REMTECH EXPO
21-25 SEPTEMBER 2020
digital edition

eni rewind

Design of asbestos removal from large-scale industrial site assets

Mariangela Venco – Eni Rewind

Brownfield decommissioning and Landfill: soil remediation case studies

22 September 2020

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Eni Rewind at a Glance

eni rewind

We are Eni's environmental company.
We work according to the principles of the circular economy to give new life to industrial land and waste through efficient, sustainable remediation and revaluation projects.
We base our work on passion, skills and technological research to regenerate soils, water and recoverable resources.
We believe in dialogue and integration with the communities that host us.

~ 1000
i employees

> 80
nr. of sites environmentally managed

3B€
spent in environmental interventions

REMEDIATION

~ 200 operative remediation work sites (as well as c. 600 environmental reclamation sites in disused and operating service Stations)

2000 ha of reclamation interventions

WATER

42 water treatment plants managed

~ 130 Mln€/y water treatment costs

> 31 Mm³/y treated water

1 Control room H24 7/7

WASTE

Entire remediation and industrial waste cycle management: from characterisation to final disposal/treatment

~ 2 M/y tonnes of industrial and remediation waste managed

~ 250 Mln€/y industrial waste management costs (in addition to remediation waste costs of c. 60 Mln€/y accounted for in remediation expenses)

DEVELOPMENT

400 ha destined to repurposing (Eni programme for renewables in Italy: solar/wind parks)

Redevelopment initiatives
(Ravenna Progetto NOI)

Waste to Fuel
Eni proprietary technology for the transformation of OFMSW into bio-oil and water

CASE STUDY # 1: Hamon cooling tower – Ravenna industrial site

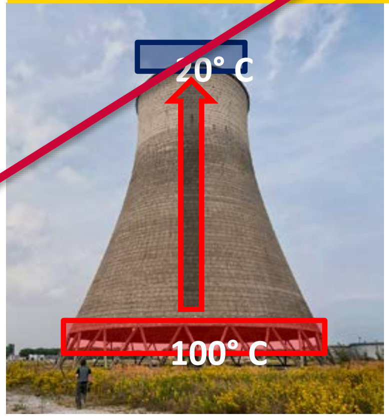
Project scope: asbestos removal

Ambient air enters through the openings at the bottom of the tower and exits from the top opening after cooling hot water via evaporation enthalpy.

- Material: steel reinforced concrete
- Shape: hyperboloid
- Height: 52 m
- Base diameter =46 m
- Top diameter =25 m
- Size of bottom opening: 4m
- Out of service since 2003

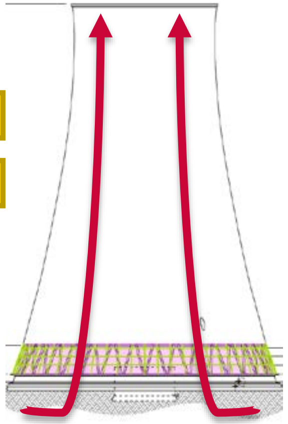
ACM pipes at the bottom of the tower, up to 6 m from ground

Fluid dynamics principles



Chimney effect

Venturi effect

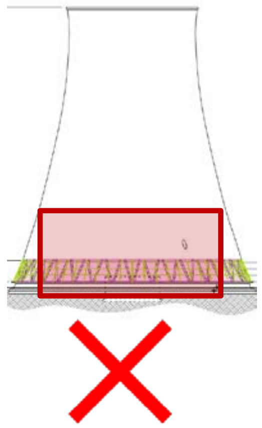


Overall rising effect

Chimney effect is induced only in presence of a heat source (working cooling tower). The Venturi effect, due to the geometry of the tower, occurs in any flow condition. In working conditions, the operation of a Hamon tower is almost independent of the external wind speed. In stationary conditions, the streams inside the tower may also be affected by the external wind speed.

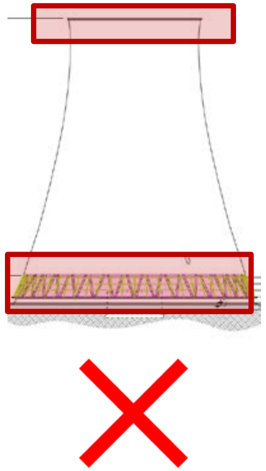
HAMON TOWER: Possible solutions for confinement

According to Italian law technical requirements, a **dynamic confinement** must be arranged. The confinement system must ensure that all asbestos fibers remain inside the tower and are conveyed to HEPA filters.



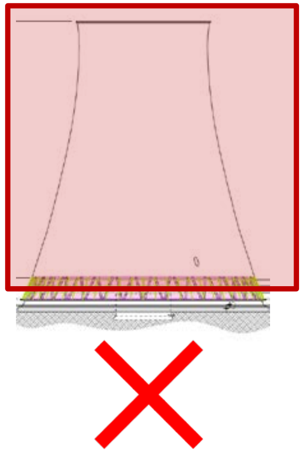
INTERNAL SEALED DYNAMIC

- Risks related to presence of deteriorated ACM during scaffold construction activities inside the tower;
- Lack of space for installing an effective confinement system;



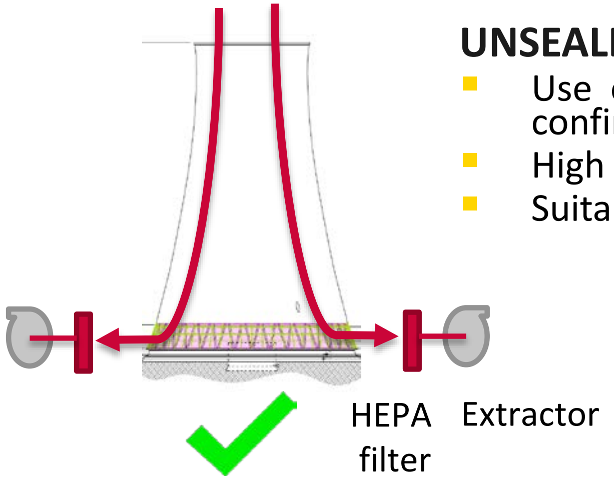
EXTERNAL ANCHORED SEALED DYNAMIC

- Use of the tower structure as part of confinement system
- Potential issues in anchoring the confinement system to the tower walls due to structural reasons (structure in precarious preservation status)
- Risks related to construction activities in elevation



EXTERNAL SELF-SUPPORTING SEALED DYNAMIC

- Risks related to the construction of tall scaffolds;
- Expensive with low cost-benefit ratio;
- High costs and long times;



UNSEALED DYNAMIC

- Use of the tower structure as part of confinement system
- High cost-benefit ratio
- Suitable working times and costs

HAMON TOWER: Fluid Dynamics Modeling

rewind

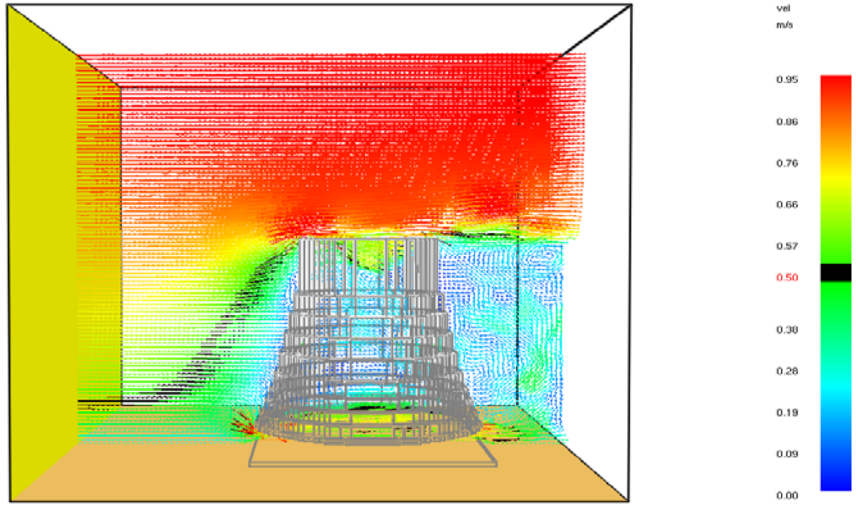
Calculation domain and wind direction

The software chosen to simulate air flow conditions within dynamic enclosure is Fire Dynamic Simulator (FDS NIST).

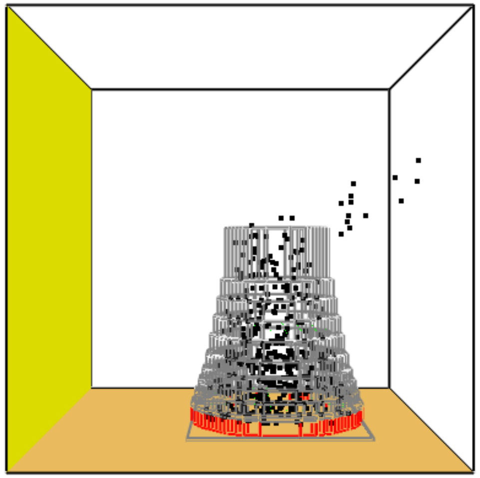
National Institute of Standards and Technology
U.S. Department of Commerce

The model allows to analyze:

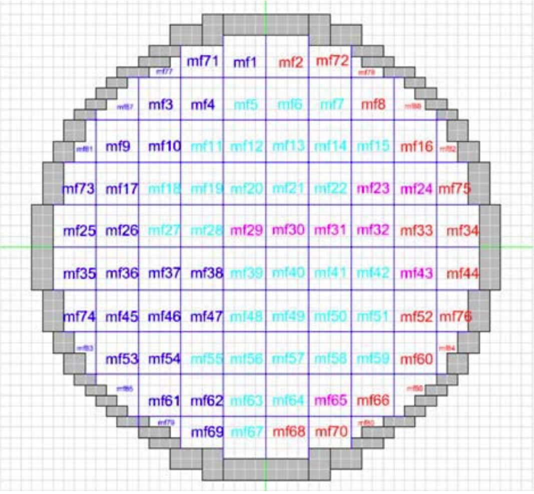
- Results of the simulations on different reference planes;
- Air flow direction and intensity on a horizontal section inside the tower @6m high (whose integral over time represents the total flow);
- Particle tracking and capture effect effectiveness;
- Trend in time and space of air speed within the confined space volume;
- Behavior of dynamic confinement system at different external wind speeds.



Wind speed vectors in the vertical plane, parallel to wind direction



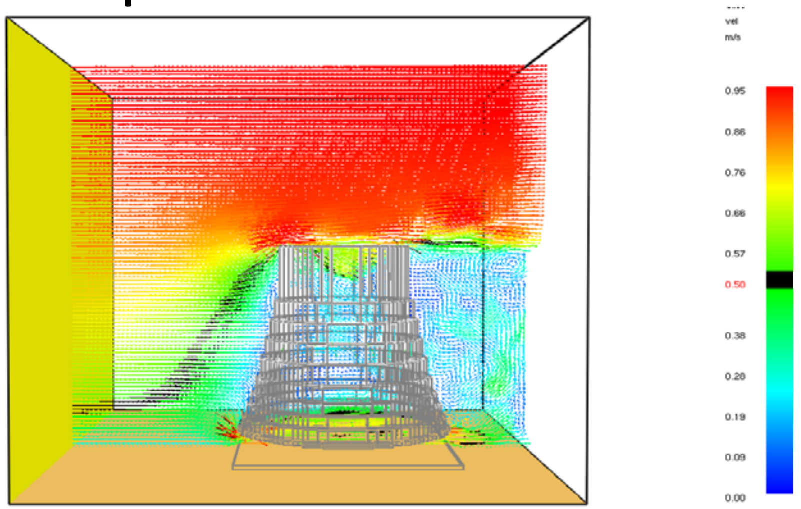
Particle tracing in the vertical plane, parallel to wind direction



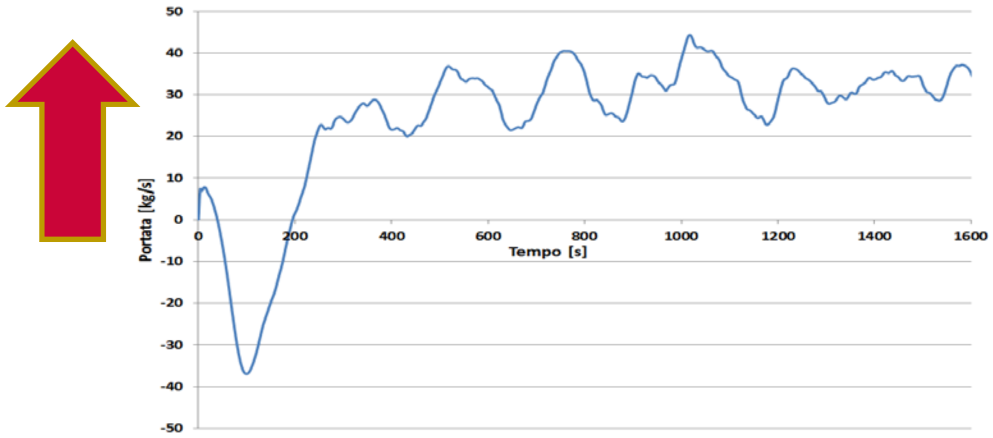
Mass flow rates (Kg/s) through surface units on the reference horizontal plane

HAMON TOWER: Simulations #1 & #2

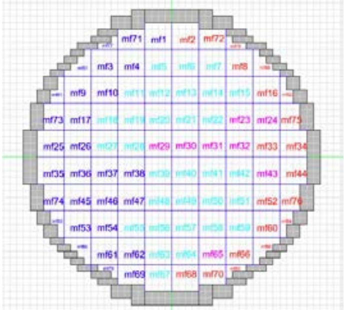
#1 «Open tower – current state»



Wind speed vectors in the vertical plane, parallel to wind direction

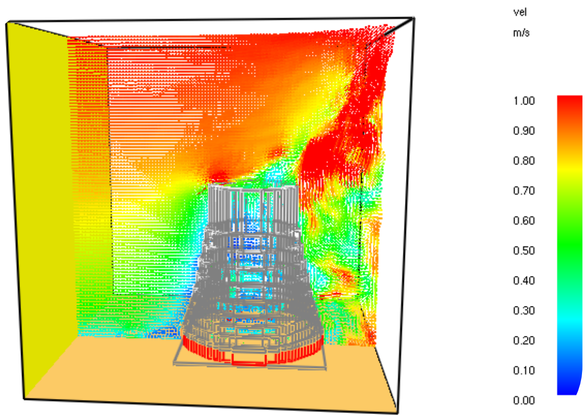


Overall bottom-up air flow rate of 120.000 m3/h

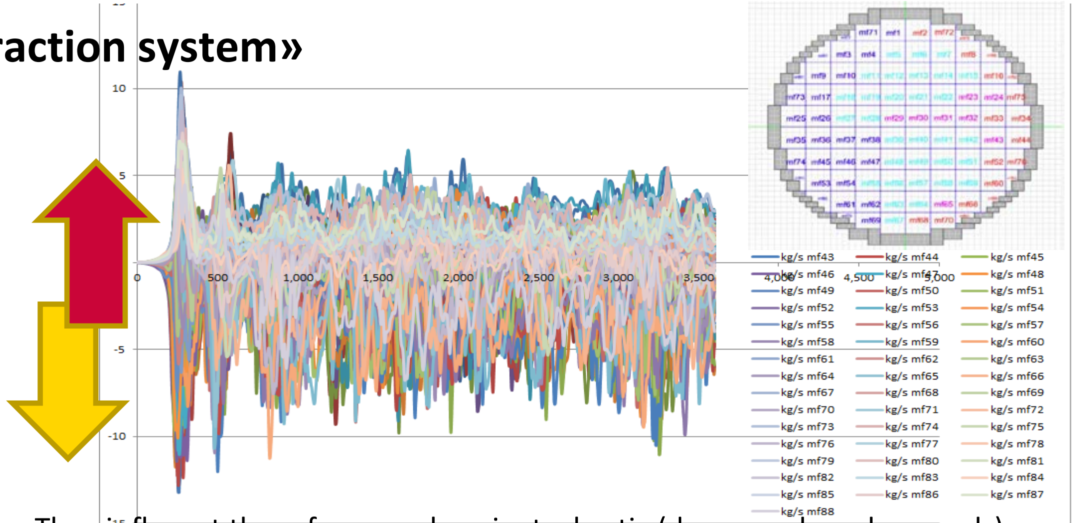


Vertical flows on the reference horizontal plane placed at 6m from the ground

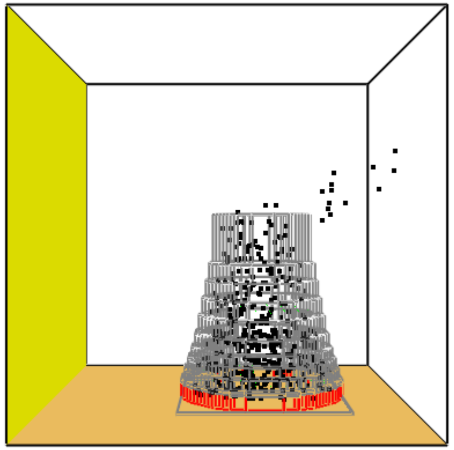
#2 «Sealed bottom openings without extraction system»



The flow inside the tower showed random direction



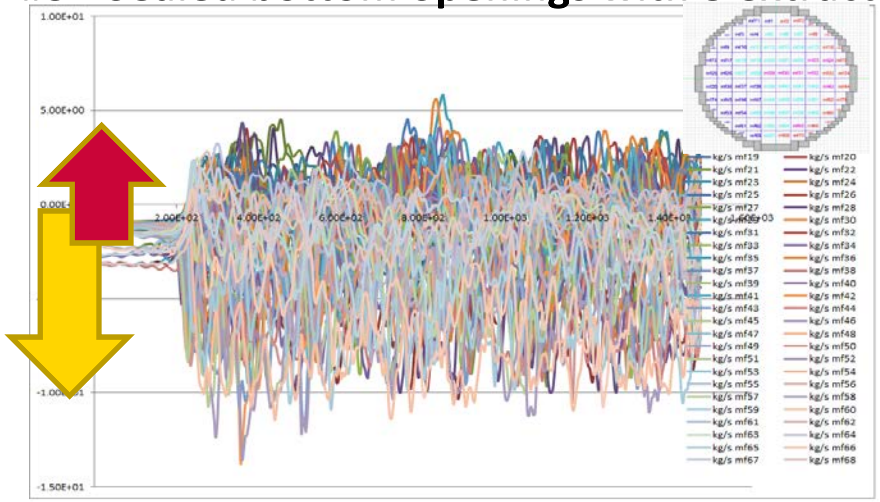
The air flow at the reference plane is stochastic (downwards and upwards)



Tracers leave the tower during the entire simulation period

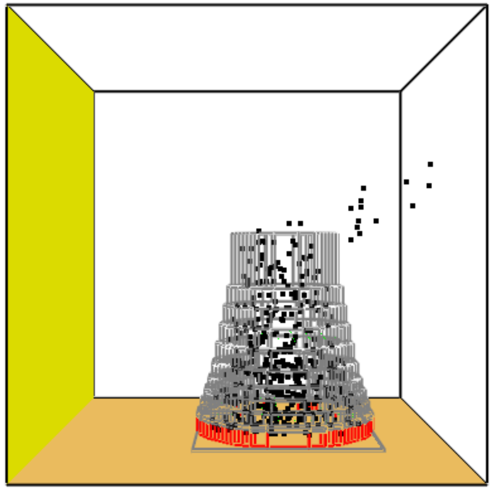
HAMON TOWER: Simulation #3 & #4

#3 «Sealed bottom openings with 8 extractors (50.000 m3/h each)»



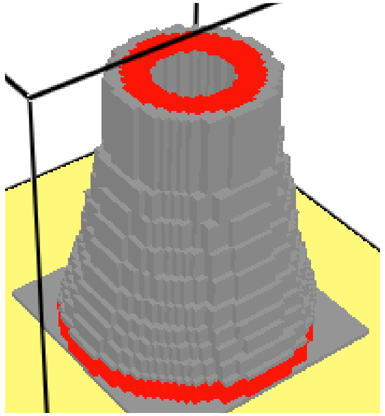
Overall downward air flow rate of 350.000 m3/h

No.8 EXTRACTORS
Q= 50.000 mc/h
P= 22 kW/cad

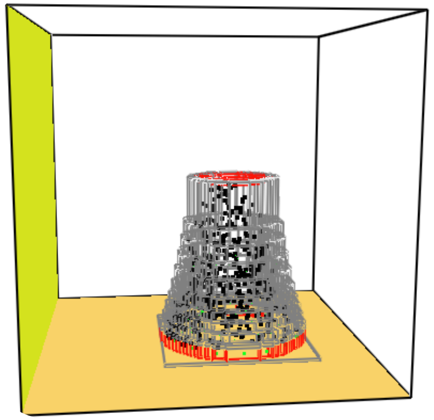


At low wind speed (0.5 m/sec) no tracers leakage was observable but at wind speed of 1 m/sec, some tracers leakage was observable (1-2%)

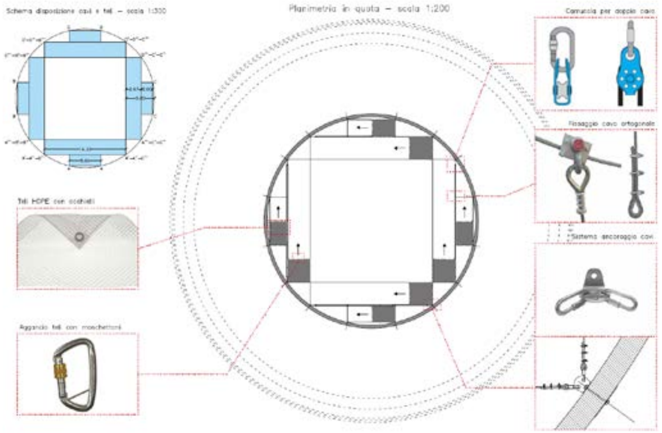
#4 «Sealed bottom openings with 8 extractors (50.000 m3/h each) and air flow barriers»



Overall downward air flow rate of 400.000 m3/h



No leackage is detected at any wind speed



HAMON TOWER: Benefits of fluid modeling implementation

The application of fluid dynamics modeling, provides reliable results for:

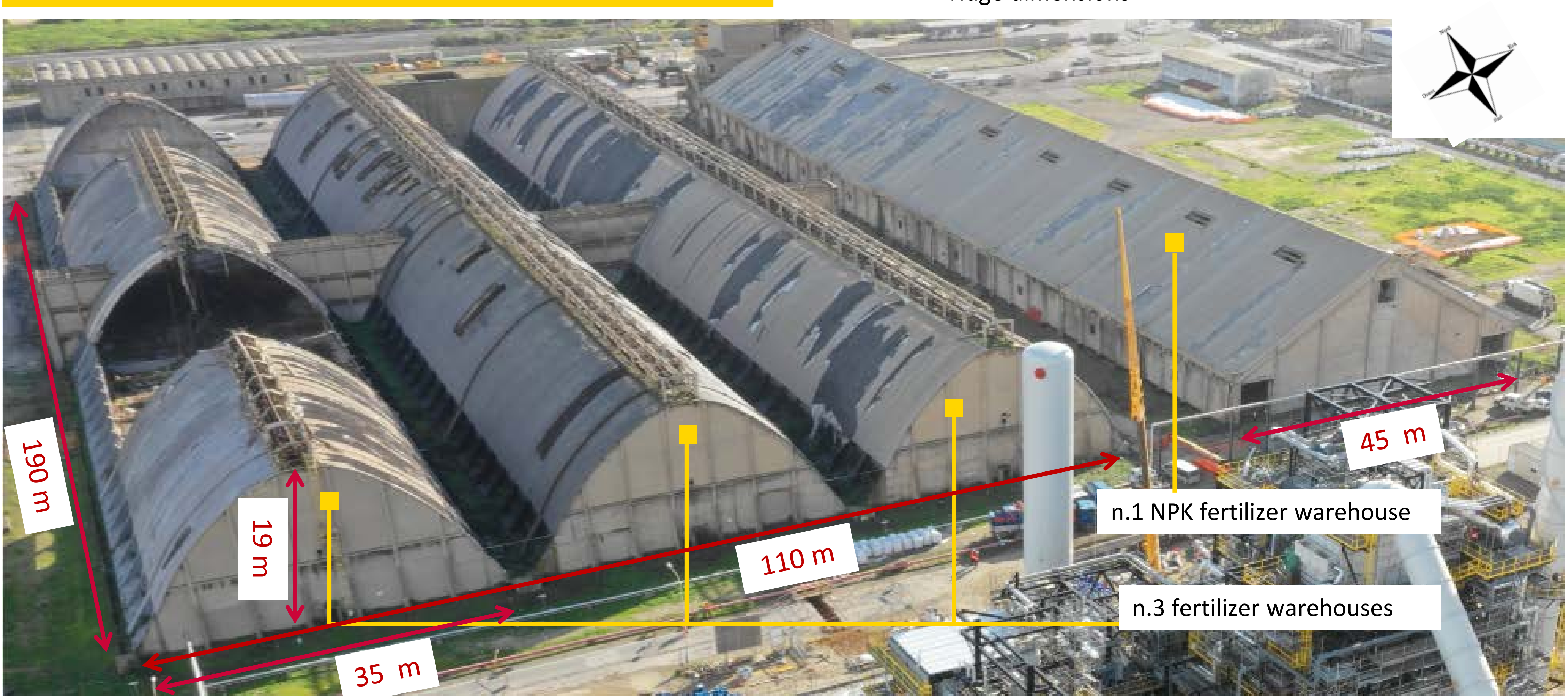
- studying air flow within the confined space according to its real geometry and size,
- demonstrating the absence of possible air stagnation zones within the confined space,
- estimating flow transient duration and location, especially during extraction system start up,
- evaluating effectiveness of dynamic enclosure system in the design phase,
- predicting the intensity and direction of air speed vectors inside working areas,
- predicting the capture speed of ACM particles inside working areas,
- predicting ACM particles capture efficiency in time and space domain,
- optimizing of extraction units sizing.

Allows a remarkable reduction of ACM removal cost and duration through the optimization of confinement and extraction systems and demonstrates that, in the identified conditions, law requirements can be fully achieved with an unsealed dynamic confinement.

CASE STUDY # 2: Decontamination and Decommissioning of Warehouses – Gela Industrial site

Project scope: Demolition to ground level

- No. 3 concrete parabolic warehouses 6.840 sqm/each
- Volume of each: 82.620 mc
- Huge dimensions

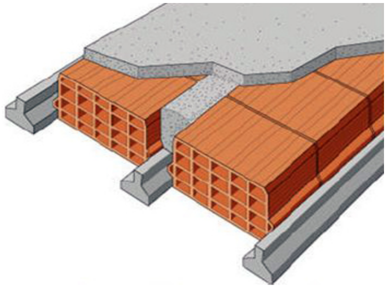


FERTILIZER WAREHOUSE: Critical issues - Conservation status & ACM presence

Brick cover partially collapsed

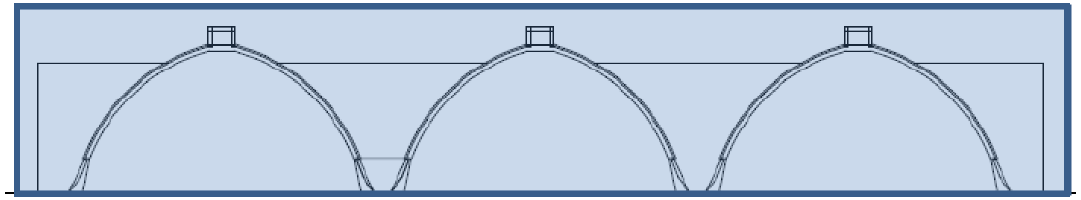
Corridors between warehouses are unsafe

Friable asbestos in waterproofing layer covering the roof and the buttresses



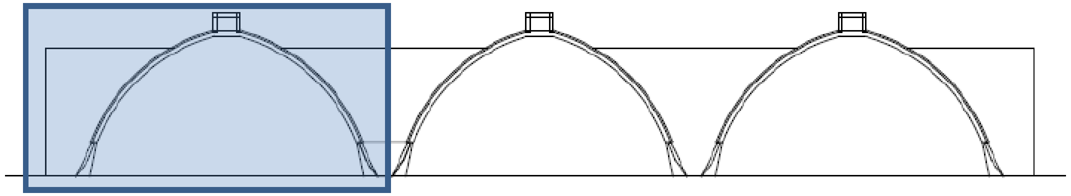
Crisotile asbestos in friable matrix found in waterproofing layer

FERTILIZER WAREHOUSE: Possible solutions for confinement



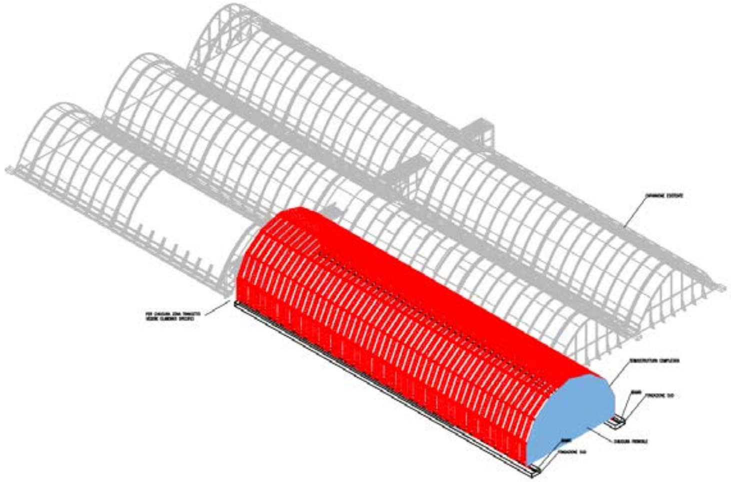
3 warehouses dynamic confinement

- 200 m x 120 m x 23 m
- V = 500.000 mc
- 50 extractors of 50.000 mc
- Installed power: 1,2 MW



Single warehouse dynamic confinement

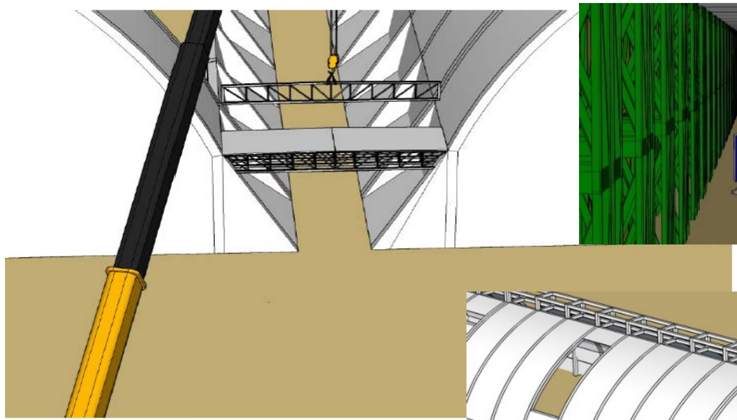
- 200 m x 36 m x 23 m
- V = 190.000 mc
- 15 extractors of 50.000 mc
- Installed power: 0,6 MW



Half-warehouse dynamic confinement sliding on rails

- 130 m x 36 m x 23 m
- V = 72.000 mc
- 10 extractors of 50.000 mc
- Installed power: 0,3 MW

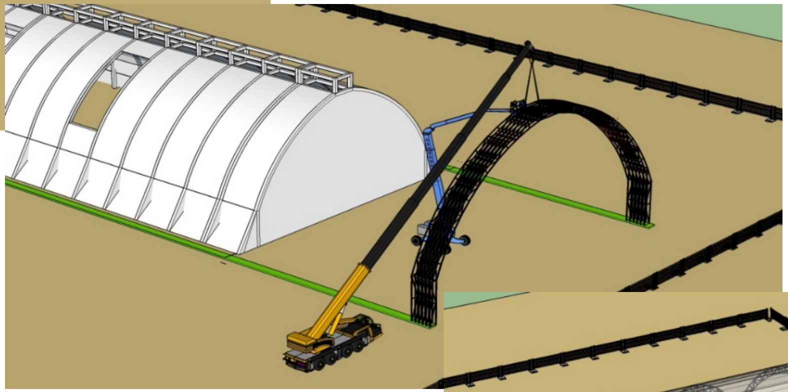
FERTILIZER WAREHOUSE: Decontamination and demolition methods



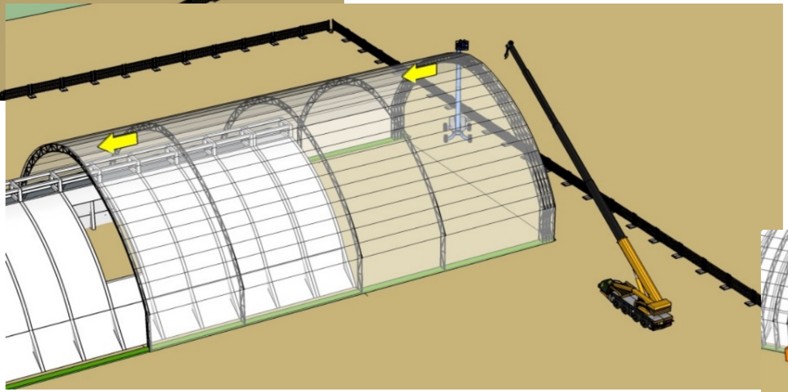
Implementation of safety measures for:

- ✓ ACM removal from buttresses
- ✓ subsequent laying of rails for marquee sliding

Protective scaffold between two warehouses

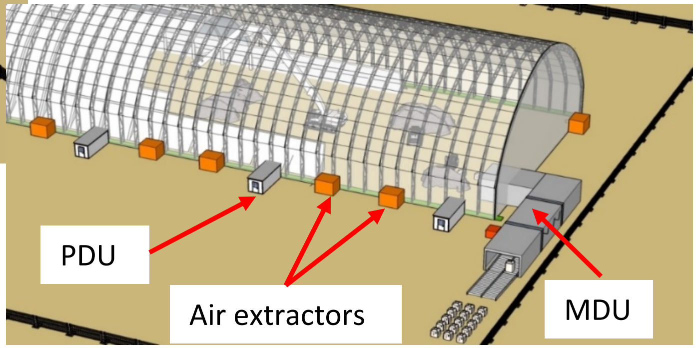


Assembly, for segments, of dynamic confinement structure up to the centerline of the shed, including double layer covering sheet, PDU (Personnel Decontamination Unit), MDU (Equipment and Material Decontamination Unit), extractors.



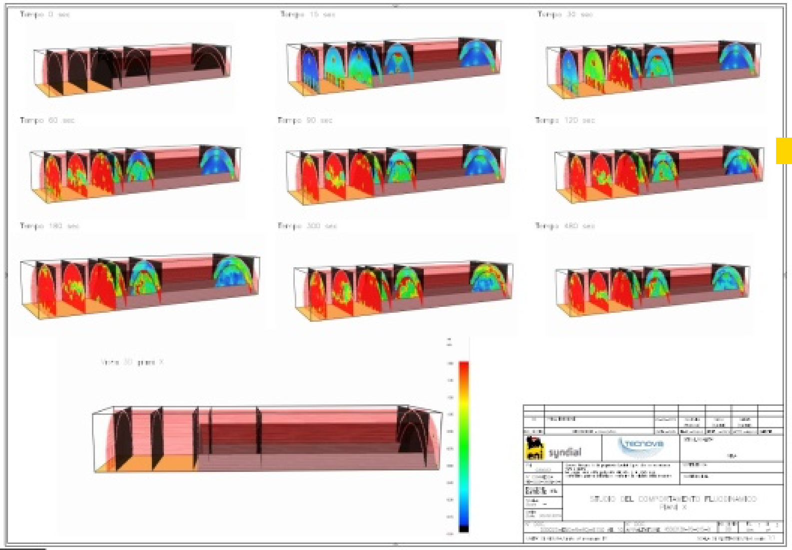
Confinement size: 130 m x 36 m x 23 m
Confinement volume: 72.000 mc

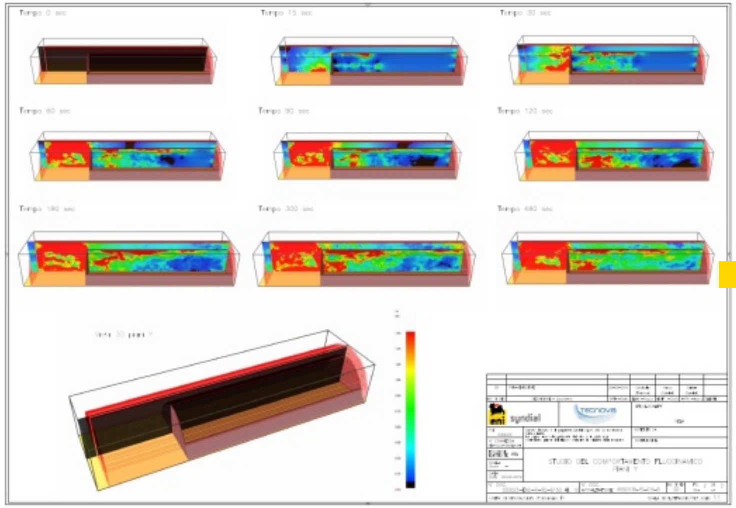
No.10 EXTRACTORS
Q= 50.000 mc/h
P= 22 kW/cad
Installed power: 0,3 MW



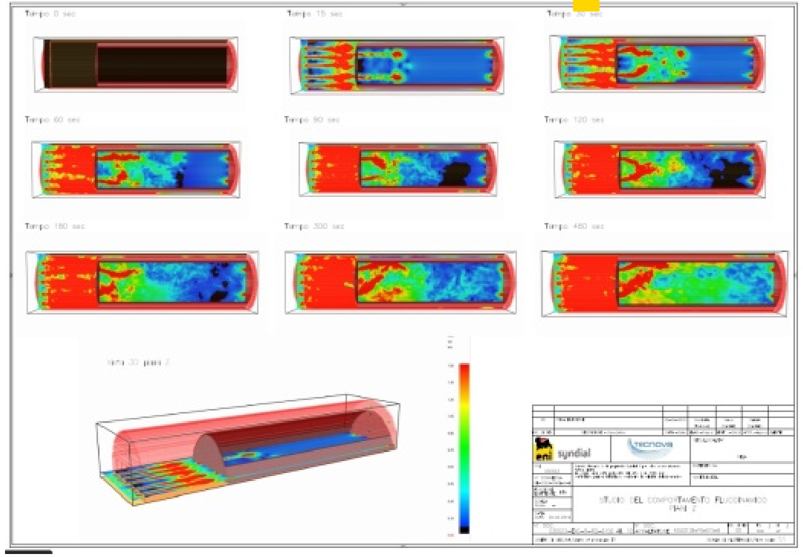
Demolition will be performed inside the confined space

FERTILIZER WAREHOUSE: Fluid Dynamics Modeling





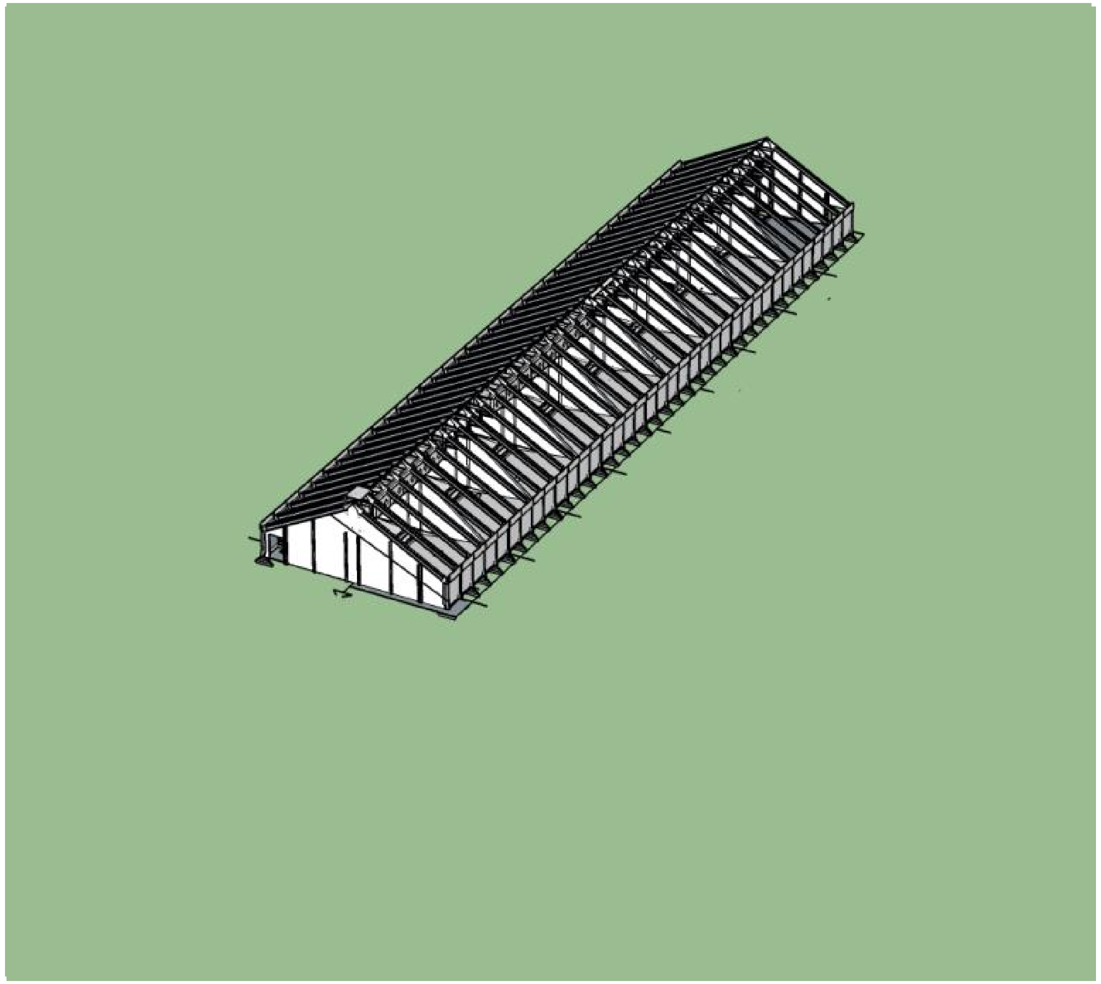
- Check the effectiveness of containment
- Check air flow conditions in working area
- Size properly extraction system



FERTILIZER WAREHOUSE: Project schedule

FERTILIZER WAREHOUSE

- ✓ Final design for contract decommissioning: June 2019
- ✓ Contract tender and award: April 2020
- ✓ Work site opening: October 2020
- ✓ Work site closure: September 2026



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THANKS FOR THE ATTENTION

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