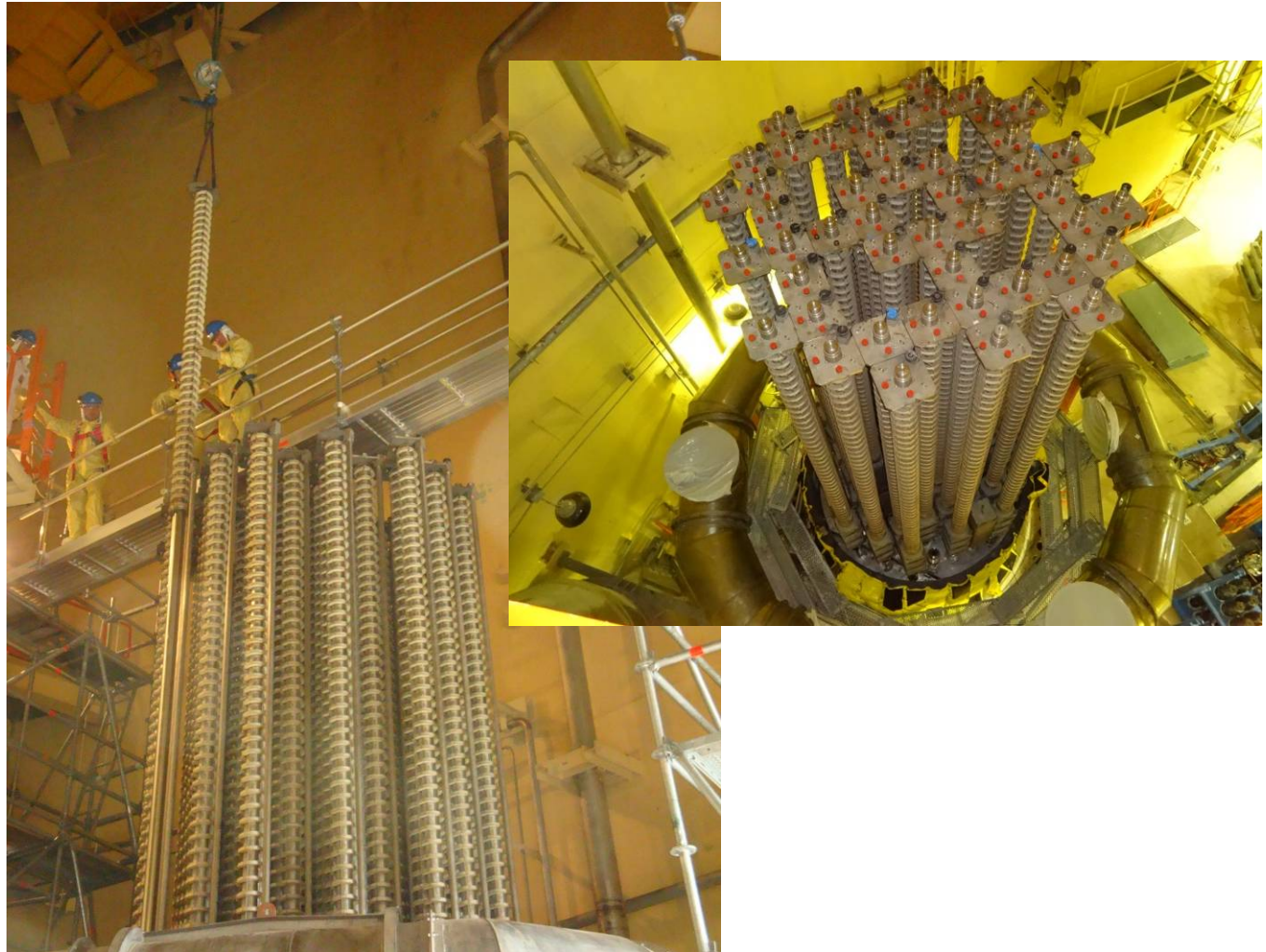
## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building



## 3. Project description and dose planning

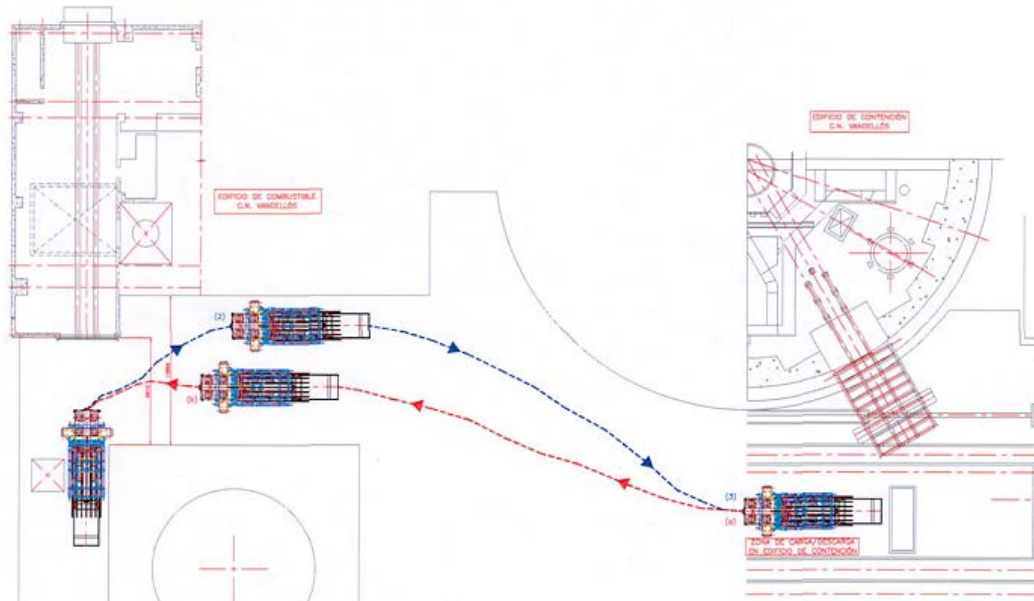
### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of the reusable items from the old vessel head

Transfer of the old vessel head to the Fuel Building

Storage of the old vessel head in the Fuel Building

Activity	Man-hours	Man-mSv		
	Inverted	Estimated	Re-estimated	Received
Preparation and Decontam.	<b>119</b>	8	7	<b>6,772</b>
Transfer to the Fuel Building	<b>1180</b>	41	22	<b>22,125</b>



Head vessel transfer much faster than expected (36 h estimated / 8 h inverted)

## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head  
to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building



- 134 smear samples before the vessel head exits out of the Containment Building (all  $< 0,4 \text{ Bq/cm}^2$ )





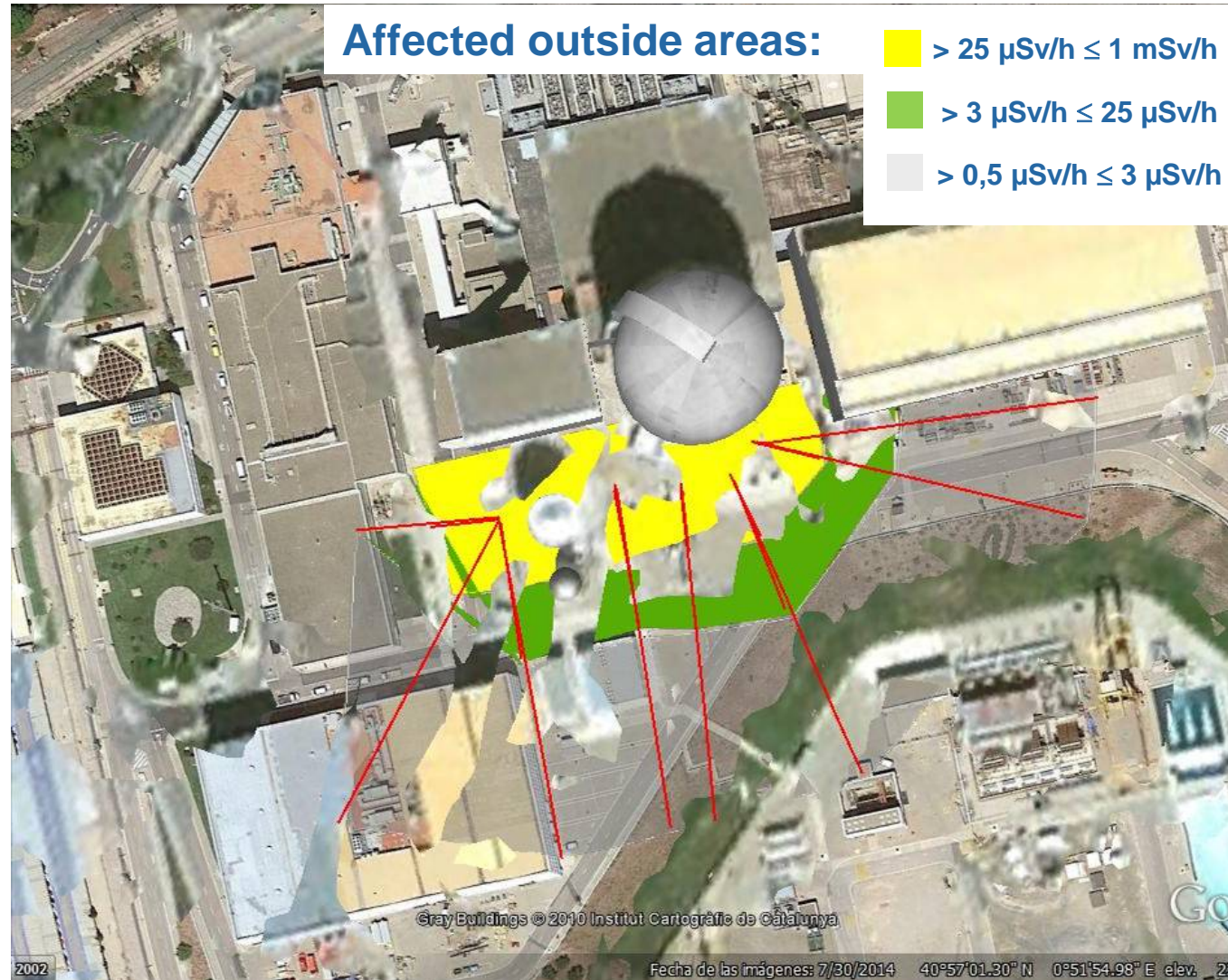
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### ACTIONS ON THE OLD HEAD- PHASE 1

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Transfer of the  
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Storage of the old  
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the Fuel Building



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head  
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Building

Storage of the old  
vessel head in  
the Fuel Building



### Teledosimetry

16 remote monitoring DLD +  
6 additional transmitters  
1 personal computer  
6 TLD



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

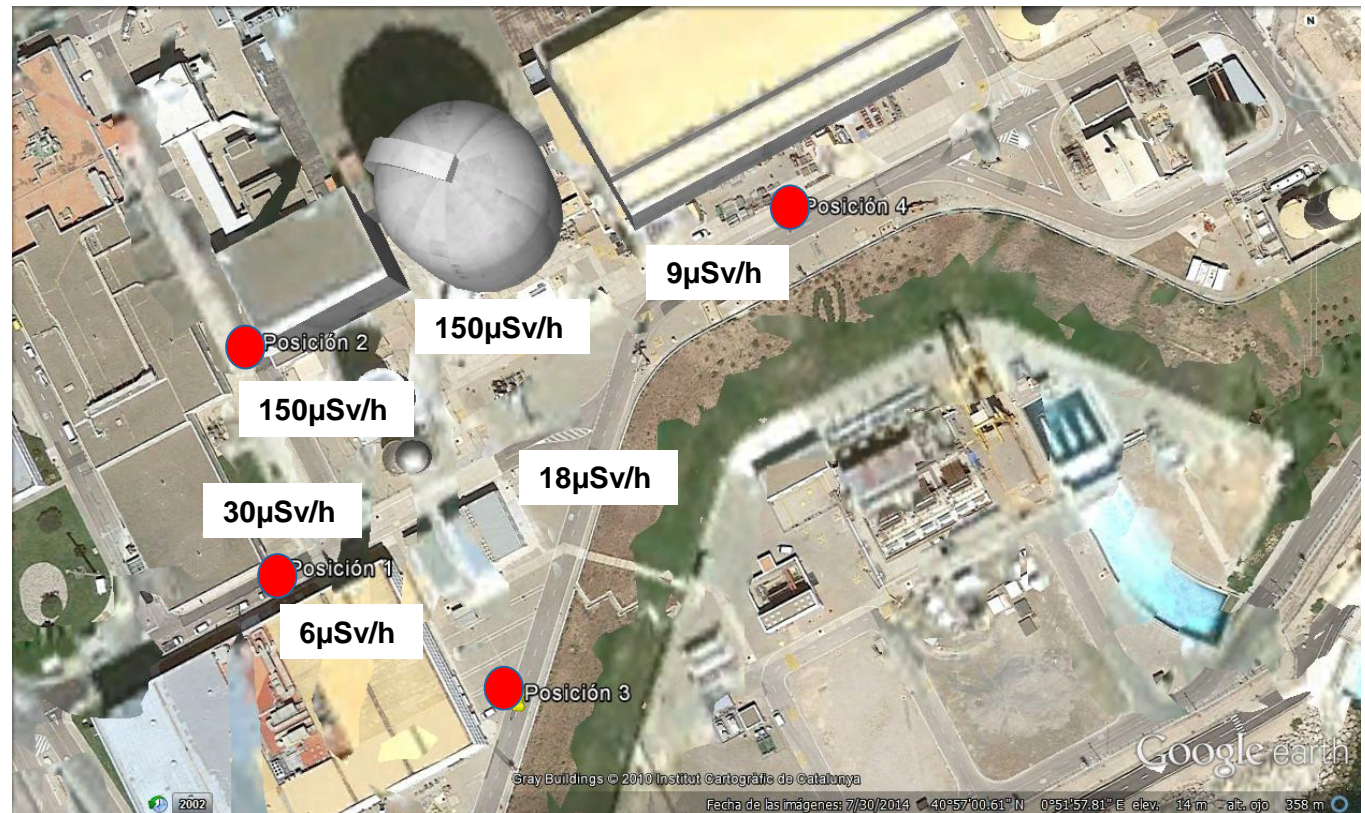
Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head  
to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building

### ● RP checkpoints (entrance to the restricted area)

Maximum dose-rate measured with the remote monitoring system



**RP team**

**8 ALARA Technicians + 2 RP coordinators (inside/outside containment) + 4 RP for teledosimetry control + RP managers**

## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head  
to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building



	Remote monitoring system:	
	Accumulated dose ( $\mu\text{Sv}$ )	Maximum dose rate ( $\mu\text{Sv/h}$ )
Crane 1	32	159
Crane 2	239	231





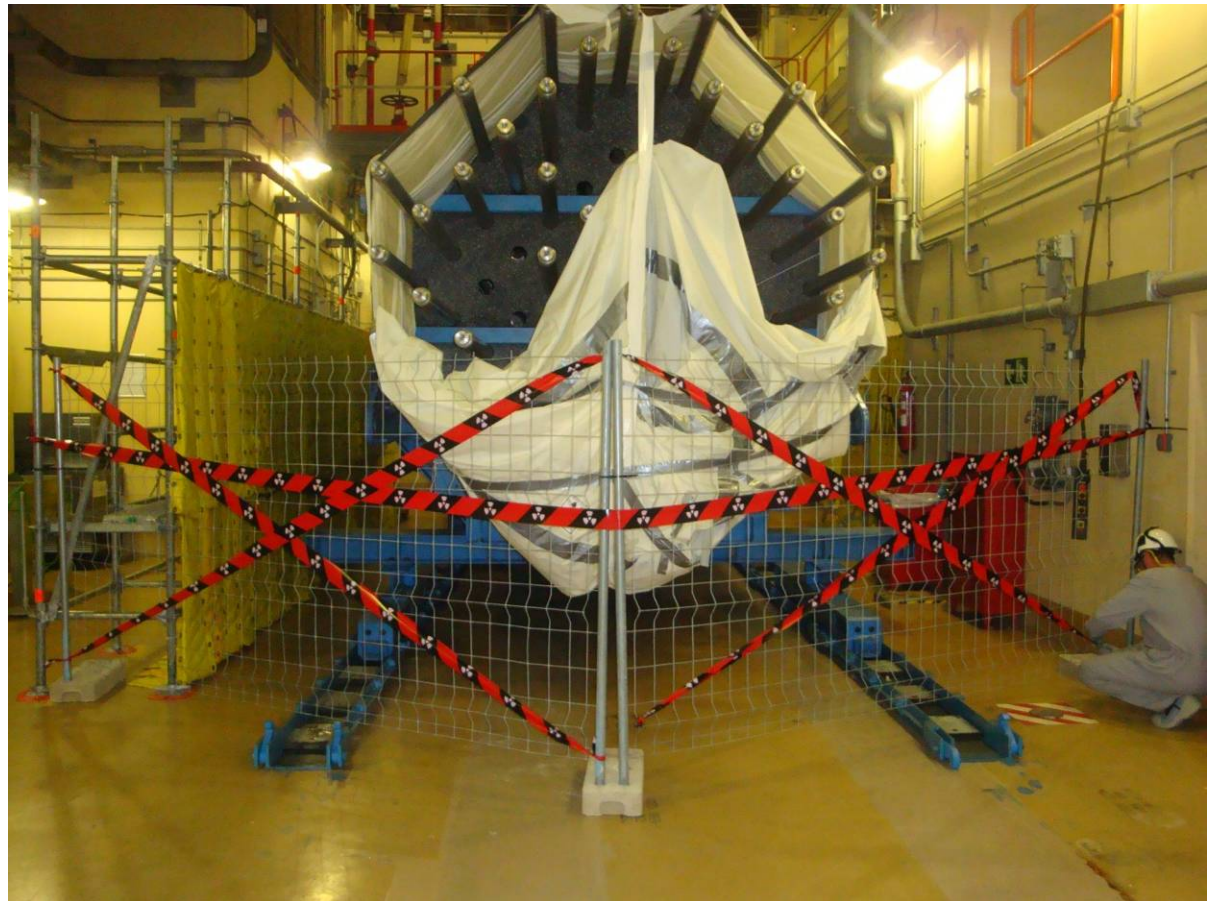
## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
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items from the  
old vessel head

Transfer of the  
old vessel head  
to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 1

Disassembly of  
the reusable  
items from the  
old vessel head

Transfer of the  
old vessel head  
to the Fuel  
Building

Storage of the old  
vessel head in  
the Fuel Building

May 2015- October 2015

- Forbidden access to the old vessel head
- Shielding to reduce the radiological impact in outer areas  
Work-management: minimization of jobs in the influenced area of the Fuel Building
- Temporal change of the affected area monitors threshold



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 2

**CRDM  
disassembling  
and conditioning  
in the Fuel  
Building**

**Transport of the  
old vessel head  
and the CRDM to  
the Waste  
Storage Building**

Activity	Man-hours	Man-mSv	
	Inverted	Estimated	Received
Scaffolding	<b>178</b>	12	<b>7,988</b>
CRDM cutting	<b>1465</b>	26	<b>11,161</b>
Decontam.	<b>290</b>	1,7	<b>2,787</b>
Shielding	<b>47</b>	1,5	<b>2,283</b>





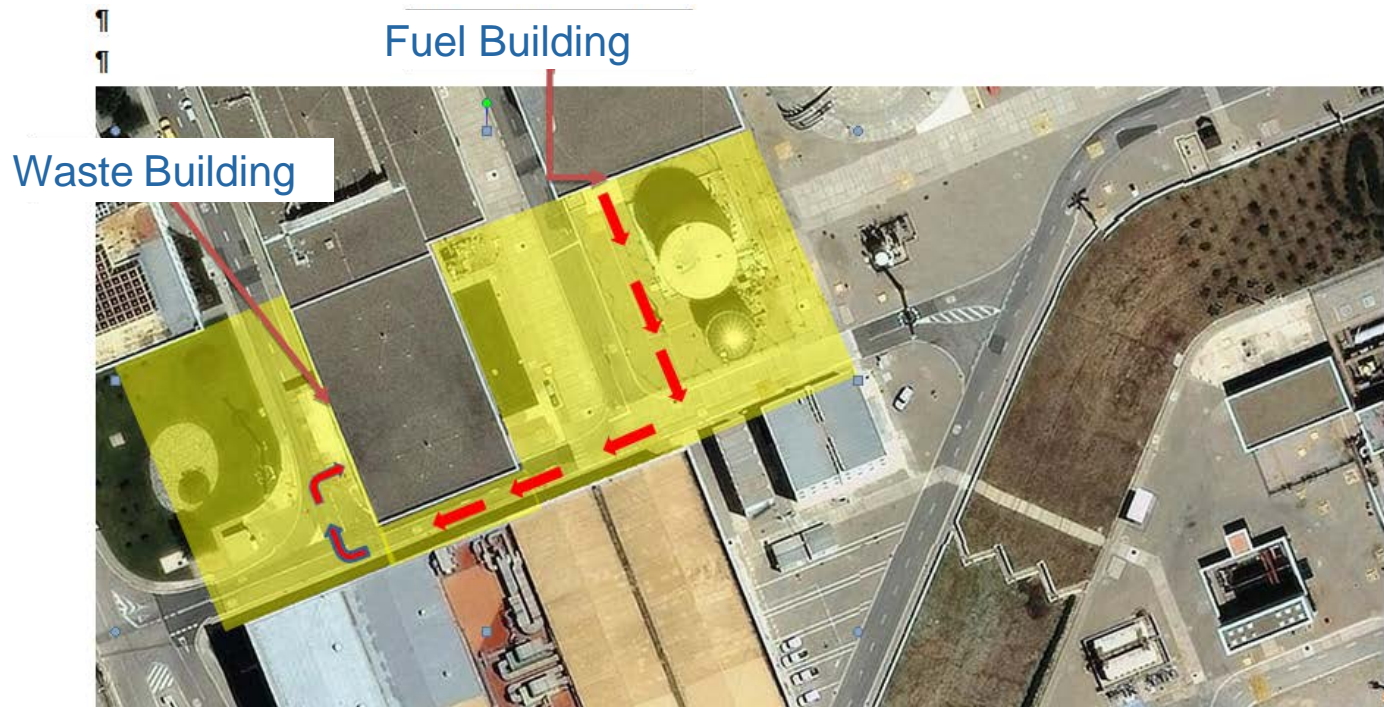
## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 2

CDRM  
disassembly and  
conditioning in  
the Fuel Building

Transport of the  
old vessel head  
and the CRDM  
to the Waste  
Storage Building

Activity	Man-hours	Man-mSv		
	Inverted	Estimated	Re-estimated	Received
Transfer to the Waste Storage Building	<b>1983</b>	37,9	<b>22</b>	<b>15,388</b>



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 2

CDRM  
disassembly and  
conditioning in  
the Fuel Building

Transport of the  
old vessel head  
and the CRDM to  
the Waste  
Storage Building



### Teledosimetry

16 remote monitoring DLD +  
3 additional transmitters  
1 personal computer  
6 TLD

### RP team

4 ALARA Technicians +  
1 RP coordinator  
+ 2 RP for teledosimetry  
control + RP manager





## 3. Project description and dose planning

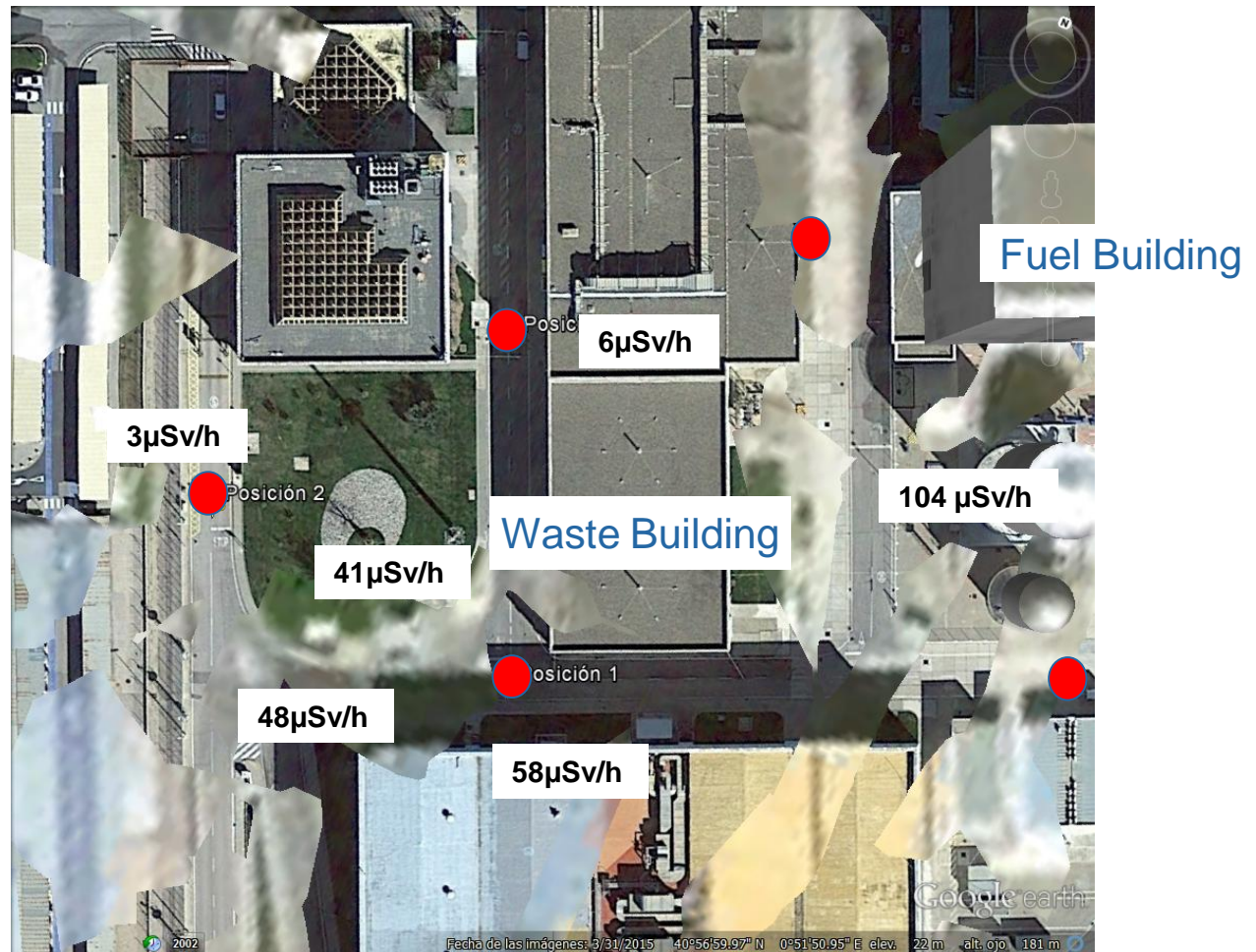
### ACTIONS ON THE OLD HEAD- PHASE 2

CDRM  
disassembly and  
conditioning in  
the Fuel Building

Transport of the  
old vessel head  
and the CDRM to  
the Waste  
Storage Building

### ● RP checkpoints (entrance to the restricted area)

Maximum dose-rate measured with the remote monitoring system



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 2

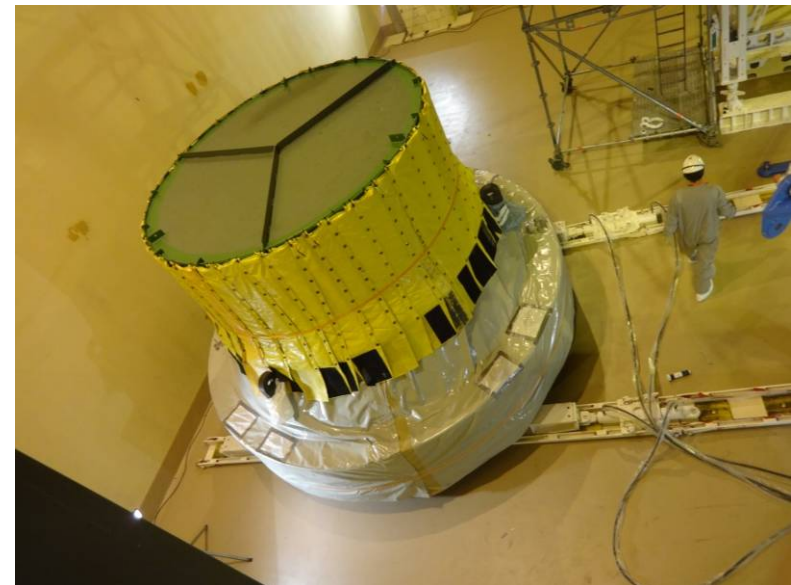
**CDRM**  
disassembly and  
conditioning in  
the Fuel Building

**Transport of the  
old vessel head  
and the CRDM  
to the Waste  
Storage Building**



12 hours for the head vessel  
movement - saturday

	Remote monitoring system:	
	Accumulated dose ( $\mu\text{Sv}$ )	Maximum dose rate ( $\mu\text{Sv/h}$ )
Driver 1	9	34
Driver 2	18	51



## 3. Project description and dose planning

### ACTIONS ON THE OLD HEAD- PHASE 2

CDRM  
disassembly and  
conditioning in  
the Fuel Building

Transport of the  
old vessel head  
and the CDRM to  
the Waste  
Storage Building



2 days /12 hours per day for  
the CDRM containers  
movement

Final disposal





## 3. Project description and dose planning

Contamination control surveillance after each movement

**ACTIONS ON THE  
OLD HEAD-  
PHASE 1 and 2**

**Transfer of the  
old vessel head  
to the Fuel  
Building**

**Transport of the  
old vessel head  
and the CRDM to  
the Waste  
Storage Building**



**Zero personal skin contamination events**

## 4. Dose Results Summary

Activity	Man-hours	Man-mSv		
	Inverted	Estimated	Re-estimated	Received
Assembly of the reusable items	<b>1091</b>	3	1	<b>1,271</b>
Disassembly of the old vessel head and auxiliary activities	<b>1304</b>	53	45	<b>43,552</b>
Preparation and transference of the old vessel head to the Fuel Building	<b>1299</b>	49	29	<b>28,897</b>
Assembly of the reusable items on the new head	<b>1091</b>	3	1	<b>1,271</b>
CDRM disassembling and conditioning in the Fuel Building	<b>1980</b>	41,2	-	<b>24,219</b>
Transfer to the Waste Storage Building	<b>1983</b>	37,9	-	<b>15,388</b>
Plant modifications	<b>2440</b>	1,65	9,95	<b>6,515</b>
<b>TOTAL</b>	<b>10097</b>	<b>185,75</b>	<b>164,05</b>	<b>119,842</b>

## 5. Information and procedures

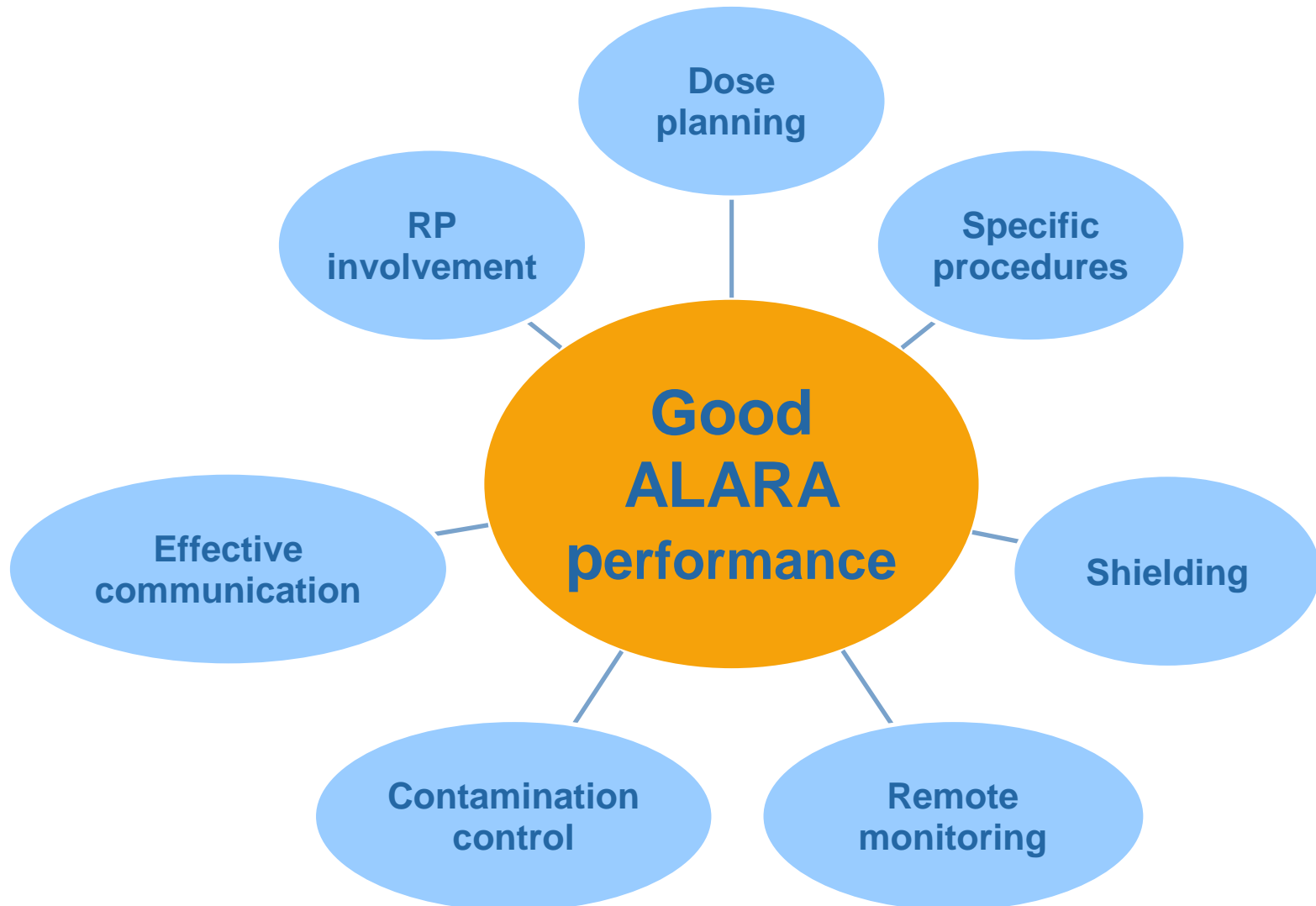
### Before

- 2 reports describing specific RP activities: to the regulatory body
- Emission of specific RP procedure describing the preparation and radiological control of the vessel head cover during transport
- Presentation to the ALARA Committee (dose estimation and main RP activities)
- Information to the entire organization (areas with forbidden access)

### After

- 2 reports summarizing the obtained results: to the regulatory body
- 2 reports with the remote monitoring system results
- Presentation to the ALARA Committee (dose results and main RP activities)
- Information to the entire organization

## 6. Learned lessons





*THANKS*

