# An approach to a Work and Safety organisation in the lhc during long shut downs

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 Abstract

Following the restructuration of early 2009, the EN department took over the territorial safety responsibility for the machines. However, the beam related safety is still handled by BE and the supervision of the LHC safety will switch from the beams department to the EN department during shut downs.

 This presentation gives an overview of the safety organisation that will be in place during an LHC shut down. It will also review a number of questions that still need to be addressed and must be settled for the next long shut down.

 A primordial element of safety is the ability to Control and trace all interventions. For this the AET (Avis d’Execution de Travaux) is under development and its main aspects will be presented. The AET is an improved tracing procedure replacing the ADI from the hardware commissioning, and the AOC.

**INTRODUCTION**

Following the restructuration in the beginning of 2009 the EN department took over the territorial safety responsibility for most of the beam facilities, including the machines LHC, SPS and PS. The creation of the MEF group within the EN department brought all the TSOs for the machines and experimental areas to the EN department, and thus the occupational health and safety in these areas fell to the EN safety organisation.

The competence and experience in beam related occupational health and safety, e.g. radiation safety, EIS and AIS interlocks and access control, did however remain with the BE department. There were several reasons for this arrangement:

* The need for continuity in the treatment of these systems
* The need for proximity between the safety organisation looking after the above mentioned aspects, and the BE operations group
* The concentration in the beams department of the competence in these fields.

The natural consequence was that EN exercised its role as territorial safety responsible only when above mentioned aspects were absent, namely during shut down. This led to the idea of a machine-mode dependant safety organization.

This paper proposes an approach to a work and safety organization for the LHC during the long shut downs. Most of the units foreseen to contribute to the long shut down effort already have a well established functioning. However, a review of the methods and procedures is needed, due to the fact that the shut down will apply a new tool, the AET, a transfer of responsibilities and – most important – the LHC will have seen beam on a large scale. This will require the full scope of radiological measures to be respected: DIMR, ALARA, dose mapping, waste handling etc. All of these have an impact on the occupational health and safety.

**MACHINE MODE DEPENDENCY**

The risks to which workers are exposed in the LHC depend on the mode of the machine. For the assessment of the general safety situation the following modes are considered sufficient:

* Machine in shut down
* Machine operational without beam (Technical stop, cold check-out, powering tests and hardware commissioning)
* Machine operational with beam.

In order to simplify further, it is possible to consider only two modes: ‘Operational’ or ‘Shut down’. As will be shown in the following there are two set of criteria that condition the global safety approach

*Machine in operation*

The safety, with the machine in operation, is, in general, based on:

* the absence of people in the machine,
* the need to control the access,
* the risks are generated by exposure of the workers to radiation and to the electrical and cryogenic systems.

This situation is primarily controlled through technical measures that will keep people out of harms way. These measures are made up of the access control system with its interlocks, the various alarm systems etc.

A system of patrols, as part of the preparation to enter into operation, is one of the measures needed to ensure absence of people in areas of risk.

The handling of this situation requires a good knowledge of the risks of the machine, of its operation and of the access control and alarm systems. This knowledge is an integral part of the competence of the BE safety organisation

*Machine in shut down*

For safety, when the machine is in shut down, it is required to handle:

* the presence of many people in the machine,
* the need to trace the people intervening,
* the risks generated by exposure to various systems undergoing maintenance or tests, and with the services operational,
* limiting exposure to radioactivity.

As this situation is characterised by the fact that people need access to the systems on which they have to intervene for maintenance or tests etc, it is not possible to rely only on technical measures. A large part of the occupational safety, i.e. risk mitigation or risk control is based on organisational measures: rules, procedures, etc. These measures are less efficient and must thus be strictly enforced in order to retain their credibility.

The handling of safety during shut down requires a comprehensive planning and co-ordination, intimate knowledge of the lay out of the machine and of ‘best practice’. The knowledge of the lay out of the machine is necessary in order to be able to maintain the overview of the activities ongoing. ‘Best practice’ is required from all units intervening; only teams that know their trade or technology, and also the safety aspects being an integral part of the work, can provide the technical and safety performance required for a successful shut down.

*Proposal for a machine mode dependant safety organisation*

Based on the requirements facing the safety organisation in the two situations, or machine modes, it is proposed that

* the EN safety organisation supervises the safety during shut down,
* the BE safety organisation supervises the safety during operation, with or without beam.

This proposal requires a clear definition of the interfaces and responsibilities during transfer from operation to shut down and back. It also requires a clear definition of when the machine can be considered in shut down mode. The answers to these detailed questions will be found during the coming months, well before the next long shut down.

**LHC SHUT DOWN SAFETY ORGANISATION**

Even though all details of the transfers between modes have not yet been determined, it is possible to describe the principles that circumscribe the safety organisation during the shut down.

*Stakeholders*

The safety on the work site (in this case in the LHC tunnel) during the shut down depends on a number of stakeholders. The most important, due to their numbers, their presence in all parts of the machine and the diversity of their activities, are the intervening groups and their contractors. They contribute to the occupational safety through application of ‘best practice’. Through good work, respective of norms and standards, they cover a large part of the safety relevant actions. They do this as part of the trade they exercise, and limited to their activities.

The other group of stakeholders are the units or individuals that have the task to set up an organisational framework within which the groups and their contractors can operate safe and efficiently. This group is constituted by:

* The shut down planning and co-ordination
* The safety coordinators [1]
* The safety officers
* The ‘service provider’ or safety inspection service
* The Safety Commission
* The Fire Brigade
* The CERN management

 These units provide help and service and make

 available planning and co-ordination, safety experts,

 emergency interventions and the necessary pressure,

 occasionally needed to make the work progress.

*Safety rules*

The basic referential are the CERN safety rules.

The Safety Commission is in the process of updating rules and instructions for Health & Safety in the Workplace and for Work Organisation.

Most groups have the procedures needed to control the safety of their activities. It is in the interest of the groups that this kind of documentation is available and up to date.

These reference documents should form a coherent set, and must be available and understandable.

The correct application of the rules will require the understanding of them. Rules that are understood and accepted as reasonable will have a much higher success than will rules that are imposed without explanation. This implies that some training or information must take place

It is part of the responsibility of the CERN groups, and of the contractors, that their personnel - and their contractor’s personnel - follow the proper training.

The personnel on site must respect the safety rules to assure their own safety and that of their co-workers.

CERN users – personnel from experiments and collaborations - that will be involved in the shut down activities in the LHC tunnel must respect the tunnel safety rules. They must receive the proper training to obtain access

*Contractors*

It is intended to hold safety information meetings with contractors before the start of the shut down, as a complement to the specific safety training. The aim is to convince the local managers, the representatives of the personnel and the safety experts of the companies of the interest in a safety alliance, where all parties contribute to occupational safety, also by realising the need for it - and planning for it - from the beginning.

*Tracing of intervening teams*

It is of great importance for the occupational safety during the shut down that the planning unit and the safety coordination knows what is happening in the machine. This is to:

* Be able to validate the analysis of working methods
* Have knowledge of the ‘imported risks’ of all activities
* Avoid risks due to co-activities
* Avoid risks due to rushed and ill-prepared interventions and the ensuing surprises

Thus - in the interest of the safety of the workers -

All interventions must be declared to the work planning and coordination.

It must be assured that access to the machine is granted only to those with activities approved by the shut down planning and co-ordination.

It must be possible for the central planning authority to know the situation at all times:

* who is in - or will go in - the machine,
* where they are
* when they are there,
* what they do,
* how they do it (Safety coordination),
* for whom are they doing it?

To trace the activities as described, a user friendly, rapid and flexible declaration of work or intervention is needed. A tool that is flexible with respect to the details of the intervention, which is not easily tricked out ‘to gain time’ and which can condition the access. [2]

Such a tool, currently under development, will be the Avis d’Execution de Travaux (AET) This tool is expected to be operational during 2010. It will replace the Avis d’Ouverture de Chantier (AOC, IS 39) and the ADI, known from the hardware commissioning.

*Outstanding questions*

A number of questions still need to be addressed:

* Are the rules governing safety during shut down complete and coherent?
* Are the safety rules and procedures properly understood by all parties?
* How do we define the start and end of operation and shut down for the transfer?
* How do we handle the transitions between operation, test and shut down?
* How do we handle the safety aspects of one sector of the machine in one mode and other sectors in another mode?

The discussion of these issues should be started soonest and the answers be ready well before the next long shut down.

**CONCLUSION**

A proposal for a safety organisation for the LHC long shut down exists. It needs to be developed in detail, but the participants in this development have been identified. All the participants are currently mastering their individual contribution; what is outstanding is the creation of a forum that can assure that all stakeholders can exchange information and requirements as needed for an efficient and safe shut down, taking into account the AET tool, the radiation situation and the handovers between the BE and EN departments.

##  References

[1] J. R. Etheridge et al, What can the Safety Coordination do for you? , Chamonix 2010.

[2] J. Coupard et al, How should the access system be operated while LHC is not in beam operation, Chamonix 2010