

# **Tunnel Safety Concept**

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# Titel: Tunnel Ventilation and Air Conditioning

Focus: Smoke Extraction System in the Tunnel in case of fire (not buildings)

# Protection Goal(s):

- 1. Protect People
- 2. Protect the Equipment and Tunnel



#### **General Remarks:**

- Conditions are based on several german laws
- Conditions are fixed in an expertise from STUVA (external engineer office)
- This expertise is part of the Plan Approval Order (Planfeststellungsbeschluss) from the authorities
- XFEL Tunnel is <u>not</u> a Standard Systems required by laws or regulations – XFEL is a "Stand-alone Device"



# **Technical Item: Smoke detection in all tunnels**

Due to long access and escape routes a smoke detection system has to be installed

- High sensitive detection
- Smoke detection with precise localisation
- Aspiration system preferred

Limiting conditions:

- High radiation level in the tunnel
- Limited space





# **Technical Item: Smoke detection**



**Extraction System** 

Flap



# Technical Item: Aspiration Systems and Flaps

| Tunnel | Length / m | Asp. Systems |
|--------|------------|--------------|
| XTL    | 2010       | 40           |
| XTD1   | 480        | 9            |
| XTD2   | 594        | 12           |
| XTD3   | 268        | 5            |
| XTD4   | 300        | 6            |
| XTD5   | 198        | 4            |
| XTD6   | 660        | 25           |
| XTD7   | 140        | 3            |
| XTD8   | 360        | 7            |
| XTD9   | 545        | 11           |
| XTD10  | 223        | 4            |

Expected

~125 aspiration systems ~360 flaps

incl.

- engineering, system layout
- installation of pipes, detectors
- network
- commissioning
- documentation



# **Technical Items: Sections**

# <u>XTL (2010 m):</u>

- Divided into 4 Sections by Fire Walls (approx. 600 m)
- with Smoke Extraction System (because of high fire/smoke load)



600 m

# <u>XTDs (140 - 660 m):</u>

- no Sections
- XTD 4,5,7,10 with Smoke Extraction System (because of high fire load)
- XTD 1,2,3,6,8,9 no Smoke Extraction System



# Technical Items: Separation into 600 m - Sections

- no emergency exit within the 2010 m
- according to traffic/subway tunnels
- NFPA 130 standard: within 7 Min. next smoke-free section must be accessible (with 1,5 m/s speed = approx. 600 m)
- Fire Walls will be equiped with High Pressure Water Curtains

# European XFEL

Approved safety concept (2005)





#### Technical Item: Smoke Extraction System

- for self-rescue phase a 1,5 1,8 m smoke-free zone is necessary
- XTL: extraction volume 23.000 cbm/h, XTD's 11.000 cbm/h











### Technical Item: Extinguishing system for XTL-linac tunnel

Due to the fire load inside the XTL-tunnel an extinguishing system (HP) for specific applications is required.

A high-pressure water mist extinguishing facility shall supply following systems:

- tunnel separation each 600 m
- protection of oil transformers each 50 m
- hose connection each 50 m for the use of mobile high-pressure fire hoses (for rescue teams)
- standard C-fire hose connection
- mobile water curtains during installation period



# **Technical Item: Installation Period XTL-linac tunnel**



A mobile water curtain allows the isolation of fire and smoke in a tunnel segment during the installation period by washing out the smoke.

The curtain needs to be moved easily with the progress of the installation.



#### Technical Items: Other additional Safety Items

- Every Transformer and Rack-Groups will be protected by an automatic extinguishing system (HP-system)
- only FRNC cables/wires are accepted
  - (FRNC = Flame Retardant, non corrosive)
- antennas for "walkie-talkie" and mobile phone
- Emergency power supply for 90 min.
  - emergency light / emergency signing
  - extraction system



### Organisation Items: Other additional Safety Items

- Access Control System
  - only trained people are allowed to enter the tunnel
  - To find out in a case of emergency that everybody has left the underground areas
- •no flamable material
  - (limited quantities for chemicals, wood and packages remove at once, only daily quote of gaz)
- smoke hood for every person
- Hot work permit
- emergency call every 50 m
- smoking ban in the tunnel
- internal Rescue Team (Dept. ZTS)







# Universally valid

All equipment and installations for XFEL have to be in accordance with all European and German standards.

This includes for designing and planning:

- Clarify category (machine? el. equipment? pressure vessel?)
- Determine scope of applicable standards
- Perform risk analysis
- Compile technical documentation
- Establish operation manuals, maintenance plans etc.
- For certain installations: Certification by external certification body required
- For certain installations: Establish Declaration of Conformity