



# TERZO VALICO DEI GIOVI Excavation in rocks containing asbestos Italy

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**O**AITES Chuzhou-Nanjing 7<sup>th</sup> November 2018 Francesco Poma & Carmine D'Auria: Excavation in asbestos







### Il Terzo Valico dei Giovi e il Sistema TEN-T



The Terzo Valico dei Giovi is a new high-speed railway line, which is part of the Corridor Reno - Alpi, one of the main corridors of the Trans-European Strategic Transport Network (TEN-T core network), that will connect the most industrial and densely populated European regions.

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# Terzo Valico dei Giovi - Construction Scheme













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# **OPHIOLITES ALONG THE TERZO VALICO LINE**

Terzo Valico underground works are located along the Sestri Voltaggio Tectonic Line, where ophiolites have been generated due to pression and temperature (metamorphism processes).



≈ 50 My ADRIA TEIDDE LidURE picno di subdiacione MANTELLO

Subduction of Oceanic Crust



**Orogeny of Oceanic Crust** 



The set of asbestos minerals which can be encountered in Cravasco tunnels are:

- Chrysotile (the most common)
- Actinolite
- Tremolite



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# **CRAVASCO ADIT – RISK FACTOR DUE TO ASBESTOS**

GEOLOGY Presence of ophiolite

**MINERALOGY** Chrisotyle, Actinolite, Tremolite

#### **EXCAVATION RISKS**

Dispersion of asbestos fibers in the air due to excavation, muck transportation, sludges dispersion and waste water treatement





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### **CRAVASCO ADIT: IDENTIFICATION OF EMISSION SOURCE AND VECTORS**

During the excavation of the tunnel, the primary vector of diffusion of the asbestos fibers is represented by the air. The two secondary vectors are instead represented by the muck and by the water containing suspended solids when they become dry. The asbestos limit values taken into consideration are the following:

- C < 2(ff/l) in the workplace
- C < 1(ff/l) in the EXTERNAL environment
- C > 1000 (mg/kg) muck as a hazardous waste containing asbestos



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### **VECTOR AIR: SUCTION VENTILATION PLANT**

#### **OBJECTIVES:**

- 1. introduce into the tunnel a clean air flow rate of approximately 60 m3 / sec
- induce a flow of air that runs from the outside along the tunnel going towards the excavation front (V = 0.4 0.6 m/sec) 2.
- prevent asbestos fibers from dispersing in the external area 3.
- 4. suck asbestos fibers as close to the source as possible
- create a dynamic confinement of the excavation face 5.
- filter the whole exhaust air coming from the tunnel using an absolute HEPA filter 6.
- 7. quickly clean the excavation face area when the excavation is complete



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### **VECTOR AIR: TECHNICAL FEATURES OF SUCTION VENTILATION PLANT**

#### TECHNICAL FEATURES:

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- No. 2 dust collectors 30 mc/s each;
- N ° 288 K4 category Dry Filters 99.96% efficiency (equivalent to HEPA H13)
- Shaking System for Filter Regeneration
- Coclee system for mixing powder with Water (Mixer Tank)







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### **VECTOR AIR: JOBSITE AND TUNNEL SUBDIVISION**



#### MONITORING POINTS

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# VECTOR WATER: TREATMENT PLANT UPGRADE

All the water coming from the tunnel and from the external job site has been pumped towards the treatment plant that has been upgraded

The huge amount of fibers within the mud/water has been treated with a new waste management system.

The improvements allow to separate undissolvable particles from water through specials filters, characterized by pore dimensions of 0,02 µm in order to filter asbestos fibers.

The improvement entails new safety measures as:

- · Sealed and depressurized chamber with HEPA filters
- Personnel decontamination unit

PERFORMANCES ACHIEVED

- Treatment capacity 20 l/s
- Efficiency 99,96 %
- · 210 tons of treated mud containing asbestos by filter press







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# **VECTOR MUCK: BIG-BAGS PACKAGING PLANT**

The muck coming from the tunnel is brought to the big-bags packaging plant equipped with a depressurization system and designed with an high level of automation in order to package a great number of big-bags (1 ton each).

The plant allowed to keep an high production performance level ensuring, at the same time, a minimum use of machinery and manpower.

The plant is equipped with:

- Sealed Chamber
- Depressurized chamber with HEPA filters
- · Workers decontamination unit
- Two indipendent packaging lines

### PERFORMANCES ACHIEVED

- Maximun productivity of 800 big-bags per day (2 m of tunnel)
- 22 580 Big Bags packaged in total equivalent to 26 783 ton





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# **«A» AREA - ABATEMENT OF ASBESTOS FIBERS AT SOURCE**

#### OBJECTIVE

Abatement as close as possible to the source of asbestos fibers produced during the rock demolition with a pneumatic hammer.

#### **DEVICES AND TECHNICAL FEATURES**

- Nebulization system mounted on the metal casing of the pneumatic hammer, formed by a crown of N° 24 High Pressure Nozzles and a power supply through 120 bar volumetric pump and 22KW of power
- Directable cannon fog consisting of N ° 60 Wetting nozzles installed on double crown powered by a high pressure volumetric pump from 5-35 I / min and droplet 10 - 300 micron;



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## **«B» AREA** - DECONTAMINATION SYSTEMS



#### PERSONNEL DECONTAMINATION UNIT

Prefabricated 6.50 x 3.00 x 2.70

Clean and Dirty Dressing Room, Local Showers, Air extraction system with high efficiency filter and pre-filter capacity 1000 mc / h Access tunnel connected to Zone C

#### OBJECTIVE

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> Decontamination of the Personnel operating in the A"" AREA (team progress of about 10 units) before the exit towards the Zone C.





#### VDU - VEHICLE DECONTAMINATION UNIT

Washing tunnel length 4.00 ml, width 2.80 ml, equipped with 110 nozzles arranged on N  $^{\circ}$  4 arcs for a total of 2000 l / min;

Water storage tank of 20mc

#### OBJECTIVE

Decontamination of the wheels, the frame and all the external surfaces of the vehicles ensuring the removal of any asbestos fibers before the exit to Zone C.

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# PHYSICAL COMPARTMENTALIZATION OF AREAS



- 1. Steel structure
- 2. Closure by electro-welded mesh and pvc sheets
- 3. Doors with automatic fast closing
- 4. Water blade with flat nozzles

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# PERSONAL PROTECTION EQUIPMENT











ELECTRO-RESPIRATOR: TMP3; FPN 2000; FPO 400.







## **AIRBORNE MONITORING**





Fibers concentration throughout excavation activities has been always kept below 2 ff/l in B zone and in C zone

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# **EXTERNAL ENVIRONMENT MONITORING**







OBJECTIVE: <u>Zero Impact</u> on the external environment

#### EXTERNAL ENVIRONMENT MONITORING



- Compliance of the jobsite activities to the guidelines
- Checking the alert level in adjacent areas



#### MONITORING CRITERIA

**Source** Tunnel Portal

First boundary External JOBSITE border

Second boundary Closest sensitive receptors

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**Best Practice** 

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# CONCLUSIONS

#### "Minimun risk" of exposure to asbestos fibers:

- Awareness, information and training to all levels
- Accurate and deep application of the procedures and processes by the manpower

"Zero impact" on external environment during asbestos excavation

Easy, feasible and easily replicable solutions and procedures on others jobsite of Terzo Valico

**Satisfactory Performance:** 2 m/dd and 35-40 m/month with a tunnel section of about 85 sqm

The local safety authorities are proposing the experience of Cravasco Adit as a national guideline for the excavation of tunnels in the presence of asbestos

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