



**ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

Technical Inspection and Safety Division

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**THE GENERAL SAFETY GROUP
ANNUAL REPORT 2001/2002**

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CERN

Abstract

This report summarizes the main activities of the General Safety (GS) Group of the Technical Inspection and Safety Division during 2001 and 2002, and the results obtained. The different topics in which the group is active are covered: general safety inspections and ergonomics, electrical, chemical and gas safety, chemical pollution containment and control, industrial hygiene, the safety of civil engineering works and outside contractors, fire prevention and the safety aspects of the LHC experiments.

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1. Introduction

This report summarizes the main activities of the General Safety (GS) Group of the Technical Inspection and Safety Division during 2001 and 2002, and the results obtained. The different topics in which the group is active are covered: general safety inspections and ergonomics, electrical, chemical and gas safety, chemical pollution containment and control, industrial hygiene, the safety of civil engineering works and outside contractors, fire prevention and the safety aspects of the LHC experiments. The organizational structure of the TIS-GS Group is reproduced in Annex 1.

2. Safety Inspection and Ergonomics Section

The main goal of the section during the reporting period was a more rigorous follow-up of safety reports and a more intense involvement of the personnel responsible for safety in the divisions (DSO, TSO). One objective was, for example, requesting that the remarks in the periodic inspection reports be answered with regard to completion and deadlines as stipulated by the CERN Safety Instruction IS4^a. Actions were undertaken through the DSOC to improve the follow up of these remarks. The enquiry reports were also followed up in a more systematic way by checking after some time whether the recommendations made had indeed been implemented. Information on accidents was also used to check the rapid and correct implementation of safety measures, as well as to define prevention campaigns. From 2003 onwards, the section also checks Safety in the vicinity of buildings, including the parking lots, and appointed a person for the Safety of roads.

The number of annual inspections of buildings consolidated at about 800, a value comparable to previous years despite the transformation of many premises into worksites. Several audits were conducted in collaboration with outside experts (climbing wall, kindergarten). Reception tests on new installations were performed, the major ones being the ventilation system of the SPS tunnel and new surface buildings for the LHC project.

The noise measuring activities related to the LHC worksites concentrated on the protection of the neighbouring houses by installing acoustic walls near these sites^b, as well as installing a fixed monitoring system at the most critical points^c. A new Collaboration with EDF^d started to evaluate a software package (TYMPAN) for simulating the impact on the environment of noise emerging from a predefined source.

Further, ergonomics issues due to noise concentrated on the protection of workers and workplace analyses in collaboration with the Medical Service. Exposed persons were followed up more closely by means of personal dosimeters.

Computational cryogenic fluid dynamics studies were concluded, based on a three-dimensional model of the LHC tunnel including equipment, such as cryo-modules and cryogenic transfer lines. The concentration of oxygen in space and time after an accidental

^a CERN Safety Instructions (IS) and CERN Safety Notes (NS) cited in this report are listed at the end. They are available from the TIS WEB pages: <http://tis.cern.ch/>.

^b Point 1: a battlement and the SX building attenuate the noise stemming from the discharge of the rubble; Point 5: battlement and acoustic wall; CNGS: battlement and acoustic wall as well as acoustic building specifically constructed to attenuate the noise stemming from the discharge of the rubble

^c Point 5 and CNGS worksites

^d EDF: Electricité de France

spill of liquid helium was determined by simulation and the results were validated by experimental data. Recommendations concerning the evacuation after such an event were issued [1].

The consequences for the Safety of personnel of a break of the CNGS decay tube window were assessed [2].

To facilitate access to Safety documents, the latest versions were made accessible on the WEB and stored in the CERN Engineering and Document Management System (EDMS). The Group and Divisional WEB pages were likewise revised and updated.

The drafting of a Cryogenic Safety Code was started by a subgroup of the CSOC^e.

3. Fire Prevention Section

The main activities were the reception of new or modified installations of fire detection (57 reports were issued).

In addition, the section focused on the LHC, buildings with specific risks occupied by a large number of persons, and on fire protection engineering.

Fire detection and fire fighting methods for the LHC underground works were analysed in collaboration with ST Division, and water supply connections were defined. Foam extinguishing systems were specified in collaboration with ATLAS and CMS.

Advice on fire safety matters was provided concerning access and evacuation (ATLAS muon chambers, UX15 cavern). Requirements on the design of escape routes and construction criteria were issued [3]. Recommendations for safety during the installation phase of ATLAS were formulated in a dedicated Working Group.

Fire test were organized in collaboration with SL Division, where sandwich panel materials compliant with CERN safety regulations were studied in a real fire [4]. Based on these tests construction criteria for sandwich panels were issued and a Safety Note is in preparation (NS29).

An exercise with the Accident Rapid Reaction Team (ARRT) took place at the most distant access points 5 and 6 of the LHC. An evacuation exercise was attended for the computer centre building.

Typical industrial fire prevention issues were studied, such as how to extinguish fires in electronic racks by water mist or how to detect electrically overheated cables. Tests of a real fire in an electronic rack were performed with one of the world's leading companies in this field [5]. Fire modelling programs are used for simulating fires and their consequences. Cable bundle fire protection was studied both theoretically [6] and practically. Fire simulation with Fire Dynamics Simulation software [7] was applied for CNGS.

A campaign was finished to install the mandatory evacuation panels in the buildings open to the general public and other buildings with specific risks.

^e CSOC: Cryogenic Safety Officers Committee

An informatics version of the Fire Permit was developed in collaboration with AS Division and is now being tested on CERN's EDH system.

The Safety Note on fire prevention measures in experimental barracks (NS3) was revised, and a new Safety Note stipulating safety rules to be observed for exhibitions was issued (NS28).

4. Gas and Chemistry Section

The section assured the reception, conditioning, storage and elimination of hazardous chemical waste, in particular waste collected during the dismantling of LEP (Halon fire extinguishers), and miscellaneous asbestos waste. A total amount of special waste of 280 tons were removed in 2001 (Annex 2) and 230 tons in 2002 (Annex 3).

CERN finished the disposal of all its devices containing polychlorinated biphenyls (PCB), thus bringing to an end a campaign that started in 1988.

Asbestos, which was routinely used for heat insulation purposes several decades ago, reappeared during repair work. This continued to demand efficient efforts in work hygiene and control measures in order to protect the workers. Expert advice regarding asbestos involved the drafting of intervention procedures, arranging for the analysis of samples and air sampling measurements. The CERN Safety Instruction IS 43 is being revised. ST Division made a database available for safety experts listing the known asbestos inventory at CERN.

Other activities were the measures to comply with the regulations concerning major accidents (OPAM), and technical work linked to new materials. The section organized different hazard and risk analysis studies, e.g. a HAZOP study for mercury in a magnetic field experiment for ISOLDE [8], and risk assessment studies for use of chemicals in line with the European "Chemical Agents Directive" 98/24/EC.

The section participated in the drafting of a new CERN Safety Instruction IS49, in collaboration with the environmental section of the Technical Services and Environment (TE) group.

The number of experts dealing with the transport of chemicals by air and by road (Dangerous Goods Safety Advisor) was increased.

The section continued to run safety courses for supervisors and other persons required to enter into confined spaces as well as for persons using gases and chemicals.

The combustion tests to check the compliance with CERN's Safety Instruction IS41 of the emerging halogen-free Printed Circuit Boards (PCBs) were completed by electrical tests [9], the results of which corroborated those obtained previously for new materials, not inferior compared to the conventional ones [10].

5. Civil Engineering and Contractors Section

The section continued with inspections of the various worksites linked to the construction of the LHC. Special projects concerned the definition of safety measures for the dismantling of LEP in close collaboration with SL Division, the renovation of the system of industrial water supply for whole CERN, and assistance to the Divisions in the implementation of safety coordinators for “category two” works [11].

The safety coordinators for the LHC project installation were administratively attached to the section and helped the CERN project engineers to fulfil their safety duties. The same contract was used to provide the financial basis for a safety coordinator for “category one” works for the installation of the CNGS project, as well as the safety coordinator for ST and SL, “category two” works [11].

The section assisted the divisions concerned in their proper duties, not yet fully implemented, such as joint inspections and the establishment of risk prevention plans, thus assuring the implementation of CERN’s safety rules for contractors.

In addition, as far as the routine work is concerned, 620 incoming “Notice of Start of Works” forms were analysed, and, depending on a risk evaluation, inspected in common with the Host States’ work inspectors. A total number of 4 sessions of the CSHS^f Committee were held in the two-year’s period of reporting.

The section defined, in collaboration with ATLAS, safety rules for workers provided by the collaboration [12].

An inter-divisional working group (ST and TIS) compared the regulations on safety coordination in force in France and Switzerland with those adopted for CERN [12].

6. Electrical Safety Section

The section continued receptions and periodical inspections of more than 200 electrical installations. One example was the reception of the electrical power supply for the cooling and ventilation installation of the SPS. High Voltage (HV) installations underwent initial or periodical checks as requested by the CERN Safety rules and were covered to almost 100%, with a small remainder postponed because of scheduling problems. New Low Voltage (LV) installations were checked prior to coming into operation; a recommendation was made for a systematic check of all existing ones (presumed to be several 1000). Whenever it was judged necessary, e.g. after an incident or accident occurred, LV installations were point checked [13].

In the framework of the LHC project, the Section contributed to the definition of protection measures of super-conducting coils against technical incidents including quenches, access conditions to the underground areas, level 3 alarm installations and avoidance of false alarms.

An important part of the activity is now dedicated to electromagnetic compatibility (EMC): a Faraday cage was installed in a small EMC Laboratory and serves for emission/immunity tests of special equipment, such as alarm equipment. A service contract was launched to assess EMC compliance for specific CERN installations, and to propose

^f CSHS : Comité Spécial de l’Hygiène et Sécurité

modifications where deemed necessary. Two dedicated training courses on EMC measurement techniques were held in collaboration with Human Resources (HR) Division, technical training. The section also participated in assuring EMC compliance of the laser ion source, one of the options for the LHC [14].

Another activity was the protection of workers against non-ionising radiation. A study was launched to place sensors for electromagnetic radiation close to well-identified sources, e.g. compensators, supposed to trigger an automatic alarm whenever a predefined threshold is exceeded [15].

Safety documents were newly drafted or revised, also in view of the French INB^g regulations. They deal with procedures for the dismantling of electrical power cables (NS24), safety rules for access to the LHC [16], on earthening metallic structures [17], on rules for installing emergency stops [18] and safety alarm systems. To this end, the Section harmonized CERN's Safety Instruction IS37 with industrial standards that are followed by CERN's CSAM^h project. A computer-assisted procedure of disabling CERN's safety alarms system (so-called Level 3 Alarm) was implemented in order to reduce even further the number of unjustified alarms by providing to the users an easy procedure.

The section contributed to the first phase of a Safety Audit for the LHC magnet test benches in SM 18 [19].

Electrical safety training, in collaboration with professional teachers and HR Division, provided more than 100 "habilitations". A training visit to a high voltage and high current test site was organised for 60 professionals in electricity, for improving risk awareness in high power installationsⁱ.

7. Safety for the LHC experiments

Safety for the LHC experiments continued to be treated in periodical and dedicated meetings. In 2001 and 2002, 28 sessions were held of the working group dealing with "Safety Coordination inside TIS for LHC Experiments". The working group comprised specialists from TIS, a link-person from EST Division, and the GLIMOSes of the four LHC experiments or their representatives. It prepared recommendations, decisions, derogations and reports on safety issues of LHC experiments, which are all summed up in minutes^j. These meetings aimed at a uniform approach to Safety within all LHC experiments during their design and conception. As the LHC project entered into the installation phase, these meetings came to an end in 2002, and shall be resumed in a modified way in 2003. Concerning ATLAS, the group assisted in the FAGIA (Fire And Gas Inside ATLAS) Working Group. Concerning CMS, it participated in various Engineering Design reviews:

Gas Systems (12 – 13 March 2001),
Hadron Calorimeter (2 – 3 Aug. 2001),
Cryogenic and Vacuum System of the CMS Solenoid (11 – 12 Oct. 2001),

^g INB : Installation Nucléaire de Base

^h CSAM: CERN Safety Alarm Monitoring

ⁱ Test Centre in Preverenges (VD), http://www.cef.ch/Home/Home_d.html

^j <http://tis-gs.cern.ch/>

Magnet Control and Safety systems (6 – 7 Feb 2002),
 Muon Alignment (28 Feb. – 1 March 2002),
 Electromagnetic Calorimeter (3 – 4 Sep. 2002),
 Muon Integration YE1 (9 – 10 Dec. 2002)
 Further, access and Safety procedures for CMS were defined [20].

As far as ALICE is concerned, the transition radiation detector was studied, and for LHCb, the vertex locator outer tracker detector. Reviews were held on the installation of CMS and ATLAS [21].

A Safety Hearing was organized for those LHC experiments with a larger participation of American collaborators [22], such as CMS and ATLAS. CERN's Safety policy and procedures were made known to representatives of the American DOE^k.

8. Safety training, Safety campaigns, and follow up of major accidents

The objectives and criteria underlying safety training were redefined by a dedicated working group, presented to CERN's Joint Training Board, and implemented. Safety training for newcomers at CERN was re-organized and the number of trainers was increased. The new proposed Safety training programme mainly concerned induction courses for newcomers, safety officers courses (e.g. TSOs), and specific risks for non-experts (Annex 4).

Safety campaigns based on the principal causes of previous accidents were launched in several publication media (Safety panels of the divisions, WEB pages, Weekly Bulletin). These concerned subjects such as Safety Inspections and Road Safety.

The group also participated in the Fact Finding concerning the magnet that fell in PM45, the fire in BA6, and the cable tray that fell down during dismantling in the LHC shaft PM85, and assured the follow up of requests by the Accident Board. The group terminated the recommendations issued after previous fact finding procedures (oil spill point 4, fire in ventilation system in BA6).

Several Safety Bulletins were issued after accidents of general interest for CERN's personnel (free egress ways, glass doors, pressurized bottles, preparation of working procedures).

The accident statistics (for CERN staff) are published in the following table, which describes declared accidents entailing at least 1 day's absence of work. Severity rate is still decreasing (referred to lost days) but on the other hand road accidents are increasing, the number of accidents being multiplied by 2 (8 in 2001 and 16 in 2002). The more detailed reports on accidents happened upon in 2001 and 2002 are published separately [23, 24].

^k DOE: Department of Energy

**Statistics (CERN staff only) for professional accidents in 2002
(2001 in parentheses)**

Total declared accidents^{a)}	Number	Lost days
(i) Accidents in total	24 (23)	206 (515)
(ii) Road accidents on the journey to or from CERN ^{b)}	10 (7)	80.5 (246)
Road accidents within CERN or between CERN sites	6 (1)	49 (35)
a) Accidents entailing at least one day's absence from work		
b) ii) are included in i)		

9. Contacts with outside groups

Contacts with outside groups were intensified by the participation in the High Energy Physics Laboratories Technical Safety Forum that took place in Fermilab (USA). Contributions made by the group dealt with reliability issues in safety alarm systems [25], cooling fluids, extinguishing agents with regard to the environment [26] and fire protection of large underground facilities for experimental particle physics [27].

A visit took place to the nuclear reactor building of EDF's power plant in Bugey (France).

A team of external auditors looked more closely into the groups' activities and made recommendations concerning the application of the CERN Safety Instruction IS4 regarding the periodicity of safety inspections of buildings as well as concerning evacuation panels in buildings with public access.

10. REFERENCES

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11. CERN Safety Instructions (IS) and Safety Notes (NS) mentioned

- IS4: Safety Inspections
- IS37: Alarmes et Systèmes d'alarme de Sécurité dite de « Niveau 3 » (Rev. 3 in preparation)
- IS43: Asbestos - Dangers and Precautions (Rev. 2 in preparation)
- IS41: The use of Plastic and other Non-Metallic Materials at CERN with respect to Fire Safety and Radiation Resistance
- IS49: Avoiding Chemical Pollution of Water
- NS 3: Fire Prevention for enclosed spaces in large halls
- NS24: Removing unburied ELV and LVA electric conduits
- NS28: CERN Exhibitions Fire Precautions
- NS29: Fire Prevention for Insulating Core (Sandwich) Panel Structures for Inside Use (in preparation)

Annex 1

General Safety and Hygiene Group TIS-GS as from 1/1/2002

Name	Function
W. Weingarten C.W. Nuttall D. Weber A. Kerhoas C. Negri	Group Leader LHC Experiments Safety Linkman Safety techniques and safety technologies Risk Management and safety audits Safety Training and Accident prevention Group Secretary
J. Gulley O. Prouteau ¹ R. Magnier F. Lefebvre ^m	Chemistry, Gas & Industrial Hygiene Section Leader (GS-GC) Risk analysis, Chemical installations & inspections Confined spaces, Industrial Hygiene Chemical installations & inspections Waste collection
F. Szoncso D. Boudikian ⁿ A. Chouvelon G. Salomon J. Svantesson ^o R. Dessens ^p	Electrical Safety & Inspections Section Leader (GS-ES), Deputy Group Leader, Adjoint LHC Experiment Safety Linkman EMC Monitoring Electrical inspections low power installations, Level 3 alarm/safety systems, EMC, INB visits Inspections electrical power installations & distribution, electric accidents Electrical tests of materials, EMC monitoring Electrical inspections
M. Vadon J. Manteca-Menendez ^o T. Taffonneau ⁿ P. Beynel J.C. Carlier B. Pichler A.P. Bernardes	Safety inspections & Ergonomics Section Leader (GS-SI) Cooling, ventilation and cryogenics; Inspection reports; EDMS and informatics contact person Computational fluid dynamics calculations Safety Audit SM18 Inspections SL & ergonomics, inventory TIS-GS Inspections EP and experiments (except PS complex), TH Inspections IT, TIS, EST, experiments EP (PS complex) Inspections AS,FI,HR,SPL,DG/DSU,LHC, ETT, Ergonomics, Documentation
F. Corsanego R. Cambarrat	Fire Prevention Section Leader (GS-PI) Underground buildings LHC Fire prevention inspections, Surface buildings HC
M. Danesin C. Pividori J.Weber ^q E.Paulat ^q J.Etheridge ^q	Civil Engineering & Contractors Section Leader (GS-CE) Civil engineering and Safety Coordination Inspections ST, Contractors, Documentation Safety Coordinators for the installation LHC machine and experiments

¹ As from 1.2.2002

^m Prestation de service

ⁿ Coopérant

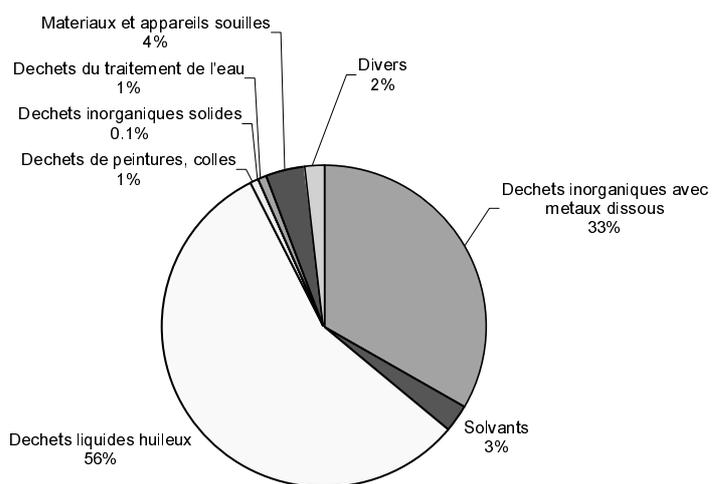
^o Technical Student

^p Contract AIF

^q Contract APAVE/GTD

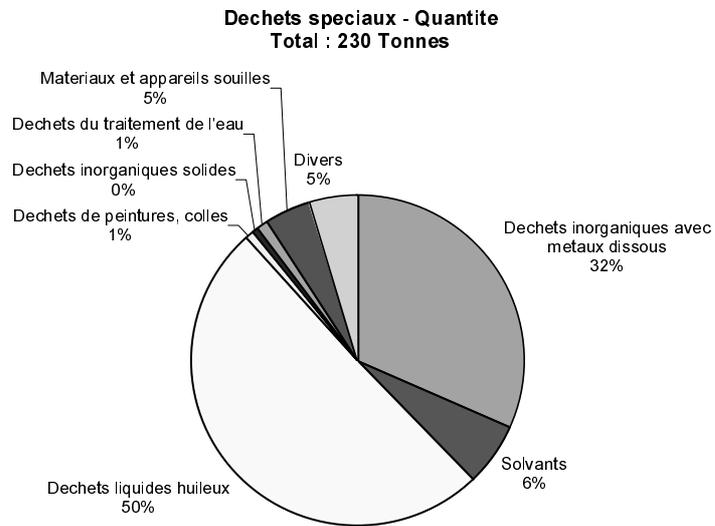
Annex 2

Dechets speciaux - Quantites expediees en 2001
Total : 280 T



■ Dechets inorganiques avec metaux dissous	■ Solvants	□ Dechets liquides huileux
□ Dechets de peintures, colles	■ Dechets inorganiques solides	■ Dechets du traitement de l'eau
■ Materiaux et appareils souilles	□ Divers	

Annex 3



■ Dechets inorganiques avec metaux dissous	■ Solvants	□ Dechets liquides huileux
□ Dechets de peintures, colles	■ Dechets inorganiques solides	■ Dechets du traitement de l'eau
■ Materiaux et appareils souilles	□ Divers	

ANNEX 4

Category of courses	Safety aspects	Title of course	Target	Aim & objectives	Status
Basic safety	New-comers	Part I - Basic safety course	All new comers	Provide new comers with general safety rules at CERN, existing risks and the way to protect against them	Completed
		Part II - Specific risks	All new comers who have a technical function	Inform new comers on CERN specific risks and the way to protect against them	Completed
		Part III - safety in tunnels	All new comers who need to work in tunnels	Inform new comers on CERN specific risks in tunnels and the way to protect against them	Completed
	First aid	First Aiders : Basic Course	Any member of personnel who wishes to become a first aider	Participants will learn, in a practical way, how to deal with life-threatening emergencies and other accidents.	Completed
		First Aiders : Refresher	Any member of personnel who has already attended a First Aider course in the three preceeding years	Participants will review and update, in a practical way, their skills in dealing with life-threatening emergencies and other accidents	Completed
Safety officers	Safety officers	Etre TSO au CERN	All safety officers (full or partial course)	Inform safety officers of their responsibilities' perimeter and provide them with methods to prevent risks .	Completed
		Introduction to radiation risks	All RSO	Inform RSO on the following aspects : * radiation legislation * radiation risks and the way to prevent them	To be defined
		Explosion Hazards in the handling of flammable solvents and gases	All FGSO	Inform FGSO on the following aspects : * Flammable gas risks and the way to prevent them * Hazardous Area Classification methodology * Examples of incidents	Completed
		Introduction to cryogenics risks	All CSO	Inform CSO on the following aspects : * cryogenics risks and the way to prevent them	To be defined
Work conditions	Noise	Bruit - Connaitre les risques liés au bruit	Any member of personnel and the supervisors of members of personnel who are exposed to noise levels in excess of 85dBA	* Provide information on noise risks and how to prevent against them * Presentation of protection means	Completed
	Display screen	Ergonomie - Sensibilisation à l'ergonomie bureautique	Computer's and other keyboard's users who type 4 hours or more per day	Provide information on possible injuries and ill health associated with the use of DSE and on how to work safely when using DSE	Completed
	Manual handling	Manual handling and safety	Any member of personnel who is required to lift more than 55kg or who move furniture, equipment.	Provide information on the anatomy of the back and proper lifting techniques	On work

ANNEX 4 (ctd.)

Category of courses	Safety aspects	Title of course	Target	Aim & objectives	Status
Radiation protection	Risk prevention in controlled areas	Radiations and regular users	CERN staff and regular users	Provide information on : *Regulatory framework *Principles of RP (optimisation, limitation... *Operational protection	On work
		Radiations and occasional users	Occasional users	Provide information addressed to specific needs of researchers, engineers...on radiation protection	On work
		Radiations and contractors	Contractors supervisors	Provide information on specific aspects of CERN related to radiation protection.	On work
Electrical safety	Electricity	Electricity and its hazards	Any member of personnel working with electricity	Provide information on electrical hazards and the way to protect against them	Completed
Chemistry and flammable gas	Chemicals	Chemical safety - Introduction	Any member of personnel who produces or uses hazardous substances	Provide information on hazards due to exposition and the way to protect against them.	Completed
	Gas	Flammable gas - Introduction	Any member of personnel who needs to work with hazards of gas at CERN	Provide information on : * CERN Regulations * Theory of flammability with demonstrations * System and components of simple gas installations (workshop)	Completed
	Confined spaces	Espaces confinés - Superviseurs	Any member of personnel responsible for confined spaces and for work involving the entry into confined spaces	Provide information on : * Regulations * Confined spaces hazards * The correct behaviour to have and particularly use of breathing apparatus	Completed
		Espaces confinés - Intervenants	Any member of personnel entering into confined spaces	Provide information on : * Regulations * Confined spaces hazards * The correct behaviour to have and particularly use of breathing apparatus	Completed
	Emergency	Plan d'intervention	Member of personnel working on emergency plan	At the end of the course, participants are able to update on line, the emergency plans for OPAM	Completed
Cryogenics	Cryogenics	Safety in cryogenics - Level 1	Any person working in cryogenic environment and who is not expert in cryogenics. This course will give access to SM18.	At the end of the course, participants should be able to identify existing risks in their work area, applying safety measures to minimize risks and react efficiently in case of malfunctioning.	Completed
		Safety in cryogenics - Level 2	Any members of personnel who works in an area with cryogenics facilities	Provide information on : * Cryogenics principles * Cryogenics hazards * Practical situations	Completed

ANNEX 4 (ctd.)

Category of courses	Safety aspects	Title of course	Target	Aim & objectives	Status
Mechanical safety	Hazardous machinery	To be defined	To be defined	To be defined	To be defined
	Handling and lifting	Sensibilisation à la sécurité levage	Any person who needs to use a crane < 20t.	Provide information on : *CERN rules related to lifting equipment *Hazards on crane's handling *Practical use of cranes	Completed
		Conduite de chariots élévateurs	Any person who needs to drive a frontal forklift	Provide information on : *CERN rules related to lifting equipment *Hazards on forklift driving *Practical drive of forklift	Completed
		Conduite de PEMP	Any person who needs to drive a PEMP (Plateformes élévatrices mobiles de personnel)	Provide information on : *CERN rules related to lifting equipment *Hazards on PEMP driving *Practical drive of PEMP	Completed
Laser	Laser	Laser basic safety	To be defined	To be defined	To be defined

Completed : the course exists and has already been given

On work : the course will be soon available

To be defined : a discussion is needed with the expert to define aim and content of the course