PART V

NON-ROUTINE ACTIVITIES IN RP GROUP IN 1998

M. Höfert, D. Forkel-Wirth, T. Otto, M. Silari and G.R. Stevenson

This chapter describes activities not directly concerned with the daily routine. These activities are nevertheless an important part of the Group's work as they encompass new projects and developments that require, in most cases, profound studies to prove their feasibility with respect to the radiation protection issues involved. In addition, there are technical and organizational developments in a quest not only to keep the standard of radiation protection at CERN high, but to ensure its constant improvement. All these activities are documented in Divisional Reports, Internal Reports and Technical Memoranda, and are listed in the tables of this chapter.

1 LHC

1.1 Shielding verification

The radiation situation around the ALICE experiment was studied in detail, both from the shielding and the induced radioactivity aspect (IR 98–10 and EST/98–03(LEA)). A comparison was undertaken of the radiological importance of running the LHC with different ion species (IR/98–30). Shielding proposals for the LHC-B experiment associated with their Technical Proposal were completed.

The shielding situation of the UJ56 cavern and the PM18 shaft were considered in detail (IR 98–02, 98–14 and 98–21). Improvements in the construction were recommended. A considerable effort was spent in influencing the design of the very-forward regions of the high-luminosity LHC experiments (IR 98-01). This included participation in the LBL-sponsored design for the TAS collimator in front of the low-beta quadrupoles and the TAN neutral beam-dump between the recombination dipoles.

1.2 Beam dumps

A complete update was undertaken of the 1992 study on the radiological situation in and around the LHC dump caverns (IR 98–27). Only minor changes were necessary.

1.3 Installation working groups

Planning for future operation of the LHC continued with the completion of the initial plans for access control and interlocks for the LHC underground areas. An important aspect is the generalized acceptance for an automated personalized operational-dosimetry system for all accesses to the machine and experimental zones.

The first stage of planning for the future installation of all radiation monitors that will have to be installed in LHC areas was completed. These studies form part of Chapter VI of the preliminary INB Report.

2 OTHER ACTIVITIES

2.1 Long base line neutrino experiment

Initial Studies for assessing the radiological implications and the environmental impact of the target station, decay tunnel, and hadron stopper areas associated with the CERN/INFN project to supply neutrinos to the Gran Sasso detectors (IR 98–13) were completed. During these studies, experimental and theoretical work on the production of radioisotopes in the molasse rock were undertaken.

In November G. R. Stevenson was invited to participate in the DOE Baseline Review of the Fermilab NuMI project, a neutrino experimental facility similar to the one proposed at CERN.

2.2 Muon collider neutrino radiation

In the framework of a prospective study, encouraged by ECFA (the European Committee for Future Accelerators), on the physics opportunities and accelerator issues presented by future $\mu^+\mu^-$ colliders, an assessment was made of the radiological hazard posed by the neutrino radiation generated by decays of muons circulating in a future high-energy collider. Values of off-site annual dose equivalents caused by the neutrino radiation in equilibrium with its secondaries were calculated for muon energies from 1 to 10 TeV and for the various depths at which the accelerator may be installed. A first evaluation was given of the countermeasures to be adopted to limit the radiation dose in case the centre-of-mass energy exceeds 3 or 4 TeV.

2.3 Photon background in CERF

In a common effort with members of the ATLAS collaboration (a research associate and two PhD-students), a first attempt was made to measure the total flux and the energy spectrum of photons behind the various shielding configurations of the CERF facility and to compare them with FLUKA simulations. These spectra, which extend typically to an energy of 10 MeV, bear a resemblance to those expected in the ATLAS muon spectrometer. Hence, CERF can be seen as a benchmark for FLUKA in this respect. A better knowledge of the photon component of the radiation fields will also be useful for CERN users when they interpret their measurements. A BGO scintillation detector and a set of TLDs in various absorbers were used during the experiments. The instrumentation was characterised and calibrated with various sources in order to determine precisely the response function of the instruments and to deconvolute the experimental spectra. Further runs are planned.

2.4 Neutron yield measurements

Preliminary measurements were made on the neutron yield from leads ions with an energy of 170 GeV per nucleon incident on lead. These will be compared with yields from proton-lead and pion–lead collisions at the same energy.

2.5 Radon measurements at ISOLDE

In order to improve the survey of the gaseous radioactivity at ISOLDE, two commercially available instruments for Rn measurements were tested: the Radon-Thoron monitor system RTM 2010 produced by Sarad GmbH (Germany), and the Radon gas monitor ATMOS 12 DPX provided by Gammadata (Sweden).

The Sarad instrument is easy to handle but suffers from an overestimation of the Rn concentration. The ATMOS is most probably one of the best devices for Rn measurements, but it will have to be modified with respect to the particular needs of ISOLDE.

2.6 Blood-counter

The medical service at CERN is equipped with a so-called blood counter designed for a fast determination of the dose a person has received by an accidental irradiation in the radiation fields of particle beams. The dose is deduced from the concentration of ^{24}Na in the blood, measured by a specially designed plastic scintillator.

In an effort to modernize and to facilitate the blood counting system at CERN, a commercially available, easily to handle device called TRIATHLER (HIDEX Oy, Finland) was tested. This device provides three different spectroscopy techniques: gamma-spectroscopy (NaJ) as well as liquid and solid scintillation counting. The detection of ^{24}Na was performed in the solid scintillation mode. The tests showed that the sensitivity of the TRIATHLER is about 20 times worse than the obsolete system actually in use. Therefore, a new approach in 1999 will use a 5"NaI detector to detect the 1369 keV gamma line of ^{24}Na.

2.7 The Radiation Protection Procedures (PRP)

The issuing of new, and the updating of old, Radiation Protection Procedures continued in 1998. These documents are now considered to be an important step towards a quality assurance system for RP that will cover all the various activities of the Group. In fact, the Individual Dosimetry Service established a quality manual describing the various activities of the Section. This was submitted to the Swiss authorities as part of the requirements for the renewal of the authorization to perform personal dosimetry. The total number of PRPs at

present is 44 some of which are still in draft form, and others in their old format awaiting an update.

PRP	Title	Issued
0c	Liste des procédures de radioprotection List of Radiation Protection Procedures	25.07.98
1a	La signalisation des zones de travail	6.11.97
2a	Les responsabilités d'un technicien affecté aux sections de surveillance	11.11.97
3b	Enregistrement à la section dosimétrie individuelle du Groupe Radioprotection	30.07.98
4a	Dosimétrie individuelle	25.11.97
5a	Sources et matériaux radioactifs	15.01.98
6a	Service de piquet radioprotection	26.01.98
7a	Matériel de récupération	9.12.97
8a	Consignes relatives aux contrôles radioactifs des poubelles du CERN	14.07.98
9a	Mesures d'urgence en cas d'accident ou d'incendie comportant une possible exposition externe ou une contamination importante	24.11.97
10a	Le système d'acquisition des données ARCON	14.06.98
11a	Visiteurs dans les zones contrôlées du CERN	7.01.98
12a	Dispositions à prendre en cas d'alarme sur les moniteurs de rayonnements ionisants placés aux sorties du CERN	10.11.97
13a	Directives concernant les demandes d'expéditions des matières radioactives	20.02.98
14a	Radiation safety instructions for LEP / Instructions de sécurité concernant les rayonnements ionisants dans le LEP	8.12.97
15a	Travaux dans les anneaux PS/PSB et les lignes des faisceaux éjectés pendant l'arrêt des machines du complexe PS	1.02.98
16a	Access to the ISOLDE target area	27.01.98
17b	Radiation safety rules for material irradiations at CERN	1.12.98
18a	Consignes à suivre pour tout accès à la cave neutrino	19.11.97

PRP	Title	Issued
19a	Consignes pour le changement des filtres dans les stations des accélérateurs et des zones radioactives	1.02.98
20a	Radiation Safety for ISOLDE Experiments	25.01.98
21a	Le dosimètre électronique DMC 100/The Electronic Dosimeter DMC 100	28.01.98
22a	Utilisation du générateur mobile de rayons X Seifert-Isovolt AS 3 pour radioscopies de type industriel dans les tunnels des accélérateurs	12.06.98
23a	L'utilisation du PCMA (Picomur)	20.10.98
24b	Personnes autorisées à signer les fiches de transfert jaunes	6.07.98
25a	Periodic Calibration of Radiation Protection Instruments	27.07.98
26a	Radioactive Sources in the Calibration Laboratory	To be drafted
27a	Calibration Instructions for Radiation Protection Instruments	To be drafted
28a	Règles à observer pour le contrôle des pièces radioactives/ Rules to be followed for the check of radioactive material	17.07.98
29a	Transport des matériaux entre les différents sites/ Transport of radioactive material between the various sites	15.06.98
30a	Règles pour la radiographie industrielle/ Rules for industriel radiography	15.06.98
31a	Working rules for the medical X-ray equipment	12.06.98
32a	Working rules for the industrial radiographic equipment	Old version
33a	Working rules for radioactive waste storage	Old version
34a	Working rules for the RP « hot » laboratory	Old version
35a	Emergency procedure in case of fire for the radiation areas of TIS Division	Old version
36a	L'exploitation de l'irradiateur au bâtiment 14-5.004	Old version
37a	L'atelier radioactif du bâtiment 109	Old version

PRP	Title	Issued
38a	Nettoyage des pièces radioactives	Old version
39a	Instructions pour intervention sur la station cible-collecteur d'AAC pendant le cycle de production d'antiprotons	Old version
40a	Consignes de radioprotection pour les salles de contrôle MCR, PCR, TCR	To be drafted
41a	Procédure à suivre en cas de perte d'une source radioactive	To be drafted
42a	Use of radiation protection instruments by other groups than RP	20.10.98
43a	Les sources de l'américium 241 dans l'expérience DELPHI	Old version
44a	Les sources radioactives dans l'expérience OPAL	Old version

2.8 The CERN-EC experiment

In 1998, two experimental runs took place at CERF (the CERN-EU Reference Radiation Facility) set up at the H6 beam of the North Experimental Area in Prévessin between 15–20 April and 15–22 July. As in the past two years, the beam operated at 120 GeV/*c*, positive particles. A large number of users from RP's European Collaboration participated in the experiments, but other groups from various European and US laboratories, concerned with radiation dosimetry, were also present. In all, 18 institutes were represented, including NASA, Fermilab, and the Pacific Northwest Laboratory. Various types of passive and active detectors were tested: TEPCs, GM-counters, different types of rem counters, bubble detectors, scintillator-based dose rate meters, electronic pocket dosimeters, Si-diodes, track etch detectors, TLDs, films, nuclear track detectors, recombination chambers, a Bonner sphere spectrometer, and CR39 foils. In addition to dosimetric instrumentation, the effect of radiation on computer memories was investigated, and a CERN group continued their tests on the prototype of a beam loss monitor for the LHC.

The CERN Radiation Protection group takes care of the schedule and co-ordination of among the various users, and monitors the primary beam and the neutron field. As usual, the beam was monitored by a Precision Ionization Chamber (PIC) of one litre volume, calibrated in terms of counts/incident particles, and placed in the beam just upstream of the target. The calibration factor was checkeded by inter-comparing the reading of the PIC with the response of three scintillation counters that are part of the instrumentation of the H6 beam line (TM 98–22). Some checks were also performed to verify that the reference dose equivalent values

measured with the HANDI TEPC in 1997 were still valid. An inter-comparison of the response of conventional and extended-range rem counters was also performed (TM 98–23).

3 SEMINARS AND LECTURES IN 1998

A total of thirteen seminars and lectures were given in 1998, seven by students and fellows who reported on the results of their studies performed within the RP Group, five by visitors, and one by a member of the group.

Date	Title	Lecturer
15.01	Development of a scintillator detector for use with the AD6	Stefan Metz, Technical Student
22.01	Release via air pathway at PSI: Monitoring, alarm system interpretation, registration.	Sven-Gunnar Jahn, Paul Scherrer Institut (PSI), Villigen, Switzerland
16.04	Data for use in radiation protection at high energies	Maurizio Pelliccioni, INFN Frascati, Italy
30.04	Data for use in radiation protection at high energies.The saga continued.	Graham Stevenson, RP
12.05	Caractéristiques et étalonnage des détecteurs de contamination AUTOMESS AD–K et AD–17	François Billon, Technical Student, INSTN–CEA, France
15.06	On-line measurement of radon and its daughters over five orders of magnitude	Annette Paul, PTB and Technical University of Braunschweig, Germany
25.06	Triathler, a combined alpha, beta and gamma counting device	Rudolf Rohr, stagiaire
16.07	Automatic scanning of NTA Films: An interim report.	Regina Müller, CERN Fellow
06.08	Radiation monitoring system for the accelerators in China	Beibei Shao, University of Tsinghua, Beijing, China
17.09	Le programme de dosimétrie des hautes doses dans le LEP ; résultats à 95 GeV	Valérie Coste, Technical Student
29.10	Waste Management in a National Research Laboratory	H.-F. Beer, Paul Scherrer Institut (PSI), Villigen, Switzerland
12.11	Radiological studies for the LHC beam dumps	Ian Dawson, CERN fellow
17.12	Alpha monitoring system of radon measurements	Alicia Marcos, Technical Student

4 DIVISIONAL REPORTS IN 1998

TIS-RP	Author	Date	Title
98–04	M. Höfert	10.04	Radiation Protection Group Annual Report (1997)
98–05	M. Silari, L. Ulrici	26.03	Induced activity in the tunnel walls of the CERN Super Proton Synchrotron
98–06/CF	M. Höfert, P. Vojtyla, D. Wittekind	31.03	Contrôle de l'environnement autour du CERN
98–12/CF	M. Silari, G. Stevenson	06.07	Assessment of the radiological consequences of an interlock failure in the injection line of the CERN super proton synchrotron (SPS)
98–14/CF	G. Stevenson	12.08	A focus on limiting unnecessary cascade analyses
98–15	M. Höfert	12.98	Categorization and treatment of solid material with low specific radioactivity from the high-energy accelerator environment
98–16/CF	S. Agosteo, C. Birattari, A. Foglio Para, M. Silari, L. Ulrici	31.08	Beam dumps for high-energy hadrons: from design to reality
98–18/CF	M. Höfert, J. Tuyn, D. Forkel-Wirth	09.10	The decommissioning of accelerators: an exercise in the recycling of radioactive material.
98–19/CF	W.A. Alberts, A.V. Alevra, A. Ferrari, T. Otto, U.J. Schrewe, M. Silari	12.10	Calibration problems, calibration procedures and reference fields

5 INTERNAL REPORTS AND TECHNICAL MEMORANDA 1998

Ref.	Author	Date	Title
IR–01	I. Dawson	19.01	Radiation studies in the collimator regions of the Atlas experimental area
IR–02	G. Stevenson	04.02	Studies of shielding in the UJ56 area of the LHC
TM–03	M. Höfert	10.02	STOA, but no indifference
TM–04	J. Tuyn C. Lamberet	04.02	Radioactive waste management at CERN
IR–05	J. C. Gaborit, F. Pirotte, M.Silari	27.02	Bilan 1997 des contrôles radiologiques sur le LEP
IR–06	M. Silari, L. Ulrici	03.03	Mesures rayonnement synchrotron dans le LEP à 92 GeV
TM–07	D. David, G. Grobon, J.M. Hanon, T. Otto	01.03	Etude de comparaison entre les dosimètres opérationnels et le film-badge
IR–08	S. Metz, T. Otto, D. Perrin	31.01	Development of a scintillator detector for use with the AD6
IR–09	C. Lamberet	18.03	Le démantèlement des installations nucléaires
IR–10	S. Roessler, G. Stevenson	07.04	The radiation environment at the LHC insertion point 2 (ALICE) in beam loss situations.
TM–11	G. Roubaud, M. Höfert	28.04	Compte rendu de l'Inspection des Matières Nucléaires de Base pour l'année 1998
IR–12	P. Vojtyla		Rapport trimestriel de la surveillance d'environnement au CERN
IR–13	G. Stevenson, H. Vincke	12.05	Initial estimates of radiological parameters of environmental interest for the CERN/INFN Gran-Sasso Neutrino project.
IR–14	G. Stevenson	22.05	Studies of the shielding of the PM18 pit at Point 1 of the LHC
TM–15/ Rev.	J.C. Gaborit	03.06	Modifications du contrôle des rayonnements par détecteurs fixes dans le bâtiment SM18
IR–16	M. Silari, L. Ulrici	30.07	Induced activity in LEP materials
IR–17	P. Vojtyla	01.08	Rapport trimestriel de la surveillance d'environnement au CERN
IR–18	F. Pirotte, M. Silari, L. Ulrici	26.08	Mesures de rayonnement synchrotron dans le LEP à 94,5 GeV
TM–19	T. Otto	23.08	Application of international standard ISO10674 to CERN's neutron calibration field
TM–20	T. Otto	26.08	PTI 'Dosimétrie des neutrons'
IR–21	G.R. Stevenson	27.08	Further studies of the shielding of the PM18 shaft at Point 1 of the LHC
TM–22	K. Elsener, M. Heilmann, M. Silari	28.08	Verification of the calibration factor of the CERF beam monitor
TM–23	M. Silari, L. Ulrici	04.09	Intercomparison of rem counters in the CERF neutron field
TM–24	Y. Donjoux	12.10	Simulation des débits de dose et activités massiques pour différents types de matériaux TFA en vue du démantèlement du LEP

Ref.	Author	Date	Title
IR–25	J.C. Gaborit, C. Lamberet, G. Roubaud, P. Vojtyla, D. Forkel-Wirth	09.04	Determination of the induced Radioactivity of the 352 MHz LEP cavities
IR–26	L. Ulrici, F. Pirotte	12.10	Ozone measurements in the LEP injection region
IR–27	I. Dawson, G.R. Stevenson	20.10	Radiological impact of the LHC Beam-Dumps
IR–28	M. Huhtinen	22.10	Method for estimating dose rates from induced radioactivity in complicated hadron accelerator geometries
IR–29	A. Ferrari, M. Silari, V. Vlachoudis	15.12	Preliminary radiological importance of heavy-ion operation at the LHC.
IR–30	S. Roessler, G. R.Stevenson	29.10	Simple estimates of the radiological importance of heavy-ion operation at the LHC
IR–31	Not attributed		
IR–32	P. Vojtyla	01.12	Rapport trimestriel de la surveillance de l'environnement au CERN
TM–33	C. Lamberet	01.12	Travaux d'usinage des dumps radioactfis (TED et TIDV) dans la zone aménagée du Bât. 100 – aspects de radioprotection
IR–34	C. Johnson, G. Rolandi, M. Silari	15.12	Radiological hazard due to neutrinos from a muon collider
TM–35	M. Silari	16.12	Are people wearing their film badge in the experimental areas (two years later)