SAFETY FOR PERSONNEL UNDERGROUND – HE EVACUATION

D. Macina and S. Weisz, CERN, Geneva, Switzerland

INTRODUCTION

This session reviewed the status of Personnel Safety Underground and in particular the measure taken after the September 19th - 2008 accident. Looking forward, the presentations described the Safety organisation during future shutdowns and the evolutions of Safety measures as the LHC will gain in intensity. There were a total of 7 presentations that can be grouped in 5 subjects:

- Follow-up of the recommendations of the Task Force on Safety of Personnel in LHC Underground Areas (Ralf Trant and Sylvain Weisz)
- Safety in the Experiments (Olga Beltramello and Christoph Schaefer)
- Safety organisation in the LHC during shutdown work (John Pedersen and John Etheridge)
- Radiation risks during LHC operation and requirements for maintenance and repairs (Doris Forkel-Wirth)
- LHC ventilation system (Mauro Nonis)

This paper presents the key points of the talks and the questions that were raised. The main messages are regrouped at the end.

TASK FORCE RECOMMENDATION AND STATUS OF THE IMPLEMENTATION

Ralf Trant recalled the mandate of the Task Force and listed the recommendations that were issued and endorsed by the Management. Most recommendations were implemented or are being addressed, and all safety measures required for the 2009/10 run have been completed. There are still two open questions: the sealing of machine specific underground service areas and the study of alternative options for guided release of overpressure and helium to the surface in case of a Maximum Conceivable Incident (MCI). The additional recommendations of the External Advisory Committee are also open issues and must be implemented.

The separation between the LHC tunnel and the experimental underground premises was a priority to allow accessing the experimental caverns while powering the magnets. The release of overpressure and helium to the surface uses presently the access shafts. This situation has important drawbacks: the air of the tunnel can mix freely with the air of the machine service galleries, and it does not insure best practice for radio-protection, ODH and fire hazard mitigation; the risk of ODH in the access shafts puts strong constraints on the access matrix when a sector is in powering phase. Sylvain Weisz exposed the strategy to pursue with the recommendations of the Task Force: the sealing of the LHC tunnel towards other underground areas is the first priority for the next long shut down. Implementation of alternate release paths from the LHC tunnel to the surface is of second priority since the present paths fulfil all safety requirements.

The separation of LHC service areas from the tunnel requires the sealing of ducts with power cables whose heat loads must be carried away by some air flow: Freddy Bordry enquired on how to do that. The idea is to install tight boxes with a specific blower to insure a flow from the service areas (UA) to the tunnel (RA), the solution should be extensively validated before implementation.

SAFETY IN THE EXPERIMENTS

Olga Beltramello reviewed the safety organisation of the experiments and the safety standards in place. She detailed how the experimental caverns have been pressure protected and sealed. She gave precisions on the Alarm 3 systems, that are operational and under maintenance control, on the collaboration with the CERN Fire Brigade and on the Radioprotection strategy that has been set up with DGS/RP. She described the role of the SLIMOS who is present 24/24h-7/7d during beam operation: the SLIMOS desk is the contact point for all matters regarding safety.

The situation of the survey galleries around Point 5 was the subject of a discussion: access to these survey galleries is actually very cumbersome, but there is no safety problem. The situation should be corrected during the next shutdown. Concerning the SLIMOS, it was asked if he has a paper version of his handbook in case of network failure: it is indeed the case, but it is not as well updated as the online version.

Christoph Schaefer exposed the remaining safety concerns of the experiments and the actions that must be pursued. These include:

- The assessment of the safety relevant functions of the ventilation system, in normal and in degraded mode;
- The assessment of the safe underground areas (structure and ventilation);
- The need for a public address system in the underground experimental premises;
- The evacuation paths and their signalization, including indication of the paths that are not useable;
- The development of a specific safety system dedicated to execute automatic actions for the level 3 alarm;
- The need for magnetic field resistant RP portable devices.

Doris Forkel-Wirth commented about the last point, recalled that such instrument does not exist on the market

and that a special in-house technical development is required.

Roberto Saban expressed his worry about the amount of resources required to do everything asked. We should first have a risk analysis to define priorities, and then the experiments and machine must collaborate on the consolidation program.

SAFETY ORGANISATION IN THE LHC DURING SHUTDOWN WORK

The EN Department took over the territorial safety responsibility for the machine, as a follow-up of the restructuration beginning of 2009. However, the beam related safety (e.g. radiological aspects and access control) will still be handled by BE who will continue to supervise the safety during operation, with or without beam. John Pedersen underlined that the hand-over of responsibility at the beginning/end of a shutdown is a new exercise and that some open questions still need to be clarified (Ex transition phase with HW commissioning tests in part of the LHC). He also underlined that safety rules must be enforced, appropriate training will be provided and a strong support of the Management is expected in case of non respect of the rules. He finally commented on the need for a new procedure to trace and control all activities, linked to the LHC access authorization during shutdown: the Avis d'Execution de Travaux (AET) will merge the AOC and ADI functionalities, Julie Coupard gives a detailed description in her presentation in the next session on Access System and Radiation Monitors.

John Etheridge commented on the evolution of Safety Coordination in the field and on its added value. He insisted for an early involvement of the Safety Coordination, already at the conception stage; they should also be consulted if there are major modifications to be carried out. The feed-back of last year is quite positive and the number of requests for joint inspections has gone up.

A question was raised about the capacity to respond to all demand on the entire site with only 4 safety coordinators. It is clear that it is sometime difficult to respond as fast as requested and that a 5th coordinator would greatly help to extend the service CERN wide.

RADIATION RISKS DURING LHC OPERATION AND REQUIREMENTS FOR MAINTENANCE AND REPAIRS

The release of radioactivity by air or water into the environment will become a growing concern. Doris Forkel-Wirth recalled that CERN committed to limit its release to insure an ambient dose equivalent to the public < 10 μSv/y: the present situation appears acceptable for the 2010 run, but it must be confirmed by measurements. She insisted on the separation between the tunnel and all other underground areas that must be completed when the luminosity and/or the energy will increase. Monitoring must be improved: two additional stations to measure the release of radioactivity by air into the environment need to be installed during the next shut-down in Pt4 and Pt6; Cooling water and infiltration water will get activated and regular sampling campaigns will be organized by RP.

The work conditions in the tunnel and the repair of machine elements will have to comply with radio-protection measures as:

- Only radiation workers are allowed to access the LHC and/or to work on radioactive equipment;
- Any destructive work (machining, cutting, drilling, etc.) on beam line components and tunnel infrastructure will require a risk assessment by DGS-RP: Grinder and similar "dirty" devices are not permitted;
- Maintenance and repair work in areas like collimator regions, inner triplets, TAN, TAS or beam dump areas will become subject to CERN's formal approach to job and dose planning (ALARA): a Dossier d'Intervention en Milieu Radioactif (DIMR) will systematically need to be prepared;
- All material that had been in the LHC tunnel or in the operational zone of the experiments during beam operation and that will leave the LHC needs to be controlled by DGS-RP. LHC Material traceability must be improved;
- All radioactive material needs to be maintained or repaired in appropriate workshops. There are few workshops available and they will probably not allow to absorb the work load: compensatory measures are very costly in man-power, time and budget for all parties involved;

There was a question about the status of CERN installations versus INB regulation and changes expected when the tripartite agreement with Swiss and French authorities enter into force. CERN is only assimilated to an INB facility and we can develop our own rules tailored to our need, the only restriction is that they must correspond to good practice and as such acknowledged by Swiss and French authorities. The tripartite agreement will avoid duplication of inspections. It is now at the government's level for approval: under this agreement, none of the host state has the authority to shutdown CERN installation and it becomes possible to transport nuclear waste across the borders.

LHC VENTILATION SYSTEM

Mauro Nonis reviewed the requirements of the HVAC system concerning confinement, filtering and smoke extraction. The safety standard for Nuclear Facilities is ISO17873 and most of its guidelines are fulfilled. The LHC ventilation system does not fully comply with ISO17873since it is not on the secured network and some functions are not ensured during abnormal or accidental situations: this is not a safety issues in our case since underground access is forbidden when the machine is in operation. The situation is different for the experimental

areas at Points 1 and 5 where the ventilation system is on a secured powering system.

The ventilation flux in the different sectors is within the 0.5-1.5 m/s range, pressure differences between the various underground premises at Points 1 and 5 are within the tolerances fixed to limit any uncontrolled release of radioactivity to the environment. Still, the overpressures at Points 2 and 8 are not stable and the work foreseen for the next shutdown should improve this situation: it concerns the tight separation of the different ventilation sector and the installation of additional sensors to monitor the air conditions and the overpressures.

Mauro also recalled that a vast consolidation program has been approved for the cooling and ventilation facilities, covering the years 2010-2017.

A question addressed the requirement for positive pressure difference between US85 and the LHCb cavern UX85: the reason is that UX85 sees the beam and US85 does not, hence the air, if any, should flow from the US to the UX.

MAIN MESSAGES

- The sealing of the LHC tunnel toward the service galleries to insure radiation, fire and ODH protection is a priority for the next shut down;
- Risk analysis and safety assessments of the cryogenic system, the ventilation , the safe areas should be systematically reviewed with regard to the latest experiences;
- The hand-over of safety responsibility between BE and EN departments at the beginning/end of a shutdown is a new exercise, some open questions still need to be clarified;
- The Safety Coordination can and should be involved from the conception stage of new equipment;
- RP considerations will modify the working conditions: need to monitor, to organize interventions according to ALARA, to trace material coming from the LHC tunnel and to maintain/repair all equipment in dedicated workshops;
- Additional monitors to control the air speed, temperature and pressure, together with differential pressure sensors, will be installed during the next shut-down;
- A consolidation program for the cooling and ventilation facilities is on-going, how far to go in an approach to fully comply with the ISO178773 referential must be assessed.