



# DGS/SEE Seminar on Fire Protection for Physics Research Facilities

7 and 8 October 2015  
CERN

## Introduction status and perspectives

S. La Mendola DGS/SEE/XP

# ITSF: a time-tested forum for exchanges on safety

**IT20 International Technical Safety Forum 2014**  
**SF14** September 8 - 12, 2014 · Fermilab, Batavia, IL USA

**Topics:**  
 Safety culture, Risk assessment, User safety, Performance improvement in HEP nations, New projects and challenges, Equipment certification, Sustainability, Communications, Interdisciplinary, Incident/accident management

**International Committee:**  
 Jeff Anderson, JLab  
 Paul Barlow, DESY  
 Boris Gavril, CERN  
 Thomas Hopp, DESY  
 Joseph C. Kenny, SLAC  
 Bert Mandlak, JLAB  
 U. Sattler, FNAL  
 Cynthia Stearns, FNAL  
 Susanna Tredici, FNAL

For registration and additional information:  
<http://www.itsf2014.org>

**International Technical Safety Forum**

ESRF, Grenoble, France, 21 – 24 May 2013

**International High-Energy Physics Technical Safety Forum**  
 April 11-15, 2005 :: Menlo Park, California

**International Technical Safety Forum**

CERN, Geneva, Switzerland, April 12-16, 2010

**International Committee:**  
 Ralf Trant, Chair, CERN  
 Rolf Berthens, DESY  
 Andreas Hopp, DESY  
 Joseph C. Kenny, SLAC  
 Bert Mandlak, JLAB  
 Stéphanie Ricco, ESRF  
 Fritz Stoenen, CERN  
 Marc Tarkenton, CERN

**Topics:**  
 Communication in matters of Safety  
 Ergogenic Safety  
 Emergency preparedness  
 "In-Rief" Combinations  
 Physics detectors  
 Risk analysis  
 Safety Organization  
 Safety Systems

**INTERNATIONAL TECHNICAL SAFETY FORUM**

SLAC, Menlo Park, California, USA, September 12-16, 2011

**International Committee:**  
 J.C. Kenny (Chair), SLAC  
 Paul Barlow, ESRF  
 Andreas Hopp, DESY  
 Bert Mandlak, JLab  
 Frank O'Neill, SLAC  
 Stefan Schrader, DESY  
 Keith Schuh, FNAL  
 Brian Sherin, SLAC  
 Ralf Trant, CERN

**Topics:**  
 Safety Communications and Training  
 Ergonomics  
 In-Rief Contributions  
 Lessons Learned  
 Risk Analysis and Systems Safety  
 Astrophysics Safety  
 Work Safety in Physics Environments  
 Environmental Concerns

For Registration and Additional Information:  
[www-conf.slac.stanford.edu](http://www-conf.slac.stanford.edu)

**Jefferson Lab, Newport News, VA**  
 April 8 - 11, 2008

**ITSF**  
<http://conferences.jlab.org/ITSF>

and safety professionals united in exchanging equipment safety from a variety of high-energy facilities. Previous fora have been held at the Fermi National Accelerator Laboratory

**2008 International Technical Safety Forum**

**Topics:**  
 Work Safety  
 Technical Safety  
 Safety Organization  
 Fire Safety  
 Health Issues  
 Environmental Issues

**Organizing Committee:**  
 R. Trant, ESRF  
 K. Schuh, FERMILAB  
 B. Mandlak, JLAB  
 J. Wells, JLAB  
 J. Kenny, SLAC  
 S. McKenzie, SNS

**International Technical Safety Forum 2006**  
 18-22 SEPTEMBER 2006 • CCLRC RUTHERFORD APPLETON LABORATORY • UK

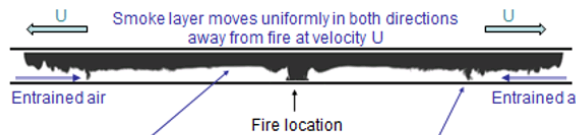
**Welcome**



# Fire safety challenges common to several labs

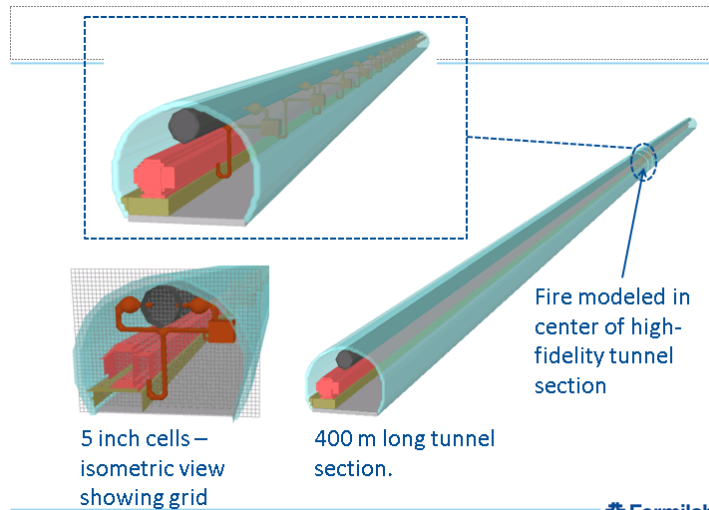
## Tunnel Fire Dynamics

- Smoke movement in level, naturally ventilated tunnels



Near the fire, the smoke layer is hot (strong buoyancy) and remains close to the ceiling with little mixing.

As the smoke moves away from the fire, cooling occurs causing smoke to lose buoyancy. Descending smoke mixes with the entrained air and is drawn back towards the fire. This is referred to as "back-layering".



James Priest PhD, Fermilab, Contributor James Niehoff

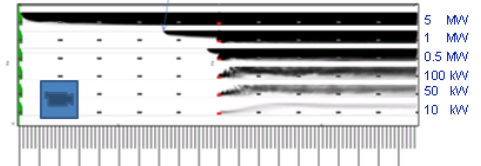
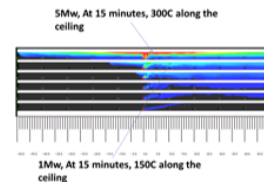
10/4/2015



## Characterization of fire hazard in tunnels



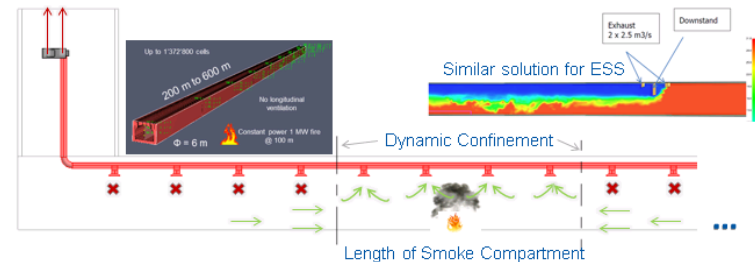
### 1.2m/s Smoke temperature



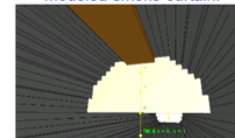
### Main results

- Back layering reaches an equilibrium distance;
- Stratification downstream is lost very early;
- Air velocity downstream slows down to ventilation speed ;
- Gas temperature reaches a maximum of almost 300 °C (5 MW fire), but after 200 m it goes down to ≈ 50 °C;
- Decrease of visibility to almost zero in smokes;
- O<sub>2</sub> concentration down to 18.5 % and CO<sub>2</sub> up to 3.2% (5 MW fire).

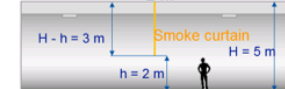
## Ongoing research – Smoke extraction system for FCC study



### Modeled smoke curtain.



Height from floor of design smoke layer = 2 m



Full confinement within the 200 m compartment for a 1 MW fire and 12 m³/s



21/01/2015

S. La Mendola DGS/SEE/XP

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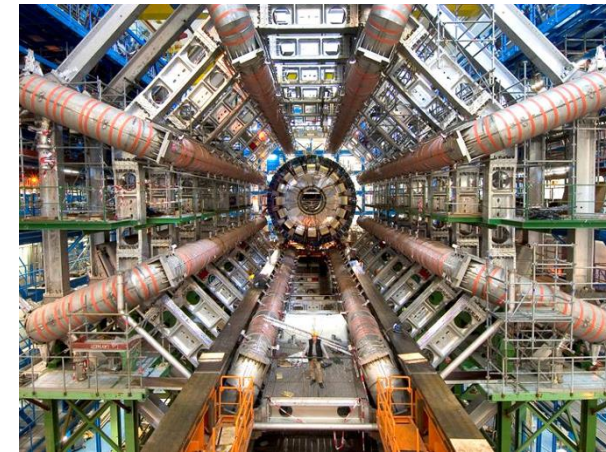
# Why fire safety can be a ground for a common effort?



Fire safety objectives for ordinary surface buildings are reached through compliance with prescriptive compulsory rules.



For underground facilities, the objectives are validated thanks to performance-based fire risk assessments.



# Workshop in Lund, a first concrete step to collaboration

## Workshop on Fire Protection at Research Facilities

21-22 January 2015  
Tunavägen 24  
Europe/Stockholm timezone



**LUND**  
UNIVERSITY

# Workshop in Lund: collaboration topics

| Main topic                            |  <p><b>FCC study: a great opportunity to cooperate!</b></p> <p><b>Schematic of an 80 - 100 km long tunnel</b></p> <p>Jura</p> <p>LHC</p> <p>Lake Geneva</p> <p>Prealps</p> <p>Aravis</p> <p>Mandalaz</p> <p>Copyright CERN 2014</p> |
|---------------------------------------|--|
| Hazard characterization               |  |
| Passive fire protection               |  |
| Active fire protection systems        |  |
| Intervention of rescue teams          |  |
| Life safety in underground facilities |  |
| Fire risk methodologies and tools     |  |

# Staying in touch: Monthly video conferences

- **Organizational and technical issues are discussed.**
- **A Fermipoint site is now available to exchange information .**
- **Deliverables for FCC study are being discussed as well.**

## Excel Fire Modeling and CFAST Integration

Monthly Conference, Fire Protection in Research Facilities  
July, 2015

  
www.YourFPE.com

MONTHLY CONFERENCE, FIRE PROTECTION IN RESEARCH FACILITIES  
JUNE, 2015  
EXCEL FIRE MODELING AND CFAST INTEGRATION






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Fermipoint

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Organization  Project  Service  Collaboration  Experiment 

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 **Fermilab** Fire Protection for Research Facilities





# The network keeps growing



- **PhD student from the university of Wuppertal/Jülich Research Center at CERN**
- **Collaboration agreements with Freie Universität of Berlin, Magdeburg (OVGU) and Lund (for HL-LHC)**

# Another milestone: Workshop on air management at ESS

## ESS Air management Workshop

Optimization of HVAC system with respect to accidental scenarios in multiple Safety domains

S. La Mendola, A. Henriques  
Visit to ESS  
2nd July 2015



10/4/2015

A. Henriques, S. La Mendola DGS/SEE

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# Fire protection: workshop at CERN

- It marks a milestone in the collaboration road map (summary, current situation and next steps);
- It includes the following topics:

|              |   |
|--------------|---|
| <b>Day 1</b> | <b>General (introduction of participants, current challenges and ongoing activities);</b> |
|              | <b>Air management (smoke extraction) in radioactive facilities</b>                        |
|              | <b>Intervention strategies of fire brigade teams</b>                                      |
|              | <b>Fixed extinguishing systems</b>  |
| <b>Day 2</b> | <b>Burning behavior of electric cables</b>  |
|              | <b>Computational fire simulations</b>   |
|              | <b>Performance-based structural fire design</b>   |
|              | <b>Evacuation simulations</b>   |
|              | <b>Draft standards for mine safety</b>  |

# Next steps: collaboration on FCC

- **Participating institutes sign a Memorandum of Understanding;**
- **Deliverables are defined in an Institute Agreement;**
- **4 IAs have been drafted on evacuation simulations, fire simulations, design fires, smoke extraction system, etc.**
- **All documents (incl. MoUs) should now be signed.**



Future Circular Collider Study

[FCC](#) ▾ [Physics](#) ▾ [Accelerators](#) ▾ [Opportunities](#) ▾ [Society](#) ▾ [Collaboration](#) ▾ [Recent](#) ▾



# What's next

A workshop on fire safety is expected to be included in ITSF 2016: opportunity to present the first advancements;



**International Technical Safety Forum 2016**  
9-13 May 2016, DESY, Hamburg

ITSF  
2016

Topics: Lessons learned, Risk assessment, Laser safety, Continuous improvement in HSE matters, New Projects and challenges, Equipment certification, Sustainability, Communications, Nanoparticles, Incident/accident management

International Committees:  
A. Hoppe (DESY), S. Kozłowski (XFEL), E. Cennini (CERN), A. Trudel, (TRIUMF), P. Jacobsson (ESSS),  
B. Marzłak (JLAB), J. Anderson (FERMILAB),  
J. Kenny (SLAC)

<http://itsf2016.desy.de>

European XFEL

DESY

- Signature of collaboration (MoUs, IAs) agreements and start of activities;
- Participants remain in close contact via video conferencing or similar and share information through Fermipoint;
- A workshop on fire safety is expected to be included in ITSF 2016: opportunity to present the first advancements;
- New participants can join the network;

Questions?

**Thank you for your attention!**