

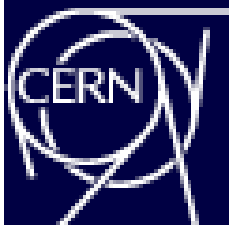


# **LHC Performance Workshop Chamonix 2009**

## **Summary of Session 02 Safety**

Ralf Trant

Laurette Ponce



# Program

- **Task Force on Safety of Personnel** in LHC underground areas following the accident in sector 3-4 on 19-09-2008  
*(Ghislain Roy on behalf of the Task Force)*
- **Safety Organisation** *(John Etheridge & Ruediger Schmidt)*
- **Access & LACS/LASS** *(Laurette Ponce)*
- **Safety systems (AL3) and systems relevant to Safety**  
*(Steve Hutchins)*
- Possible scenarios for a safety upgrade of the **ventilation system** *(J. Inigo-Golfin)*
- **Emergency preparedness** *(Enrico Cennini)*



# Task Force on Safety of Personnel in LHC underground areas following the accident in sector 3-4 on 19-09-2008 (*G. Roy*)

- **Between the accident and today**
  - **Access conditions** defined in the repowering procedure
  - WG defined the **working and transport conditions** in the LHC tunnel during 08/09 shutdown based on risks of cryogenic nature
- **Taskforce mandate**
  - **Establish the sequence of facts** related to safety of personnel, based on e.g. AL3 data and FB emergency intervention records.
  - **Analyse the LHC underground environmental conditions** with respect to Safety of personnel and explain their development, in relation with original risk analyses (incl. tests) performed.
  - **Recommend preventive and corrective measures** for the Safety of Personnel in the LHC underground.

Note : Scope limited to cryogenic accidents with release of cryofluids, caused by any sources.
- **Interim conclusion**
  - We still have more questions than answers...
  - Work has started in gathering all info necessary to come to meaningful conclusions.



# Safety Organisation

*(J. Etheridge)*

- **Evolving Safety culture at CERN**

- CERN is building safety in from the conception stage of nearly all new projects.
- Avoiding the after thought syndrome

For any operation to retain integrity scheduling, Safety and related documentation must be built in from the pre planning stage.

- Safety can save us time, improve working condition, the quality of the work, and if we look at the global picture for the life time of the installation it can save us a lot of money...

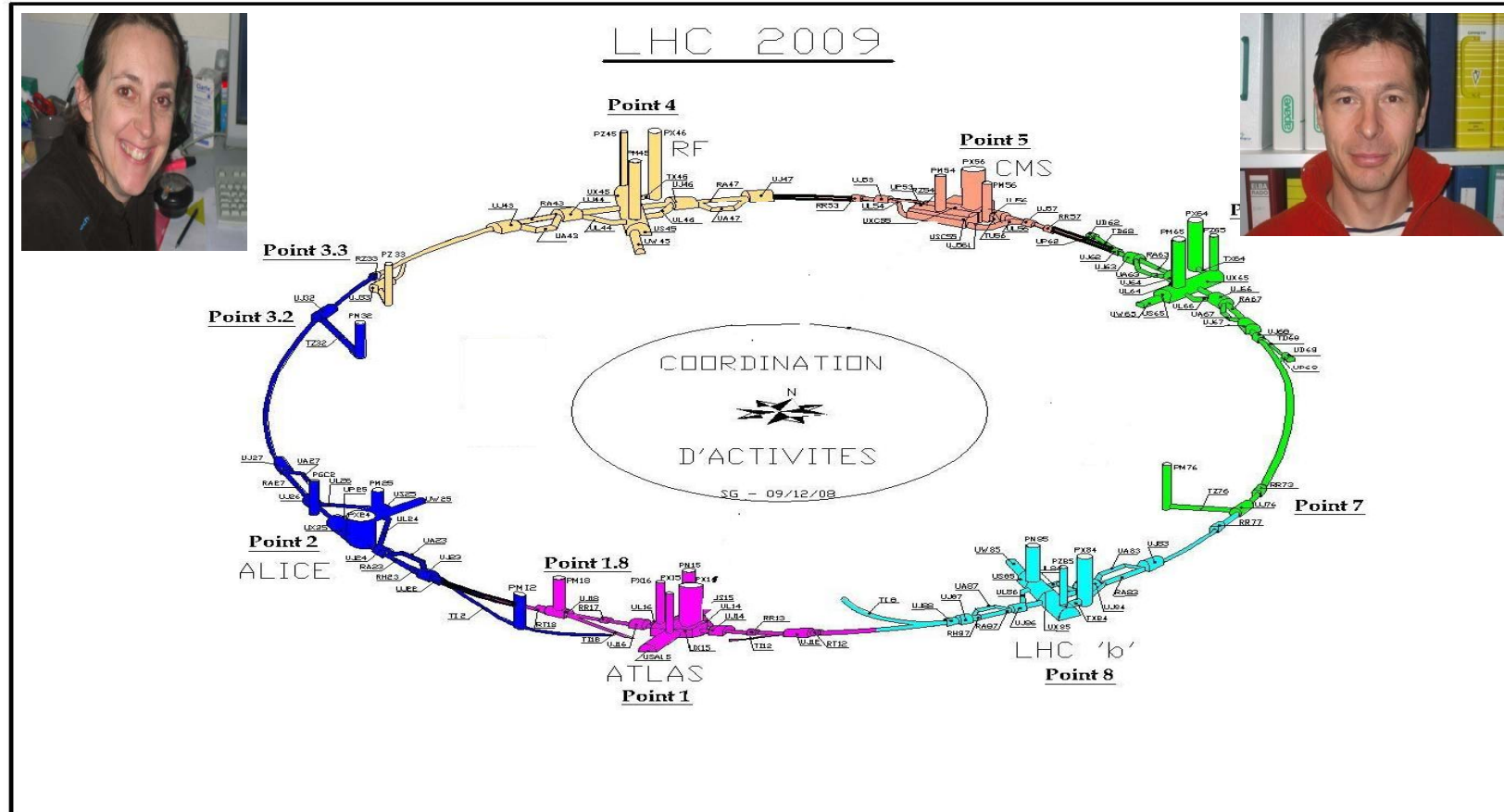
- **Special Situations**

- There are none! All work tests, interventions must be planned, prepared, authorized and all documentation respected



# Planning & General coordination

(*J. Etheridge*)

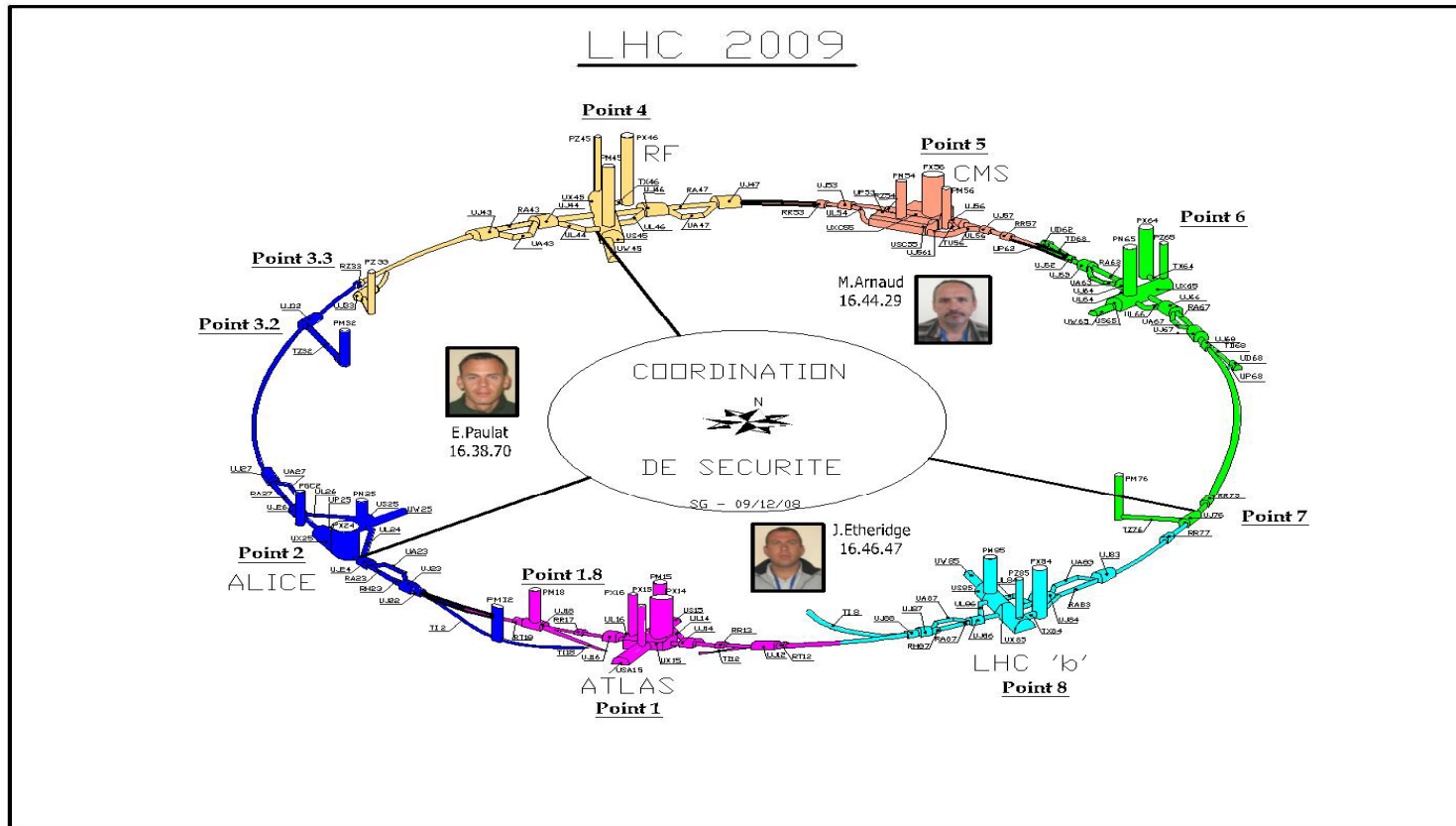


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# Health & Safety Coordinators

(*J. Etheridge*)



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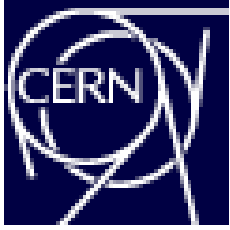
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# Safety Organisation

*(J. Etheridge)*

- Take into account the information contained in the PGC Shut Down 2008/2009 No **EDMS 978710**
- Certain **documentation** needs to be made **more user friendly** (e.g. AOC or one EDH documents for all tests [pressure, electrical or X-ray])
- Improve **verification of materials** coming out of the tunnel in relation to RP
- Wearing of **individual protection**
- Improve **reaction time** in producing the safety related documents
- Ensure the same rules are applied **CERN wide** i.e. no difference between PS, SPS, LHC
- Clean up after ourselves ....



# Safety during powering tests

*(Ruediger Schmidt)*

- Many safety issues were discussed during the LHC Safety Day on 18 October 2007:  
=> <http://indico.cern.ch/conferenceTimeTable.py?confId=22150>
- In particular, the procedures that were used to ensure electrical safety when working on equipment remain in place (locking-off circuits etc.)

What is new?

- **How can we perform the powering tests in the future?**
- **Lessons learned from 19/9/2008**

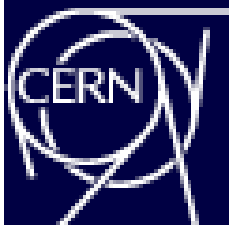




# Safety during powering tests

*(Ruediger Schmidt)*

- **PHASE I - Low current powering tests:** current limited to a value to be defined, taking the risks into account
  - **Underground access** is in restricted mode
  - Limitations for access to **tunnel** to be discussed (closed or restricted)
  - No limitations for access to **experiment**
  - No limitations for access to **adjacent sectors**
- **PHASE II - High current powering tests:** the current in the circuits is not limited
  - Access is closed & all necessary areas patrolled
  - Access to experiments to be defined
- For each circuit type, it is required to define “High Current”
- For each circuit powered with “High Current” is required to define what areas need to be closed and patrolled (Task Force chaired by R.Trant)
  - Adjacent tunnel areas ? Service areas ? Experiments ?



# Safety during powering tests

*(Ruediger Schmidt)*

- If there is an agreement on the **two phases of powering**, work to define and implement tools for operation can go ahead
  - there are several open questions to be addressed
- **Most urgent:** matrix between maximum current for circuits and access conditions needs to be defined
- Circuits with normal conducting magnets are not considered as no risk for helium release and electrical protection is done according to IP regulations



# Access System – LASS/LACS

*(Laurette Ponce)*

- **LHC Access Safety System (LASS):**
  - End of the contract phase
  - non conformities fixed in the last release, but DSO tests to be done
  - Main issue is the sorting out of SPS interlock signals to avoid wrong BIW alarms at points 2/8
- **LHC Access Control System (LACS):**
  - Treatment of well known non-conformities pending,
  - The two main issues for operational efficiency seems to be solved in the last version, but only partial deployment and need testing
  - Most of the changes cannot be tested before switching back to RESTRICTED mode
  - Delay in software delivery from the contractors makes the improvements slow.



# Access System – LASS/LACS

*(Laurette Ponce)*

- **Major challenge** is the **period before beam operation** (short term):
  - MAD problem : compensatory measures to be put in place to avoid intrusion (local or remote human control of the opening?)
  - During shut-down: tracking of people in the underground area
  - During powering tests: how to guarantee that the proper zone is empty when dangerous conditions are given
- Most of the problems are linked to the **use of the access system for more than** the specified protection against **radiation hazard**: for adequate and safe use of the Access System during powering phase, specifications (and implementation) have to be revisited
- As the LACS/LASS projects are reaching the end, what about future developments, maintenance, manpower?



# Safety systems (AL3) and systems relevant to Safety *(Steve Hutchins)*

- **AL3** are those system which require immediate intervention from rescue team.
- **Safety systems** are those that are relevant to prevent or reduce risks.
- **LHC AL3 systems:** Automatic fire detection, oxygen deficiency monitoring, flood alarms, flammable gas alarms, emergency phones (“red phones”) and lift alerts, evacuation alarms and emergency stops.
- LHC AL3 systems are spread over 8 of the **33 geographical CSAM zones**.
- **20000 detectors at CERN**, covering surface building and underground areas.
- The **CSAM system monitors** the status of every alarm **and communicates** the information over two separate communications systems to the **CCC** and **SCR**.

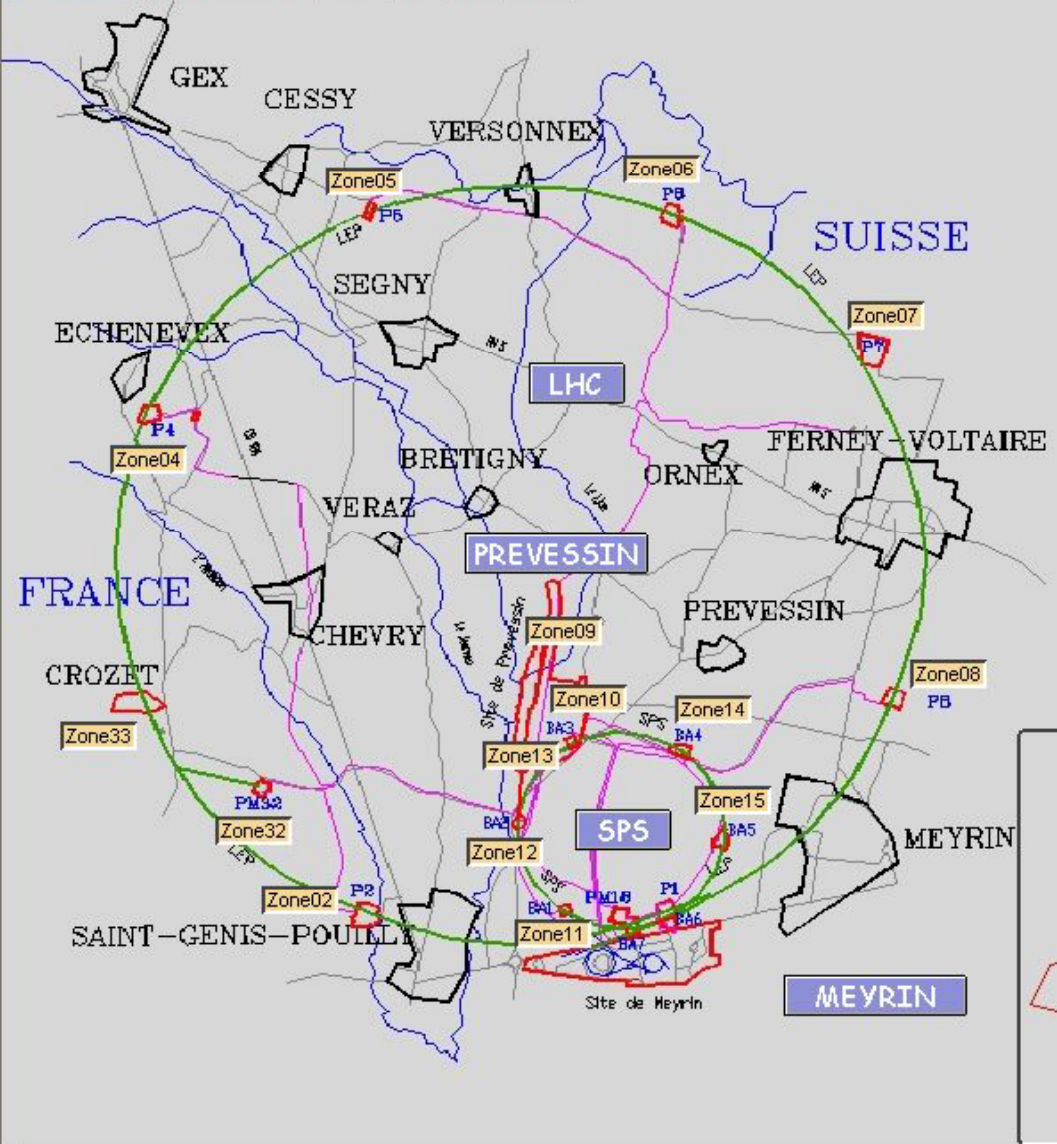
The information is also redistributed to **local display terminals** for use in an intervention, replacing the local hardwired synoptic panels that the pompiers had relied on for years.



	MEY	PRE	SPS	LHC
Alarme niveau 3	2	0	0	0
Hors service	0	0	0	0
En test	0	0	0	0
En maintenance	0	0	0	0

CERN

OPERATEUR : admin	26/01/09
POSTE : STCSAM D7i	17:29:35



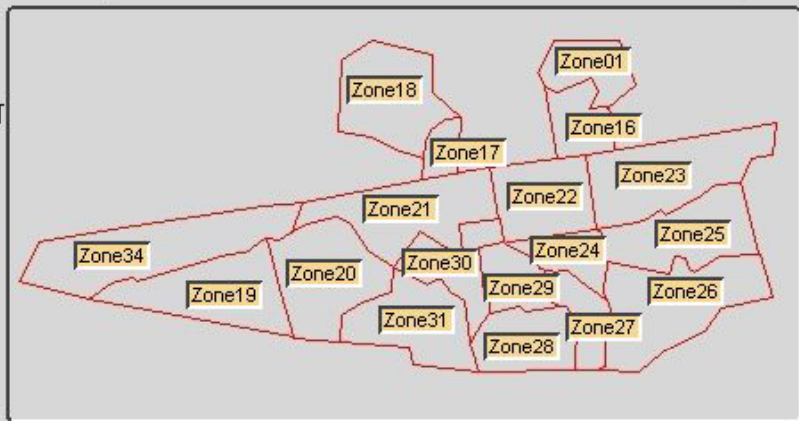
MEYRIN	
Zone19	0
Zone20	0
Zone21	0
Zone22	0
Zone23	0
Zone24	0
Zone25	0
Zone26	0
Zone27	0
Zone28	2
Zone29	0
Zone30	0
Zone31	0
Zone34	0

SPS	
Zone11	0
Zone12	0
Zone14	0
Zone15	0
Zone16	0
Zone17	0

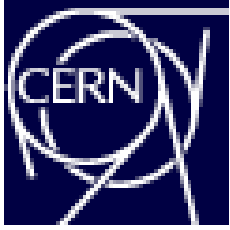
  

PREVESSIN	
Zone09	0
Zone10	0
Zone13	0

LHC	
Zone01	0
Zone02	0
Zone04	0
Zone05	0
Zone06	0
Zone07	0
Zone08	0
Zone18	0
Zone32	0
Zone33	0







# Safety systems (AL3) and systems relevant to Safety *(Steve Hutchins)*

- Overall, the required **LHC safety systems** are in place and perform well, despite some shortcomings.
- **CSAM** single failure points will be eliminated with the introduction of the new network.
- The “**CSAM - test mode**” should be used as soon as possible.
- The few missing **ODH detectors** are to be installed.
- The **TaskForce** results might entail more actions on safety and safety related systems.
- **Safety information panels** would make it possible to inform users of any local alarms, the status of adjoining sectors etc. (cryo conditions, transport restrictions, power testing plans, the need to evacuate an area at a certain time, x-ray tests...)





# The LHC HVAC system

(*Joaquin Inigo-Golfin*)

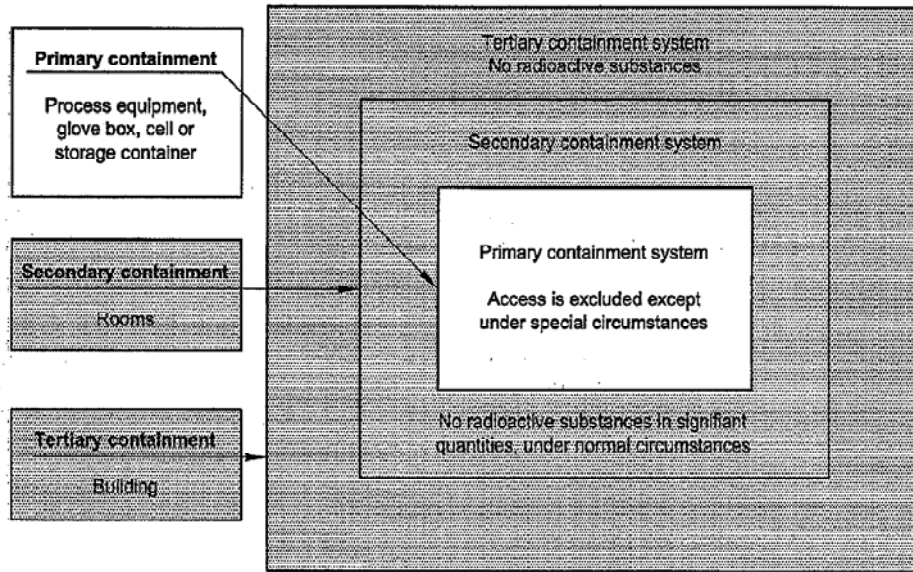
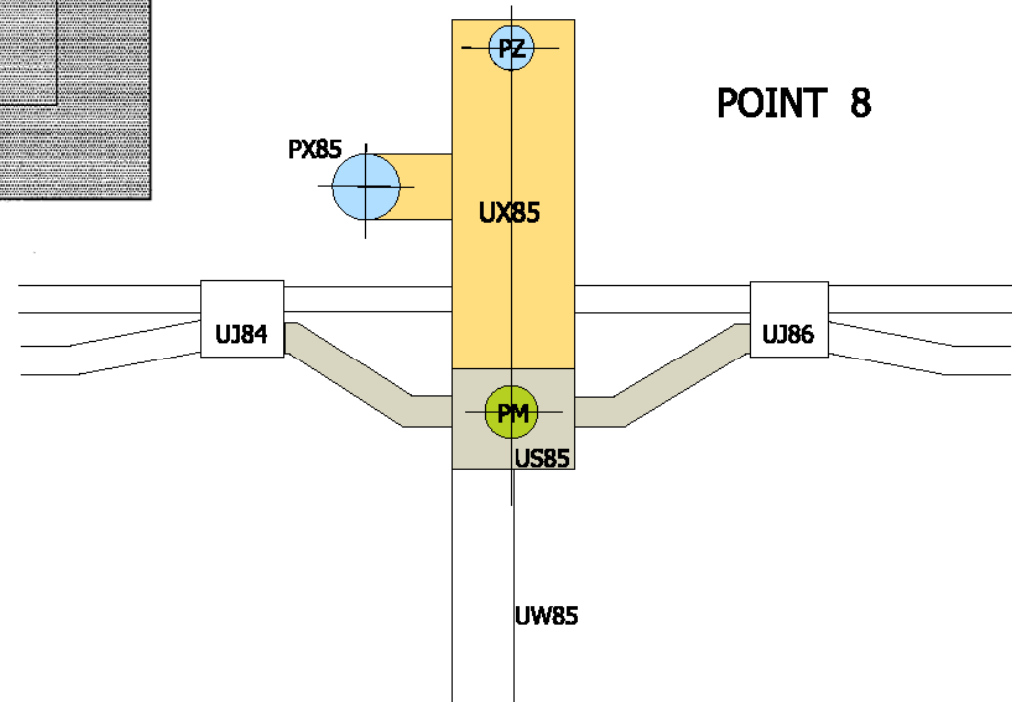
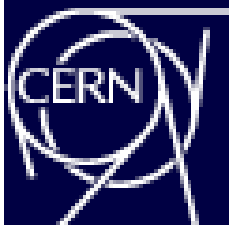


Figure 1 — Schematic drawing of a three-containment system

- Different volumes should remain distinct in all operation conditions,
- Confinement of experimental caverns important for fire/ODH reasons.





# The LHC HVAC system

*(Joaquin Inigo-Golfin)*

1. The existing LHC HVAC system is **inherited from LEP**. It has undergone no upgrade to conform to new regulations.
2. Recent ISO standards provide a relevant referential for possible improvements. The **major improvement axes** would be:
  - Confinement and filtration,
  - Availability and reliability,
  - Monitoring,
  - Procedures,
3. However full adherence to the ISO impractical and costly for the LHC.
4. **Improvement of some aspects** very affordable (door contacts, independent alarms).
5. **Some modifications** (filtration of smoke, back-up electrical supply) very costly and require careful consideration.

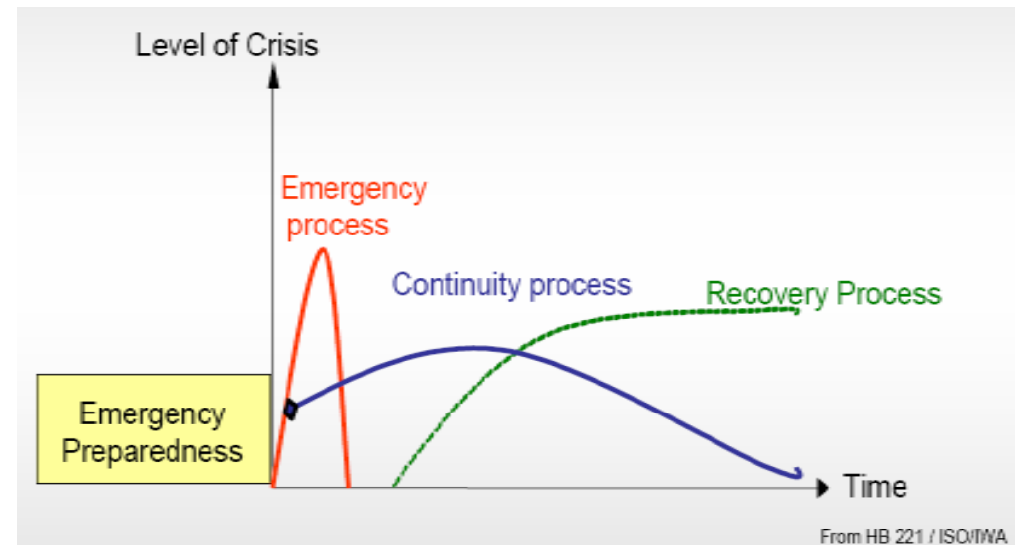


# Emergency Preparedness

(*Enrico Cennini*)

Situations	NORMAL	INCIDENT	ACCIDENT	ACCIDENT <small>Requiring external assistance</small>	MAJOR ACCIDENT	CRISIS
	<b>NORMAL OPERATION</b> - Situation under control - Limited and « short » downtimes			<b>EMERGENCY MANAGEMENT</b> - Unexpected and unknown situations, threat for people, environment, equipment - Operation interrupted, long downtimes		

- Continuous risk assessment
- Preventive/protective improvements
- Reviews (audits)
- Safety procedures/instructions
- Safety training
- Equipment and system maintenance
- Equipment and system test
- Equipment and system monitoring
- Management of technical alarms
- ...



A serious incident/accident/crisis includes three different processes:

- ✓ Emergency response
- ✓ Continuity
- ✓ Recovery

Each must be planned and organised in advance in the emergency preparedness process.

**Sector 3-4 accident** **Sector 3-4 opportunity?**

Threats / Hazard Identification	✓ <b>exhaustive?</b>	➤ Re-assess the risks of damage to equipment
Risk assessment - Probability - Impact/ Consequences	✓ <b>incomplete?</b>	<ul style="list-style-type: none"> <li>➤ Check the risk assessment at the interfaces</li> <li>➤ Tackle the Safety File production process</li> <li>➤ Elaborate a centralised accident logging and analysis tool</li> <li>➤ Compare CERNs current situation on Emergency management with ISO 31000 and ISO PAS 22399</li> </ul>
Prevention Define preventive measures	✓ <b>availability/reliability to be assured</b>	<ul style="list-style-type: none"> <li>➤ Define a list of critical/sensitive systems</li> <li>➤ Implement a quality assurance plan for these systems</li> <li>➤ Evaluate the residual risk impact also on downtimes</li> </ul>
Residual risk acceptance	✓ <b>awareness of the residual risk</b>	<ul style="list-style-type: none"> <li>➤ Define the consequences related to the residual risk</li> <li>➤ Search for potential improvements</li> </ul>
Preparedness	✓ <b>(Fire Brigade)</b> ≈ Organisation/documentation	<ul style="list-style-type: none"> <li>➤ <b>Review/clarify Safety Rules on Emergency Management</b></li> <li>➤ <b>Update Safety Plans/Procedures, Internal Emergency Plan</b></li> <li>➤ <b>Ask/help for the elaboration of an External Emergency Plan</b></li> </ul>
Emergency response mitigation of effects	✓ <b>external support?</b>	<ul style="list-style-type: none"> <li>➤ Elaborate “modus operandi” with external Emergency services</li> <li>➤ Perform regular training and exercises</li> </ul>
Continuity	✓ <b>immediate response</b>	<ul style="list-style-type: none"> <li>➤ <b>Define a Emergency Management Method</b></li> <li>➤ <b>Elaborate Continuity/Recovery Plans (guidelines)</b></li> </ul>
Recovery	≈ <b>framework</b>	



# Summary of summary

- **Safety Task force** following 19<sup>th</sup> of Sept. is running full speed.
- **Safety culture during shut-down** is evolving: to be continued & supporting tools to be improved/supplemented.
- Risk assessment of proposed two phases of **powering tests** (“access conditions”) is being detailed.
- Further improvements and (DSO) test(s) of the **access system** for the period before beam operation are underway or identified.
- **Safety systems** in place and performing well; further improvements are set-up & additions are identified.
- Identified development potential of the **HVAC system**, inherited from LEP, shall be analyzed.
- While the emergency intervention process is developed, the continuity & recovery part of the **emergency preparedness process** needs to be elaborated.