
Building structures
and
infrastructures
P.Favaron M.Calderolla

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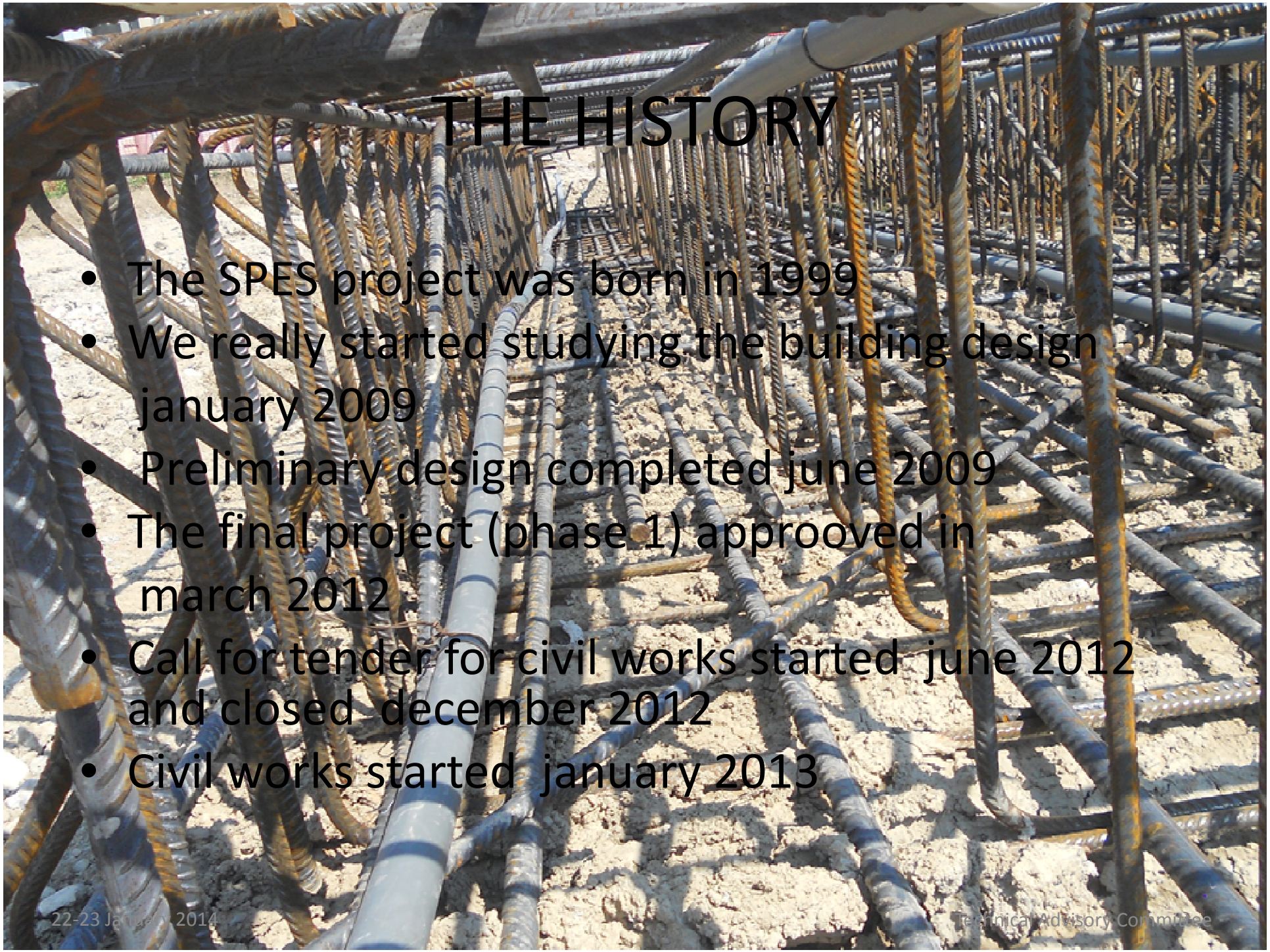


THE HISTORY

- The SPES project was born in 1999
- We really started studying the building design – january 2009
- Preliminary design completed june 2009
- The final project (phase 1) approoved in march 2012
- Call for tender for civil works started june 2012 and closed december 2012
- Civil works started january 2013

Call for tender…. details

- Publication of tender — 9 July2012
- Submission documents — 06 August 2012
- 66 companies run for tender
- Maximun reduction
- 29 companies submit documents — 19 September 2012
- 28 companies allowed to take part
- Public match — 26 September 2012
- NBI (Astaldi group) win with 31,7% reduction
- Acceptance proceedings — 22 October2012
- Documents signature — 22 December 2012

Civil works Schedule

- Delivery works 10 January 2013
- Building completed in order to accept the cyclotron June 2014
- Installation of the cyclotron september 2014
- End of the works December 2014
- After Laramed approoval new end works June 2015

Total Costs and cash flow

5986492 + IVA 10%

- **SAL 1**

(10/01/2013-20/06/2013)

- Construction site
- Diaphragm walls
- Excavation
- Reinforcement

Euro 370 400 + IVA 10%

- **SAL 2**

(20/06/2013 – 26 /8/2013)

- Diaphragm walls
- Barrets
- Excavation
- Reinforcement

Euro 591 956 + IVA 10%

1,9 Meuro + IVA 10%

=> 2,09 MEuro

- **SAL 3**

(26/08/2013 -26/10/2013)

- Concrete for foundation
- well-point system
- Excavation
- Reinforcement

Euro 407 654 + IVA 10%

- **SAL 4**

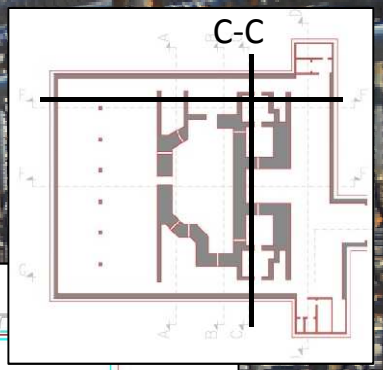
(26/10/2013- Now)

- Excavation
- Load test
- Sonic test
- Waterstop system
- Concrete for foundation

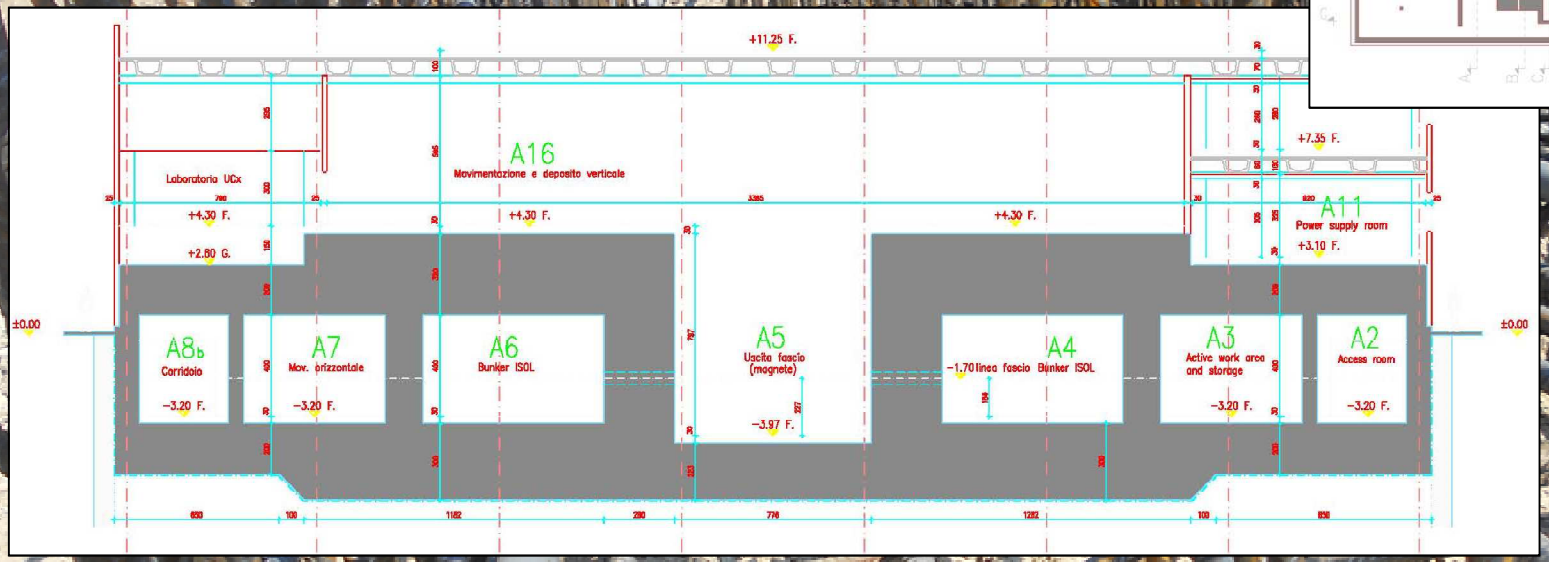
«Expected» Euro 540 000 + IVA 10%

Spes plant

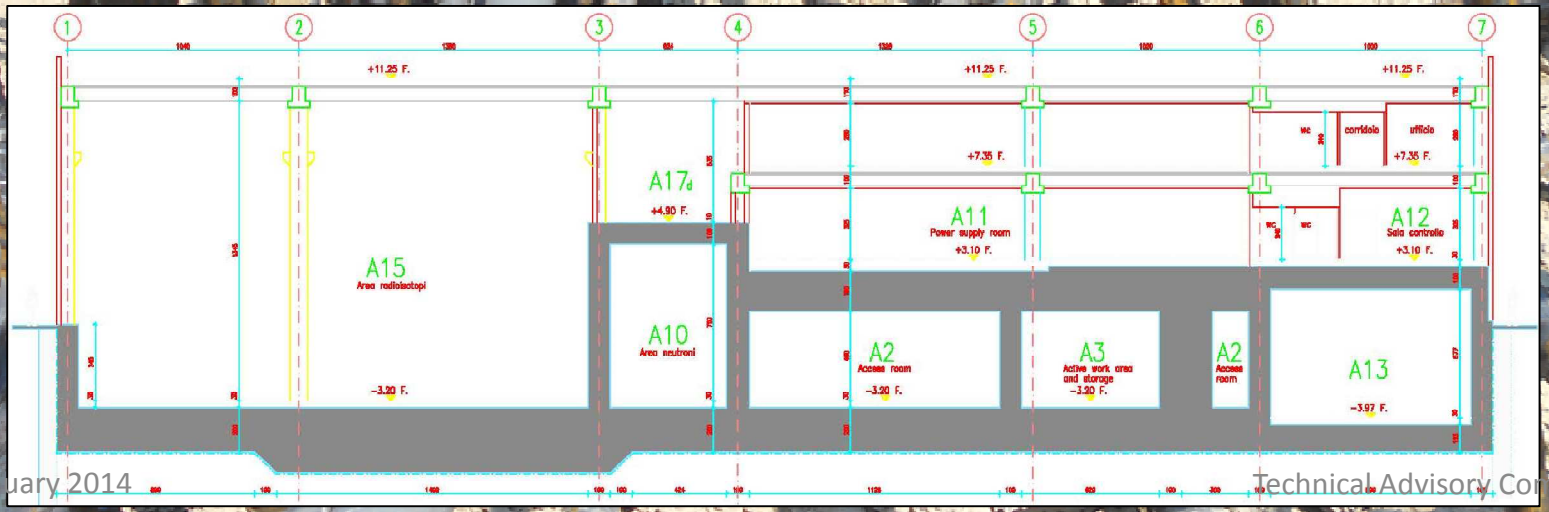
Cross sections



C - C



E - E

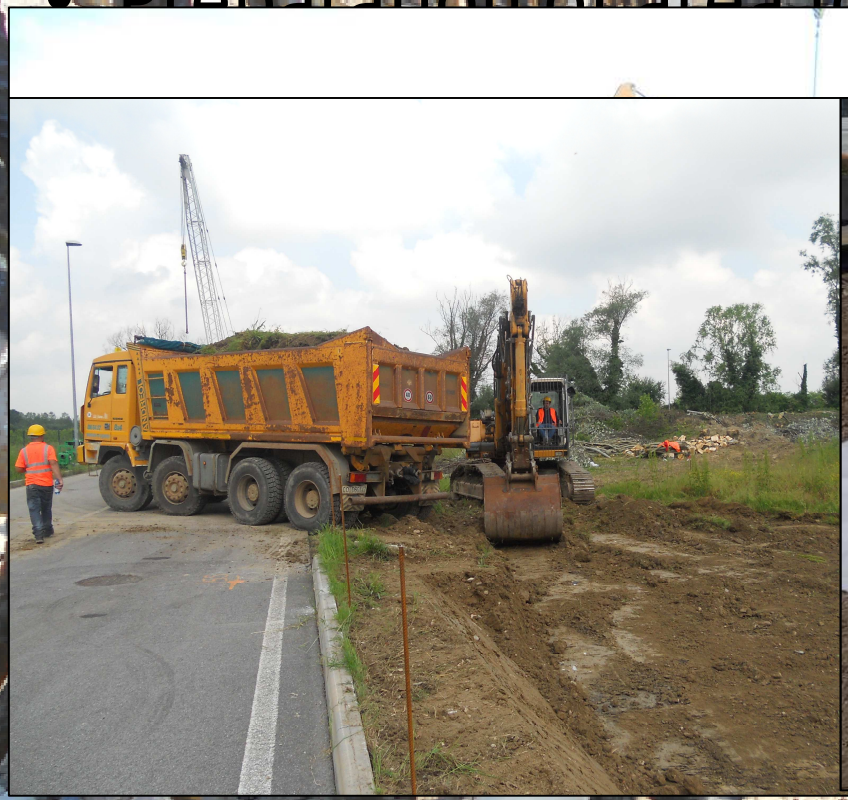


Timeline and technical information

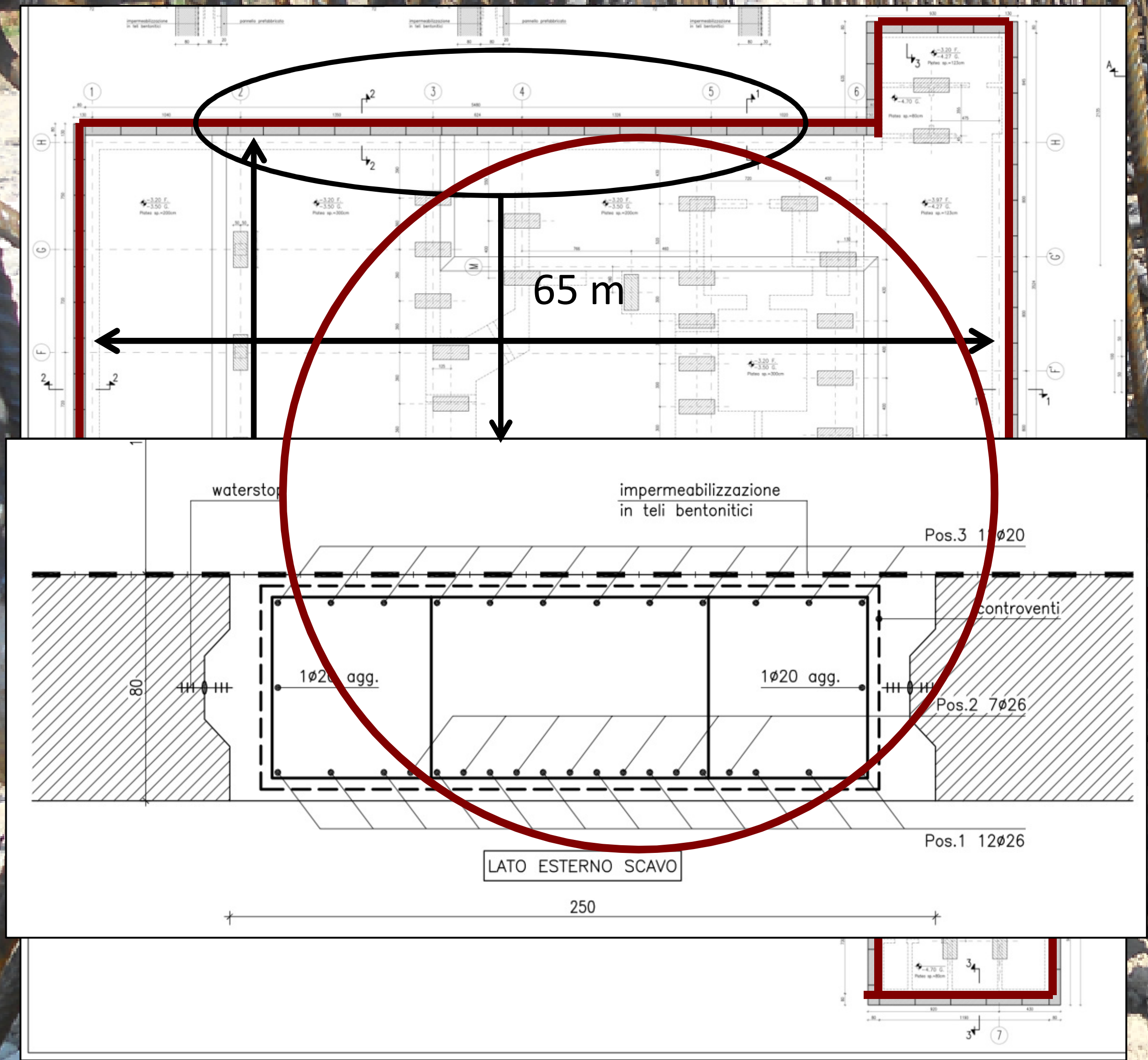
- Construcion site
- Diaphragm walls and barrets
- Union wall
- Excavation
- Sonic test
- Before foundation..
- Waterproofing system
- Load test
- Some numbers

Construcion site

- Removal the overhead power line 20Kv
- Deforestation of site (2584 square meters)
- Preparation of area for construction site



Diaphragm walls and barrets



The plant of building is about 19.000 square meters and the external perimeter is around 250 meters

This wall is realised with AVEC® system

Piave - Alpi building

soil outside

Diaphragm walls

1) Put the high-resitance plastic joint on a joint support sheet piling
2) Excavation of opening panel
3) Installation of the reinforcement
4) Installation of joint support sheet piling
5) Pouring of diaphragm panel
6) Excavation of the adjoining diaphragm panel
7) Removal of joint support sheet piling

Barrets

Same process as diaphragm wall without plastic joint

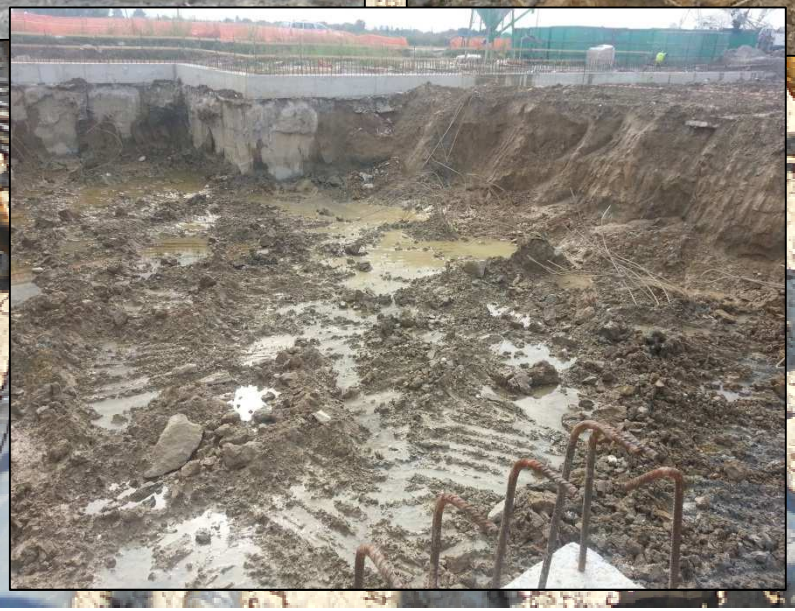
Dimensions: 1m x 2.5 m

Depth: 22 m

Union wall

Over the diaphragm a wall is realized to block the single diaphragm in position, after that is possible remove the material inside

Excavation



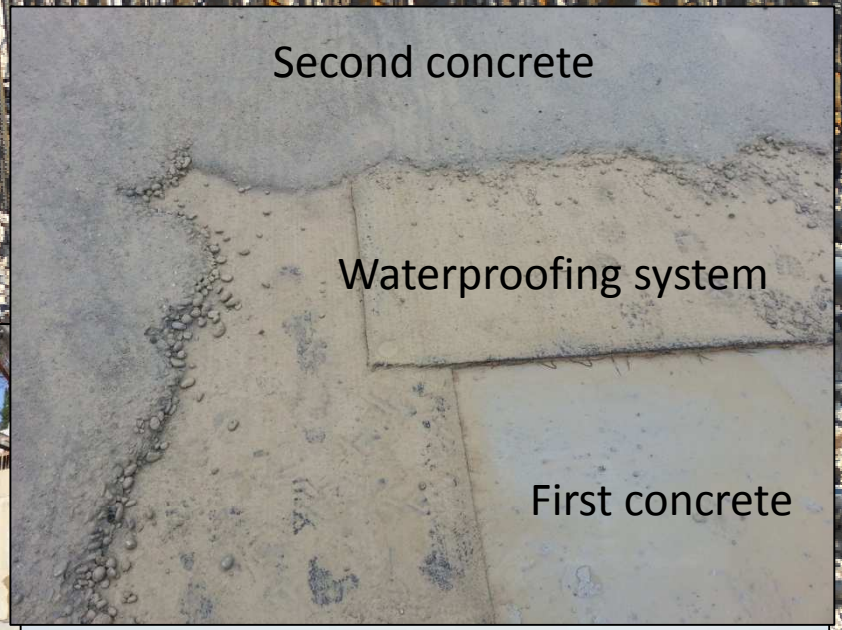
Sonic test

Some pipes are include in the reinforcements for barrets and for diaphragm walls to do sonic test to measure variations in the density of concrete

PIPES

Before foundation..

1) Pour a concerete slab on the ground
2) Place a waterproofing system
3) Pour a small concrete slab for protection

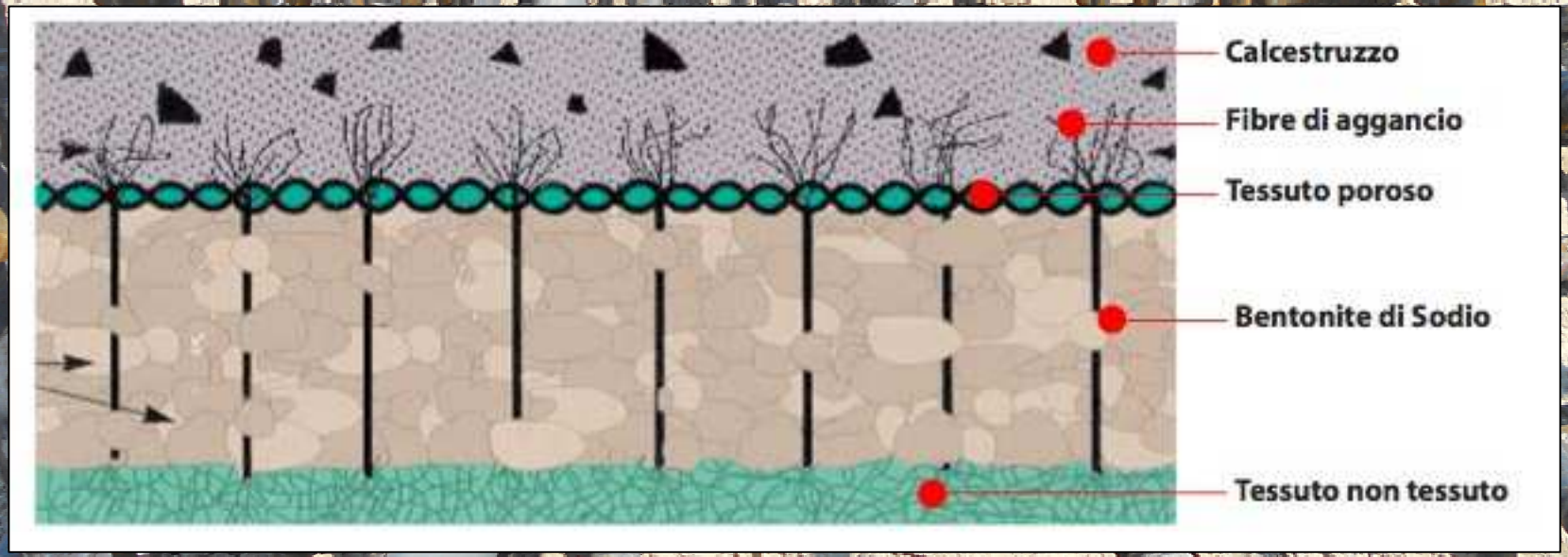


Waterproofing system

A layer of Sodium Bentonite is placed and fixed on the concrete.

After a second layer of concrete screen to proect the waterproofing system.

When the mambrane meets water it expands untill 16 times so stop the water penetration.



Load test

Load test to confirm the theoretical load on a single barret.

Load 650 tonn => displacement 7mm

(theoretical displacement => 11mm)

Some numbers…

- 2584 m^2 trees removal
- 25965 m^3 soil removal => 1730 trucks
- 3782 m^3 of concrete for barrets
- 3641 m^3 of concrete for outside wall
- 1226 m^3 of concrete for preparation of foundation

=> In total 8649 m^3 of concrete => 787 cement mixer

- 402573 kg of iron for outside wall
- 143100 kg of iron for barrets

=> 545673 kg of iron => 15 trucks

Computer simulation

The reality show

Tecnical plants the requiements

SPES

ISTITUTO NAZIONALE DI FISICA NUCLEARE DI LEGNARO (PD) - PROGETTO SPES

Rev. 31/10/2011

AREA	PIANO	CODICE LOCALE	Rif. CODICI BEST	DESTINAZIONE D'USO	ZONA RADIOATTIVA	CLASSIFICAZIONE AREA DI CONTENIMENTO	SUPERFICIE MQ	ALTEZZA LOCALE	VOLUME MC	PERSONE PERMANENTI	CONDIZIONI CON FASCIO IN FUNZIONAMENTO						CONDIZIONI CON FASCIO SPENTO						CONDIZIONI CON IMPIANTI IN MANUTENZIONE						APPARATI	CARICHI TERMICI APPARATI IN AMBIENTE (kW)	CARICHI TERMICI APPARATI RAFFREDDATI CON H2O (kW)	ACQUA DI RAFFREDDAMENTO NON DEMINERALIZZATA A 20°c (20/25°C)	ARIA COMPRESSA TECNICA (probabile eliminazione)	AZOTO TECNICO	IDROGENO DA CRYO COOLER	ALTRO	NOTE
											TEMPERATURA INVERNALE +/-1°C	+/- UMIDITA' RELATIVA INVERNALE +/- 10%	TEMPERATURA ESTIVA +/-1°C	+/- UMIDITA' RELATIVA ESTIVA +/- 10%	+/- DEPRESSIONE (Pa) +/- 10%	RICAMBI ORARI IN VOLUM/ORA	TEMPERATURA INVERNALE +/-1°C	+/- UMIDITA' RELATIVA INVERNALE +/- 10%	TEMPERATURA ESTIVA +/-1°C	+/- UMIDITA' RELATIVA ESTIVA +/- 10%	+/- DEPRESSIONE +/- 10%	RICAMBI ORARI IN VOLUM/ORA	TEMPERATURA INVERNALE +/-1°C	+/- UMIDITA' RELATIVA INVERNALE +/- 10%	TEMPERATURA ESTIVA +/-1°C	+/- UMIDITA' RELATIVA ESTIVA +/- 10%	+/- DEPRESSIONE +/- 10%	RICAMBI ORARI IN VOLUM/ORA									
CICLOTRONE	-1	A1	C1	Ciclotron Room	SI	C1	322,24	5	1611,2	-	24	60	24	60	60	3	24	60	24	60	60	1	24	60	24	60	60	5	Ciclotrone e linee trasporto fascio	10	300		SI	SI	NO		aria 250 l/min - 0,55 Mpa - max 1 ppm olio
	-1	A2		Decontamination Room		C1	163	4	652	-	20	n.c.	24	60	40	4	20	n.c.	24	60	40	4	20	n.c.	24	60	40	10					SI	SI	NO		non ha necessità di depressione durante la fase transitoria
	-1	A3		Active Work Area and Storage	SI	**C2**	31,6	4	126,4	-	20	n.c.	24	60	80	5	20	n.c.	24	60	80	5	20	n.c.	24	60	80	10					SI	SI	NO		
ISOL	-1	A4		Bunker ISOL#1	SI	**C3**	44,14	4,2	185,388	-	20	45	20	45	120	10	20	45	20	45	120	10	20	45	20	45	120	10		1,5	35						
TRASPORTO	-1	A5		Uscita fascio	SI	C1	63,6	4,2	267,12	-	20	60	20	60	60	1	20	60	20	60	60	1	20	60	20	60	60	1		1							
ISOL	-1	A6		Bunker ISOL#2	SI	**C3**	44,14	4,2	185,388	-	24	45	24	45	120	10	24	45	24	45	120	10	24	45	24	45	120	10		1,5	35						
	-1	A7		Zona di movimentazione orizz.	SI	**C2**	31,6	4	126,4	-	20	n.c.	24	60	80	5	20	n.c.	24	60	80	5	20	n.c.	24	60	80	10									
	-1	A8a+A8b		Zona deposito e corridoio	SI	C1	44,6	4	178,4	-	20	n.c.	24	60	40	4	20	n.c.	24	60	40	4	20	n.c.	24	60	40	4									
	-1	A8c		Zona di deposito orizz.	SI	C1	68,9	4	275,6	-	20	n.c.	24	60	40	4	20	n.c.	24	60	40	4	20	n.c.	24	60	40	4									
TRASPORTO	-1	A9		Area Neutroni	SI	-	110,5	7	773,5	SI	20	n.c.	24	60	atm	4	20	n.c.	24	60	atm	4	20	n.c.	24	60	atm	4		SI							
	-1	A10		Area Neutroni	SI	-	66,45	7	465,15	SI	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1		SI							
CICLOTRONE	T	A11	C3	Power Supply Room	NO	-		3,45		-	26	n.c.	26	60	atm	1	26	n.c.	26	60	atm	1	26	n.c.	26	60	atm	1	Generatori di potenza	35-50	5		SI	NO	NO		
	T	A11*	C4	Service Room	NO	-		3,45		-	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	Criocompressori e scambiatori acqua deionizzata	^	^		SI	NO	NO		
	T	A12		Cyclotron Control Room	NO	-		3,45		SI	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	Sistemi di controllo ciclotrone	10			NO	NO	NO		
	-1	A13		Maintenance, Spare Parts Inventory Room	NO	-	190	5,77	1096,3	SI	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1		10	50		SI	SI	NO		
	T	A14		Access Room		N.C.		3,45		SI	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1									
ISOL	-1	A15		Area radioisotopi		-	1125	13,45	15131,25	-	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1									
	T	A16		Movimentazione e deposito verticale	NO	-	891	6,1	5435,1	NO	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1									pressione negativa rispetto ai locali confinanti allo stesso piano
	-1	D		Area trasporto	NO	-	331	6,97	2307,07	NO	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1	20	n.c.	24	60	atm	1					SI	SI	SI		verificare

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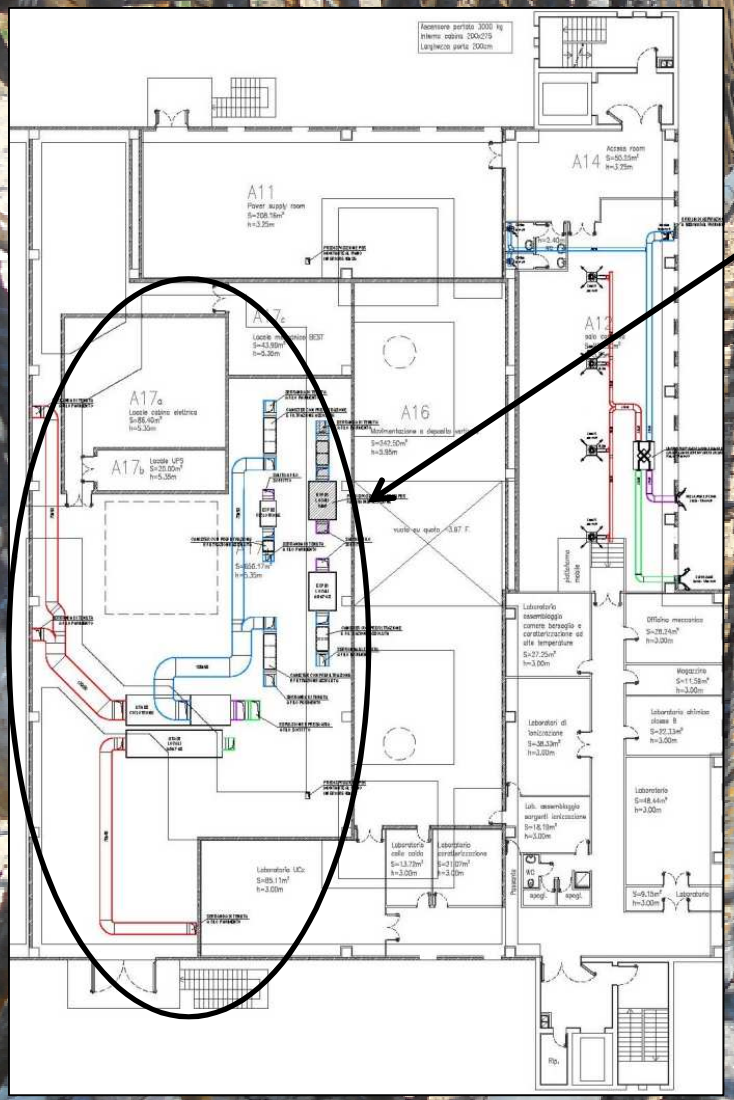
Technical plants
air distribution and treatement



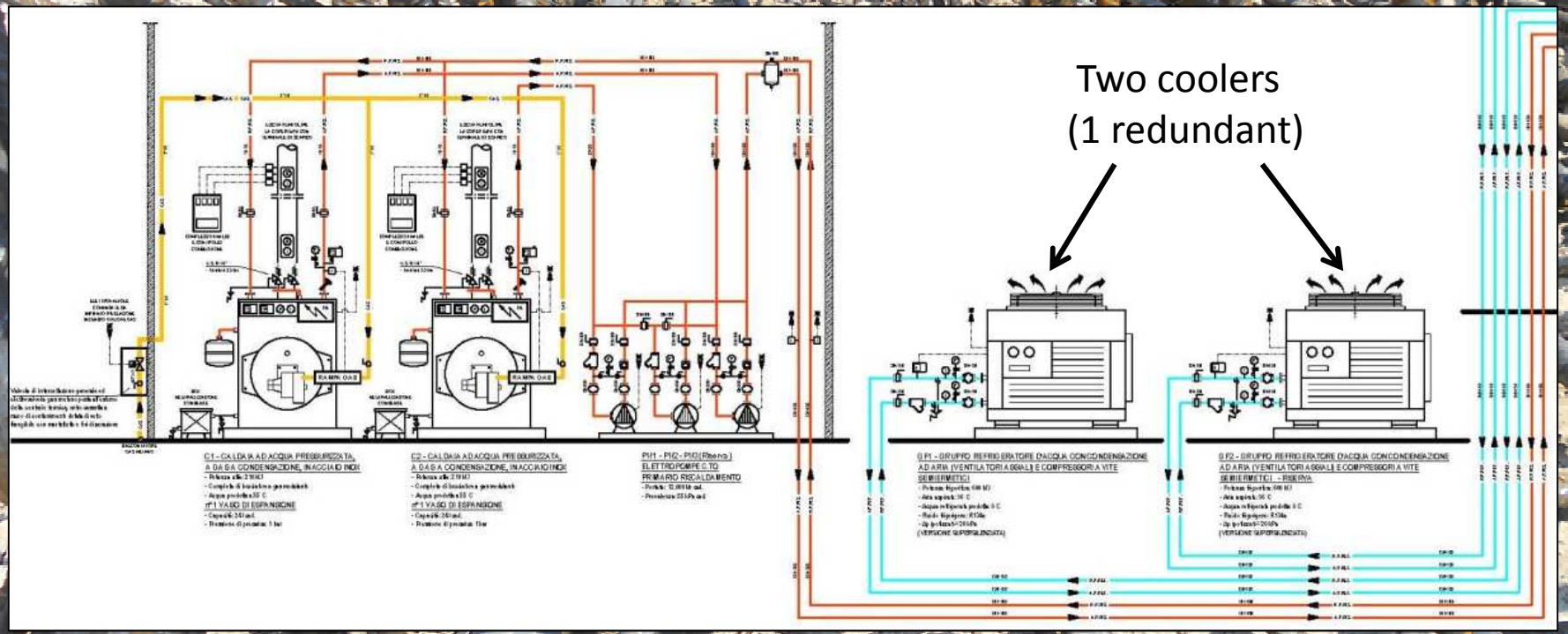
Air distribution firts floor

Canister with absolute filtration

Technical plants
Cooling and heating

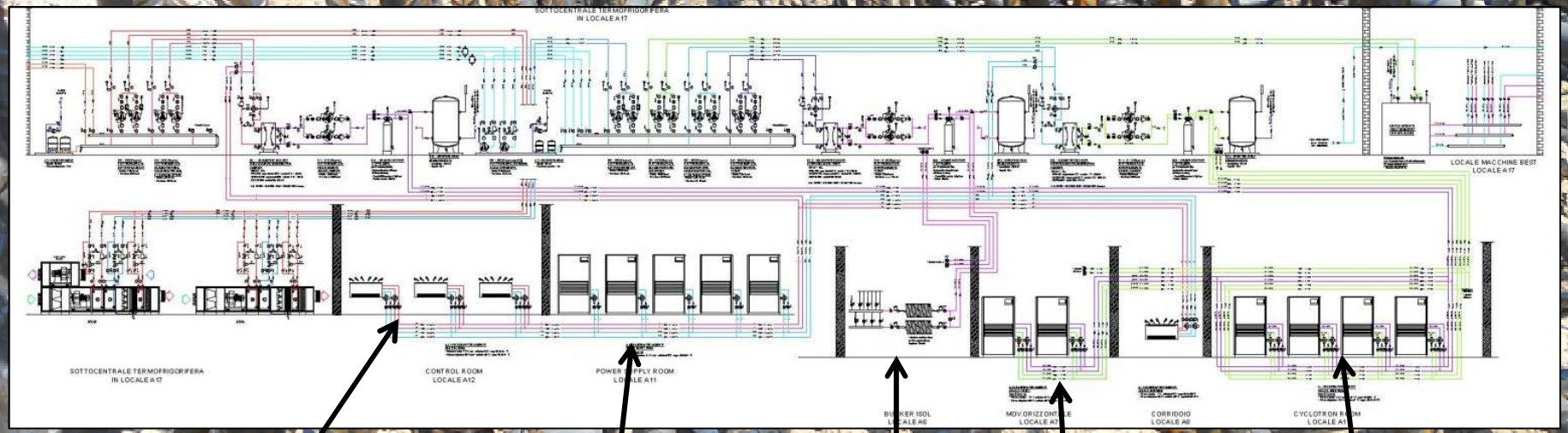
Thermal power plant

Cooling plant



Technical plants
Water distibution

Water plants



Control room

Power Supply room

Bunker ISOL

Handling room

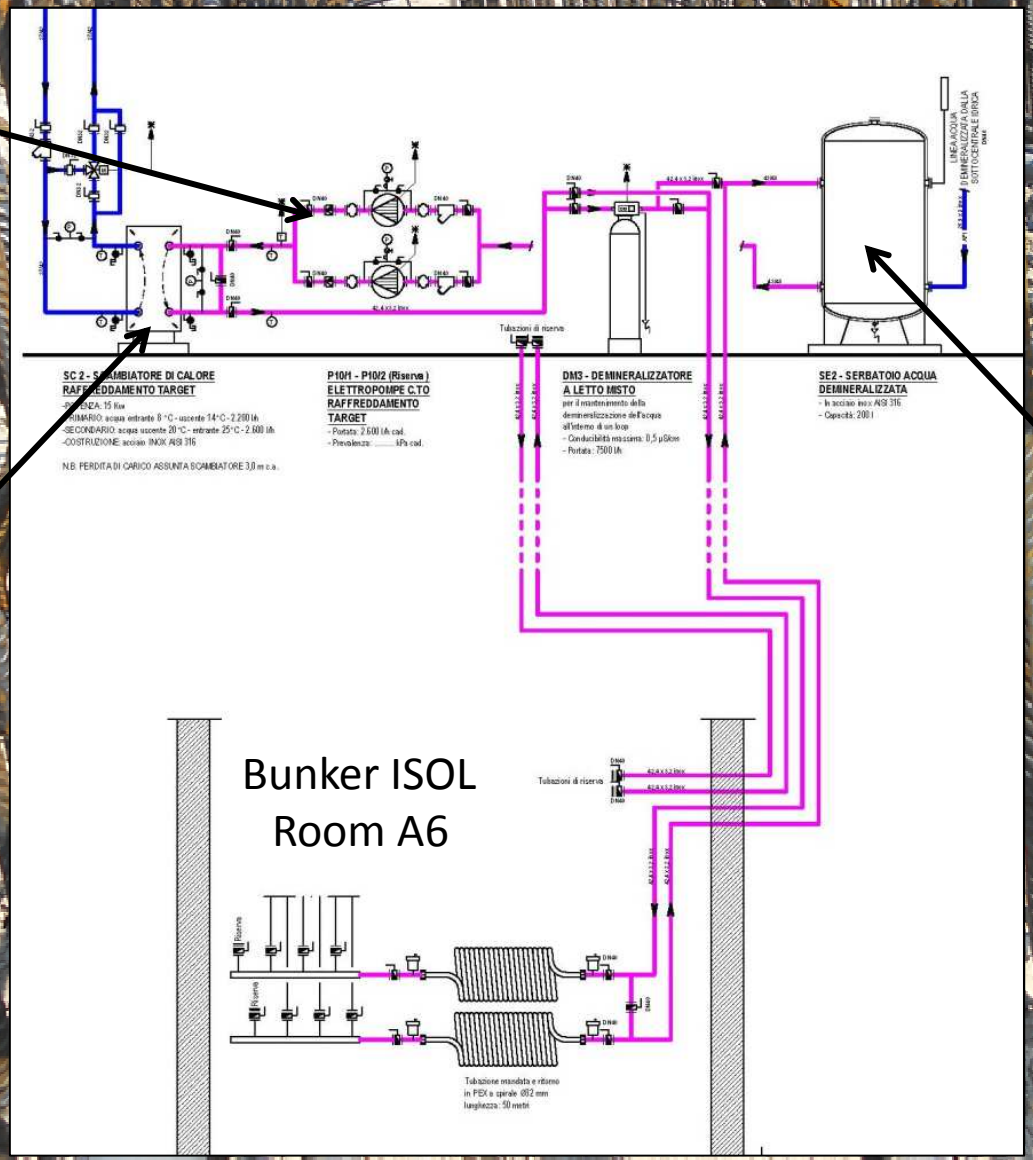
Cyclorton room

Target separeted water plant

Electropumps
(1 redundant)

Heat exchanger

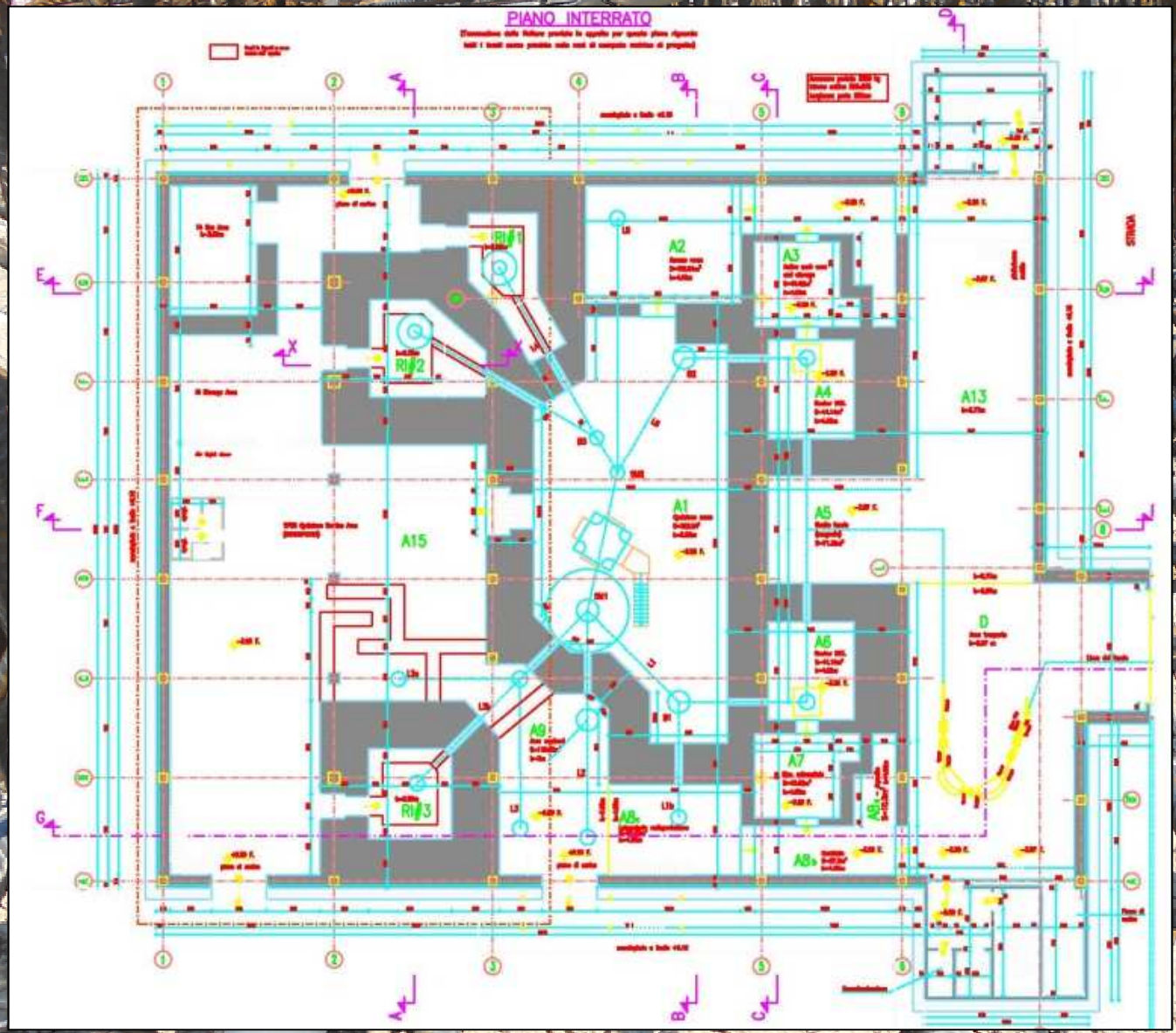
Tank



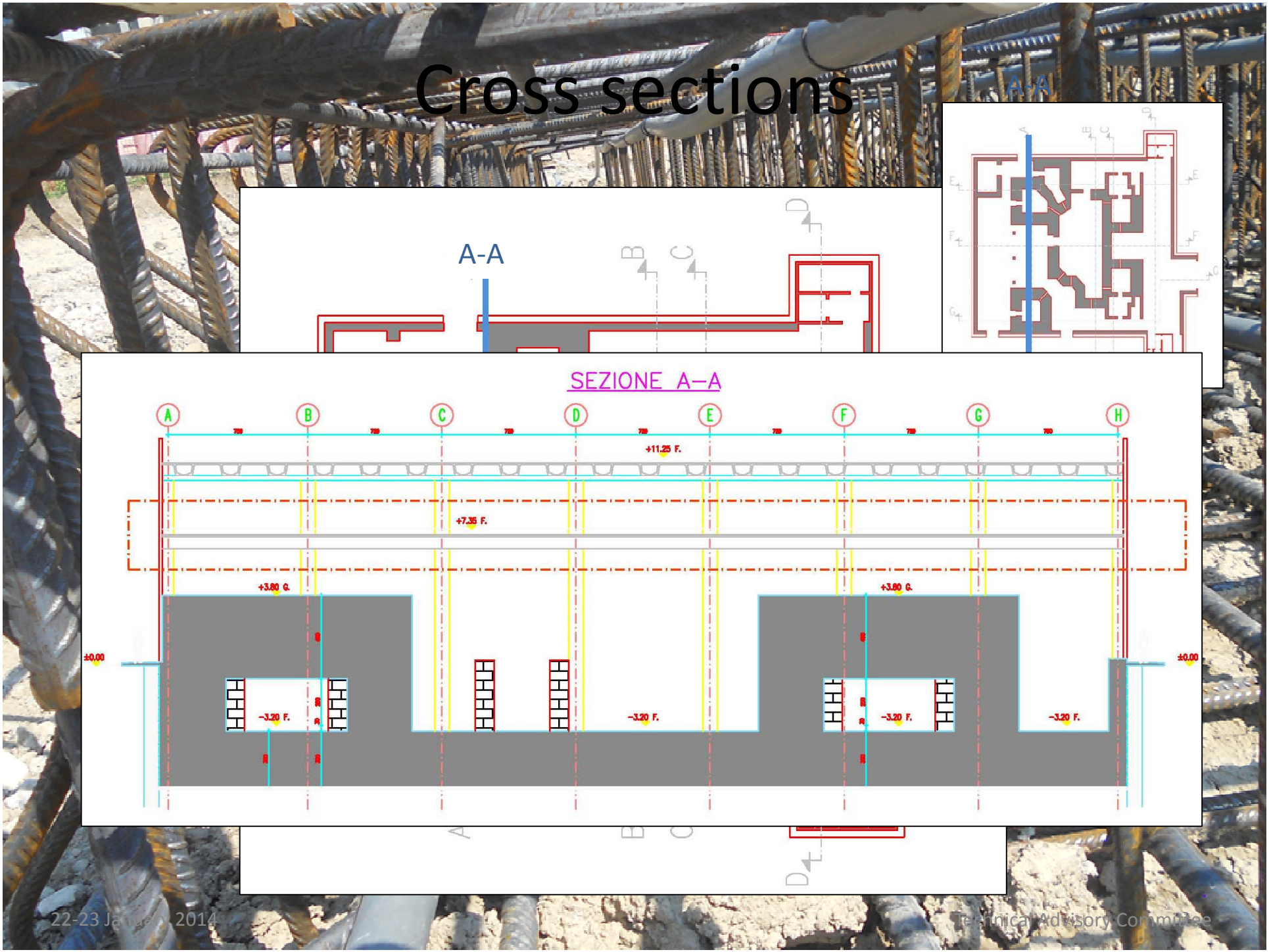
LARAMED ….

- New Civil works…. costs increasing 800 k€
- Technological plants ……under study
- New delivery date june 2015

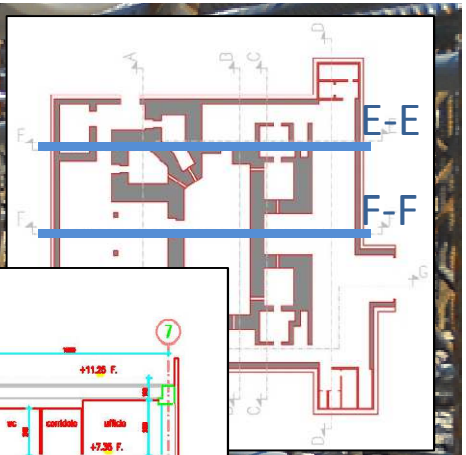
New bunkers on the lower floor

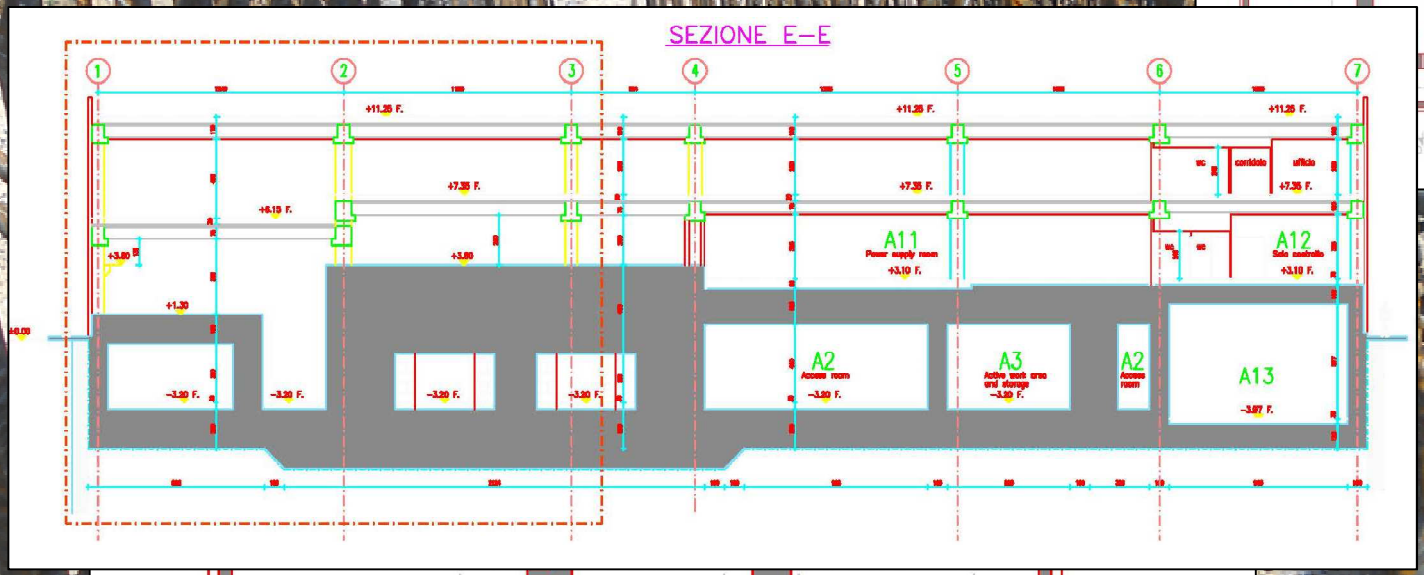


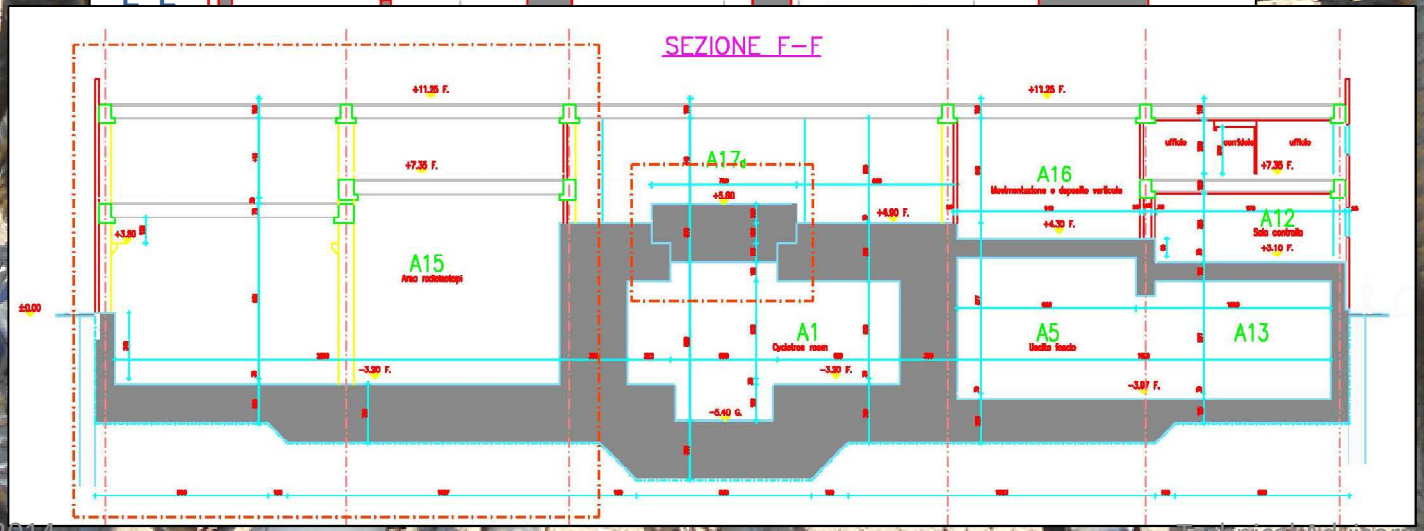
Cross sections



Longitudinal sections







Closing credits

Average presence for month

• INFN: RUP, project management unit	3,8	FTE
• NBI (Astaldi group)	2,5	FTE
• TIFS & MG progetti (direction work)	2,8	FTE
• Eurogeo (diaphragm walls and barretts)	5	FTE
• Asfalti coppo (waterstop layer)	5	FTE
• Edilmanna (civil works)	4	FTE
• RGM (load test)	0,7	FTE
• Special Effects/Visual Effects	0,25	FTE

TOT 24 FTE/month


THE END