Safety issues for underground structures

Two issues:
-Safety norms, who are the stakeholders?
-A specific layout aspect related to evacuation and fire control?

Fabio Corsanego

CERN -Safety Commission
Fabio.corsanego@cern.ch

Stakeholders

a) Owner of the territory (typically a government).

Focus on:
-environment
-Population
-consensus

Forgot any?
Your feedback welcomed

SAFETY FUNCTIONS

b) "Owner" of the facility (typically a research center):

Focus on:
- Safety of member of personnel
-assets of the organization

c) Service Provider (typically enterprise or collaborations providing people and physical resources):

focus on:
-safety of their workers
-contractual responsibilities

d) Financing institutions

Focus on:
-scientific findings
-respect of planning
-operation continuity

a) Owner of territory:

Diplomatic negotiation or standard authorization procedures?

We may imagine that the government owning of the territory will either:
- issue formal approvals by use of existing procedure (construction permits, etc.),
- or take a position in the diplomatic negotiation, basing on feedback from its safety agencies

The hosting government mediates between:
- interest in fostering scientific development
- need to protect citizens, assets, and consensus

…can imply our need to consider national legislations as either:
- directly applicable (if standard procedures)
- reference benchmark (if negotiated procedures)

Host state, or supranational regulation is rarely made for a particle accelerators:
- Case by case, integrated by direct discussion with experts of domestic agencies

A large project can be in the need to communicate in a technical language understandable by the territorial authority

- Dossiers showing compliance with the **basic principles** contained in the regulations and guidelines, where :
  - We can make use of a reasonable freedom of interpretation;
  - We have to fulfill the gaps existing in the reference regulation, and produce sounding justifications, typically by risk analyses.

b) Owner of the facility

Should the "owner" be CERN, we would have:

- Need to prove compliance with regulation applicable at CERN.
  - List of codes and instructions available online
- Need to assess the risk and prove efficacy of measures for subjects not covered in details
  - (again, benchmark laws and directives, and risk analyses)
- Need to obtain approval of the Safety Commission,
  - one or more Safety file(s) for the project to be submitted for approvals and technical reviews
  - Guidelines available

“Service Providers”

- Two distinct cases:
  - Private enterprises and their workers,
    - at CERN, are subjected to national legislation enforced in the host states
  - Collaborating Institutions
    - may be required to grant that their employees assigned abroad are exposed to hazards not larger than those acceptable in their home country (I.E: detached US Government Agency Employees)

This may impact indirectly also on layout of the facility

Financing Institutions

- Protection of the scientific program against risks of different nature (incl financial ones) .
- Focus is on:
  - Scientific return on investment
  - Continuity of operation
  - Recovery capacity
  - containment of damage in case of sinister

Safety requirements aimed to achieve this goal may be quantitatively stricter than the “prescriptions by law”

Salient aspects of integration

- Identify the agencies supporting political decisions in the host states. Typically:
    - municipalities and makers of construction rules,
    - fire brigades,
    - health and safety agencies,
    - nuclear safety agencies
- Identify their reference codes and standards
- Define areas that shall undergo to risk analysis with the most appropriate techniques:
    - “what if”
    - “accident scenarios”
    - Quantitative methods (Fmeca, Hazop, etc)
- Identify safety requirements internal to the owning organization
- Identify requirements arising from Labor Codes for hosted workers
- Identify needs to assure protection of mission continuity and recovery capacity

Distance between access pits for different machines:

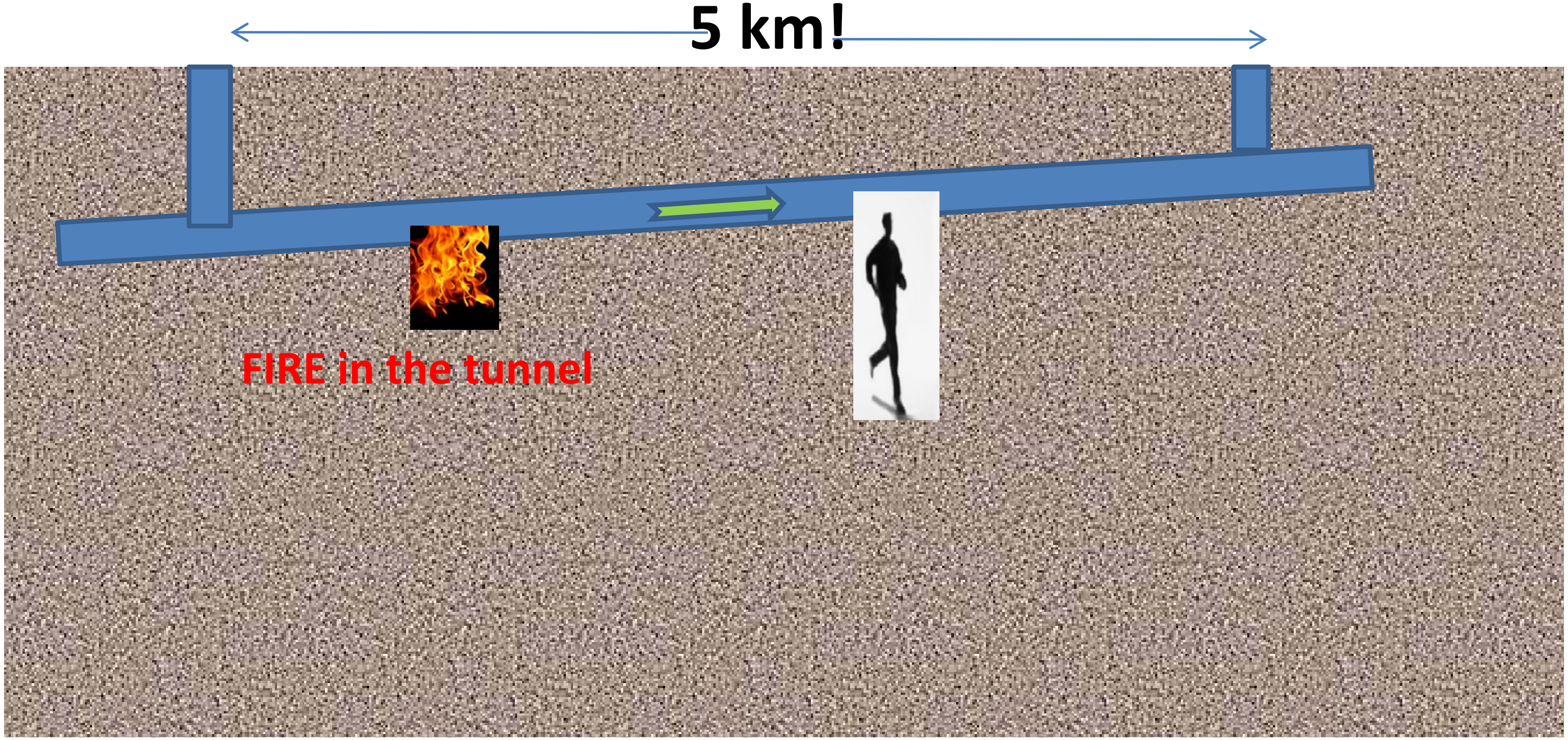
- SPS~=1200m
- LEP-LHC~=3000m
- ILC-CLIC~=5000m

Cost reduction requires to reduce number of access pits…law of the double every 20 years?

Need to assure quick and easy evacuation of personnel in case of accident

Layout and fire escape

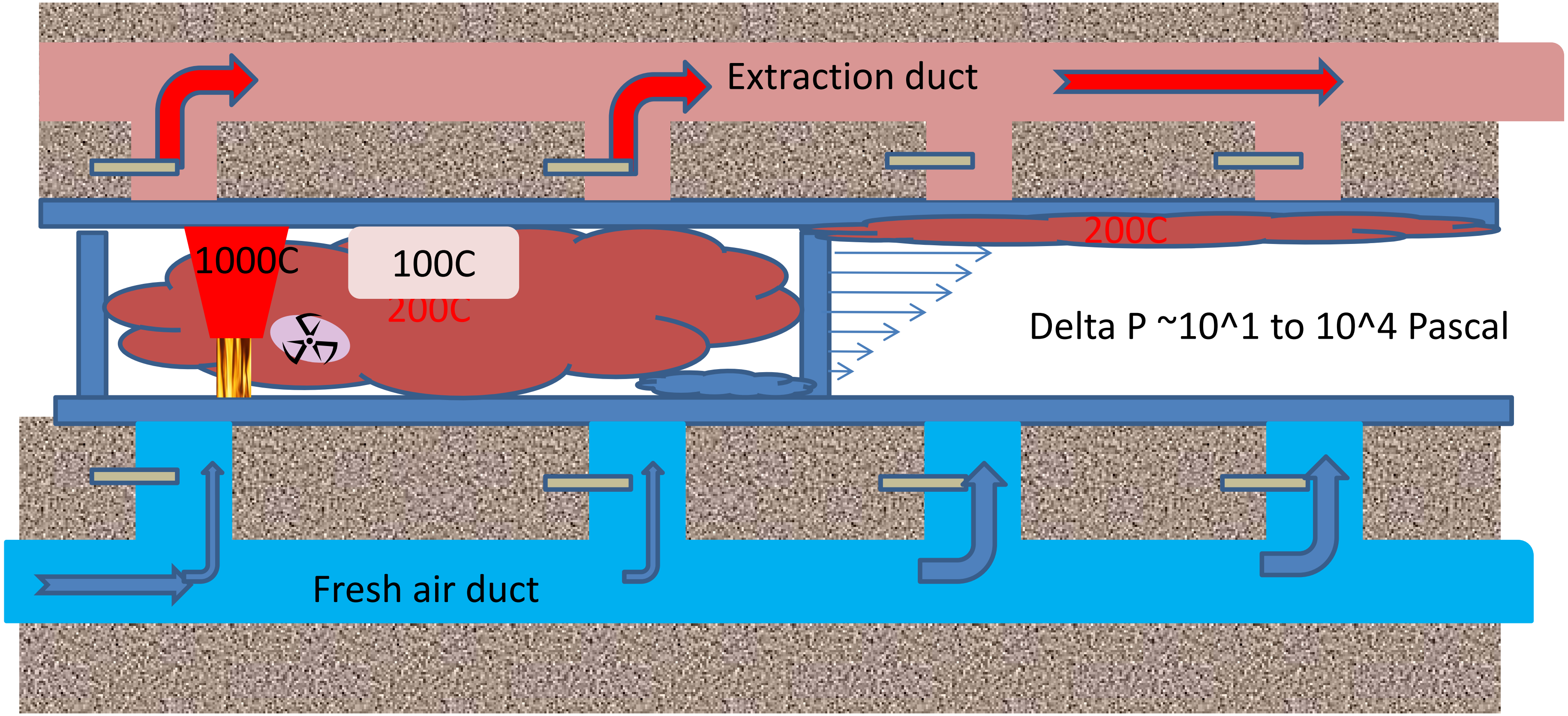
Run fast for an 1hr hoping
to beat the smoke motion!?



tunnel integration, including transport, cooling and ventilation, and safety issues


Fire
Door
FIREWALL

The ventilation system has a role to play in controlling smoke within one sector:



The natural overpressure of fire can be contrasted by over-pressurizing the side compartments

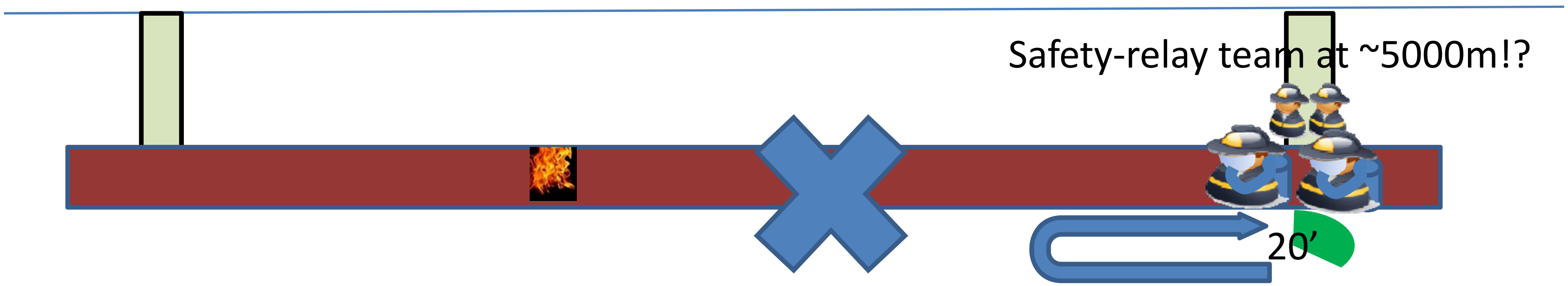
Fire compartment enhance greatly fire brigade capacity

CASE a: fire doors every 500m

Engaged team autonomy ~20’ can be fully spent for active work on the fire

Safety-relay team at <500m-not consuming their air bottles

CASE b: access every 5000m



They go as far as they can within~20’: available time for intervening is shrunk by distance

Sectorization:

- Has to be decided at early layout stage
- Integration of walls with equipment assembly, disassembly, calibration
- Integration with transportation
- Requires additional ducts
- Has a cost

- Safest approach for personnel evacuation
- Confines equipment damage
- Reduces dispersion of isotopes
- Allows effective intervention of fire brigade
- Reduces recovery time and costs
- Allows compliance with benchmark codes